All India Aakash Test Series for NEET - 2026

TEST - 3 (Code-A)

Click here for Code-B Sol.

Test Date : 09/11/2025

ANSWERS

1.	(2)	37.	(4)	73.	(3)	109.	(1)	145.	(2)
2.	(4)	38.	(4)	74.	(2)	110.	(3)	146.	(1)
3.	(1)	39.	(2)	75.	(4)	111.	(4)	147.	(2)
4.	(2)	40.	(3)	76.	(1)	112.	(1)	148.	(1)
5.	(4)	41.	(3)	77.	(3)	113.	(1)	149.	(4)
6.	(4)	42.	(2)	78.	(2)	114.	(3)	150.	(2)
7.	(2)	43.	(1)	79.	(1)	115.	(3)	151.	(4)
8.	(4)	44.	(4)	80.	(4)	116.	(2)	152.	(2)
9.	(3)	45.	(3)	81.	(1)	117.	(1)	153.	(3)
10.	(4)	46.	(3)	82.	(3)	118.	(4)	154.	(3)
11.	(2)	47.	(3)	83.	(4)	119.	(2)	155.	(3)
12.	(4)	48.	(4)	84.	(1)	120.	(4)	156.	(3)
13.	(2)	49.	(2)	85.	(1)	121.	(4)	157.	(1)
14.	(3)	50.	(2)	86.	(3)	122.	(1)	158.	(4)
15.	(2)	51.	(3)	87.	(1)	123.	(3)	159.	(4)
16.	(1)	52.	(1)	88.	(3)	124.	(1)	160.	(4)
17.	(2)	53.	(2)	89.	(2)	125.	(1)	161.	(1)
18.	(4)	54.	(2)	90.	(1)	126.	(2)	162.	(1)
19.	(3)	55.	(3)	91.	(1)	127.	(3)	163.	(4)
20.	(3)	56.	(4)	92.	(1)	128.	(1)	164.	(2)
21.	(3)	57.	(2)	93.	(3)	129.	(2)	165.	(4)
22.	(2)	58.	(2)	94.	(3)	130.	(2)	166.	(3)
23.	(1)	59.	(4)	95.	(3)	131.	(2)	167.	(3)
24.	(2)	60.	(3)	96.	(4)	132.	(1)	168.	(4)
25.	(1)	61.	(3)	97.	(1)	133.	(4)	169.	(4)
26.	(4)	62.	(3)	98.	(1)	134.	(4)	170.	(2)
27.	(2)	63.	(3)	99.	(3)	135.	(1)	171.	(1)
28.	(1)	64.	(2)	100.	(3)	136.	(3)	172.	(4)
29.	(2)	65.	(3)	101.	(4)	137.	(2)	173.	(1)
30.	(2)	66.	(4)	102.	(2)	138.	(3)	174.	(1)
31.	(3)	67.	(4)	103.	(4)	139.	(3)	175.	(4)
32.	(3)	68.	(4)	104.	(2)	140.	(1)	176.	(3)
33.	(1)	69.	(2)	105.	(2)	141.	(2)	177.	(2)
34.	(2)	70.	(3)	106.	(3)	142.	(1)	178.	(4)
35.	(3)	71.	(2)	107.	(2)	143.	(4)	179.	(1)
36.	(2)	72.	(2)	108.	(2)	144.	(2)	180.	(3)

HINTS & SOLUTIONS

[PHYSICS]

1. Answer (2)

Hint and Sol.: $i_{rms} = \left[\dfrac{\int_0^T i^2 dt}{\int_0^T dt}\right]^{\frac{1}{2}}$

$$i_{rms}^2 = \frac{\int_0^T (i_1 + i_2 \sin\omega t + i_3 \cos\omega t)^2 dt}{\int_0^T dt}$$

Mean of $\sin^2(\omega t)$ and $\cos^2(\omega t)$ is $\frac{1}{2}$ and mean of $\sin(\omega t)$ and $\cos(\omega t)$ over one cycle is zero.

Solving this, we will get

$$i_{rms} = \left(i_1^2 + \frac{i_2^2}{2} + \frac{i_3^2}{2}\right)^{\frac{1}{2}}$$

2. Answer (4)

Hint: $\langle i \rangle = \dfrac{\int_{t_1}^{t_2} i dt}{\int_{t_1}^{t_2} dt} = \dfrac{\int_{t_1}^{t_2} i dt}{(t_2 - t_1)}$

Sol.: $\langle i \rangle = \dfrac{\int_{t_1}^{t_2} i dt}{(t_2 - t_1)} = \dfrac{\int_1^5 (2 + 3t) dt}{5 - 1}$

$$\langle i \rangle = \frac{1}{4}\left(2t + \frac{3t^2}{2}\right)_1^5 = \frac{1}{4}\left[2 \times (5-1) + \frac{3}{2}(5^2 - 1^2)\right]$$

$$= \frac{1}{4}[8 + 36] = 11 \text{ mA}$$

3. Answer (1)

Hint and Sol.: In pure capacitive circuit power factor is $\cos\theta = 0$

As, $\theta = 90°$

4. Answer (2)

Hint: $X_c = \dfrac{1}{\omega C} = \dfrac{1}{2\pi f C}$; $X_L = \omega L = 2\pi f L$

Sol.: For inductor, graph of X_L vs f is a straight line, hence the circuit should contain inductor only.

5. Answer (4)

Hint: At resonance, $X_L = X_C$ and impedance becomes minimum.

Sol.: At resonance, $X_L = X_C$. Hence, voltage across L and C are equal in magnitude, but they are 180 degrees out of phase and therefore cancel each other.

6. Answer (4)

Hint: Use equation $V = i\sqrt{R^2 + X_L^2}$

Sol.: Given $i = 1$ A, $R = 100\ \Omega$, $L = 1$ H, $V = 200$ V

Impedance $z = \sqrt{R^2 + (2\pi f L)^2}$

$$z = \frac{V}{i} = 200\ \Omega$$

$$200 = \sqrt{100^2 + (2\pi f)^2}$$

$\Rightarrow$ $40000 = 10000 + 4\pi^2 f^2$

$$f = \sqrt{\frac{30000}{4\pi^2}} = \frac{100}{2\pi}\sqrt{3} = \frac{50\sqrt{3}}{\pi} \text{ Hz}$$

7. Answer (2)

Hint: Power consumed, $P = V_{rms}\, I_{rms} \cos\phi$

Sol.: Given, $\phi = 60°$, $V_{rms} = 100$ V, $I_{peak} = \sqrt{2}$ A

$$I_{rms} = \frac{I_{peak}}{\sqrt{2}} = \frac{\sqrt{2}}{\sqrt{2}} = 1 \text{ A}$$

$$P = V_{rms} \times I_{rms} \cos\phi$$

$= 100 \times 1 \times \cos 60° = 50$ W

8. Answer (4)

Hint: Speed of EM wave, $v = \dfrac{\omega}{K}$

Sol.: Using equation, $v = \dfrac{\omega}{K}$, we get speed of the given EM wave as

$$\frac{3 \times 10^7}{0.05} = 6 \times 10^8 \text{ m s}^{-1}$$

This speed is greater than speed of light in vacuum, which is not possible.

9. Answer (3)

Hint and Sol.: Microwaves are used in RADAR systems due to their ability to penetrate through most atmospheric conditions like rain, clouds, smoke and also because their wavelengths are suitable for reflecting off objects of interest.

10. Answer (4)

Hint: For an EM wave $\hat{E} \perp \hat{B} \perp \hat{v}$

Sol.: $\hat{E} + \hat{B}$ will lie in the plane of $\hat{E}, \hat{B}$ and hence, it will be perpendicular to $\hat{v}$.

$\therefore \quad \left(\hat{E} + B\right) \cdot \hat{v} = 0$

11. Answer (2)

Hint and Sol.: The correct form of Gauss's law for magnetism is $\oint \vec{B} \cdot d\vec{A} = 0$

12. Answer (4)

Hint: Properties of γ-rays.

Sol.: γ-rays are produced in nuclear reactions.

γ-rays have wavelength from about 10^{-10} m to 10^{-14} m

13. Answer (2)

Hint and Sol.:

$$1 \times \sin i = \mu \sin r \Rightarrow 1 \times \sin 30^\circ = \frac{3}{2} \times \sin r$$

$$\sin r = \frac{1}{3} \Rightarrow r \neq 60^\circ$$

In a glass slab, emergent ray is parallel to incident ray but laterally shifted and lateral shift increases with increase in thickness of the slab.

14. Answer (3)

Hint: Use equations $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$ and $m = \frac{h_i}{h_o} = \frac{v}{u}$

Sol.: $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

$$\Rightarrow \quad \frac{1}{v} - \frac{1}{-20} = \frac{1}{10}$$

$$\Rightarrow \quad \frac{1}{v} = \frac{1}{10} - \frac{1}{20}$$

v = 20 cm

$$m = \frac{h_i}{h_o} = \frac{v}{u}$$

$$\Rightarrow \quad \frac{h_i}{1} = \frac{20}{-20}$$

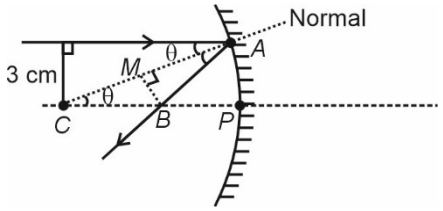
$\Rightarrow h_i = -1$ cm

Taking given coordinate system into consideration, the coordinates of image is (20 cm, – 1 cm)

15. Answer (2)

Hint: Use law of reflection $Li = Lr$ and geometry to solve the given question.

Sol.:



$CP = CA$ = radius of curvature = 5 cm

$\theta = 37^\circ$

Due to congruent triangles, $CM = MA$

$$CM = \frac{CA}{2} = \frac{5}{2} \text{ cm}$$

In $\triangle BMC$, $CB\cos\theta = CM$

$$CB = \frac{\frac{5}{2}}{\cos 37^\circ} = \frac{5 \times 5}{2 \times 4} = \frac{25}{8} \text{ cm}$$

$$\therefore \quad PB = CP - CB = 5 - \frac{25}{8} = \frac{15}{8} \text{ cm}$$

16. Answer (1)

Hint: Use formula $\delta_{min} = 2i - A$

Sol.: Given $A = 60^\circ$, $\delta_{min} = A$

$\delta_{min} = 2i - A$

$60^\circ = 2i - 60^\circ$

$\Rightarrow \quad i = 60^\circ$

17. Answer (2)

Hint: Use formula : $I = I_{max} \cos^2\left(\frac{\phi}{2}\right)$

Sol.: Intensity formula in YDSE is

$$I = I_{max} \cos^2\left(\frac{\phi}{2}\right)$$

Given $I = \frac{I_{max}}{2}$

$$\therefore \quad \frac{I_{max}}{2} = I_{max} \cos^2\left(\frac{\phi}{2}\right)$$

$$\cos\frac{\phi}{2} = \frac{1}{\sqrt{2}} \Rightarrow \phi = \frac{\pi}{2}$$

In general, $\phi = \frac{\pi}{2}, \frac{3\pi}{2}, \frac{5\pi}{2} \ldots$

Since, $\Delta\phi = \frac{2\pi}{\lambda}\Delta x \Rightarrow \Delta x = \frac{\lambda}{4}, \frac{3\lambda}{4}, \frac{5\lambda}{4} \ldots$

18. Answer (4)

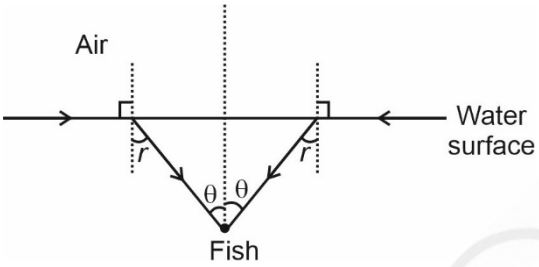
Hint and Sol.:

- Focal length of a lens is dependent on refractive index which in turn depends on wavelength of light used.
- Frequency of light remains same, hence $v \propto \lambda$. Thus, when a light wave enters from a rarer to denser medium, its speed as well as wavelength decrease.

19. Answer (3)

Hint: Take the angle of incidence to be 90°, for the fish to see complete sky.

Sol.:



$1 \times \sin 90^\circ = \mu \times \sin r \Rightarrow 1 = \sqrt{2}\sin r$

$r = 45^\circ$

From geometry, $r = \theta$

Total angle subtended at the fish's eye = 2θ

$= 2 \times 45^\circ = 90^\circ$

20. Answer (3)

Hint and Sol.: Only a real image can be formed form on a screen. According to the given situation, only a convex lens can achieve the desired outcome.

21. Answer (3)

Hint: Use formula of magnification.

$$M = \frac{-L}{f_o} \times \frac{D}{f_e}$$

Sol.: In normal adjustment, the formula of magnification for compound microscope is given by $M = \frac{-L}{f_o} \times \frac{D}{f_e}$

Putting values, we get

$$M = \frac{-40}{2} \times \frac{25}{4} = -125$$

Hence assertion is correct

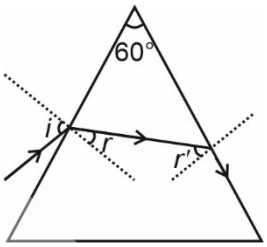
As evident from the formula, magnification is dependent on tube length, hence reason is incorrect.

22. Answer (2)

Hint: For TIR, the angle of incidence at second face should be equal to the critical angle.

Sol.: For just TIR at second face

$$r' = c = \sin^{-1}\left(\frac{1}{\mu}\right)$$



From prism geometry:

$$r + r' = A = 60^\circ \Rightarrow r = 60^\circ - \sin^{-1}\left(\frac{1}{\mu}\right)$$

Apply Snell's law at the first face:

$1 \times \sin i = \mu \times \sin r$

$$\sin i = \mu \times \sin\left[60^\circ - \sin^{-1}\left(\frac{1}{\mu}\right)\right]$$

$$\therefore \quad i = \sin^{-1}\left[\mu \sin\left(60^\circ - \sin^{-1}\left(\frac{1}{\mu}\right)\right)\right]$$

23. Answer (1)

Hint and Sol.: Fringe width $\beta = \frac{\lambda D}{d} \Rightarrow \beta \propto \frac{1}{d}$

$$\beta' = \frac{\beta}{2} = \frac{0.2}{2} = 0.1 \text{ cm}$$

24. Answer (2)

Hint: Only transverse waves can be polarized.

Sol.: Sound wave is longitudinal, so it cannot be polarized.

25. Answer (1)

Hint: Maximum possible path difference between the two sources is 3λ

Sol.: Maximum path difference = 3λ which can be achieved on the line joining the two sources.

Path differences corresponding to dark fringes will be $\frac{\lambda}{2}, \frac{3\lambda}{2}, \frac{5\lambda}{2}$

$\therefore$ Dark rings due to these will be 3 on screen.

26. Answer (4)

Hint: Use, Malus law:- $I = I_0\cos^2\theta$

Sol.: $I_0 \rightarrow \Big| \rightarrow \frac{I_0}{2} \quad \Big| \rightarrow I_1 \quad \Big| \rightarrow I_2$

A B C

$$I_1 = \frac{I_0}{2}\cos^2(30^\circ) = \frac{I_0}{2}\times\frac{3}{4} = \frac{3I_0}{8}$$

$$I_2 = I_1\cos^2(45^\circ) = \frac{3I_0}{8}\times\frac{1}{2} = \frac{3I_0}{16}$$

27. Answer (2)

Hint and Sol.: Width of central maximum, $W = \frac{2\lambda D}{a}$

$\Rightarrow$ W is inversely proportional to slit width a

28. Answer (1)

Hint: $\mu_{water} = \frac{\lambda_{air}}{\lambda_{water}}$

Sol.: Angular fringe width is given by

$$\theta = \frac{\lambda}{d} \Rightarrow \theta \propto \lambda$$

$$\frac{\theta_{air}}{\theta_{water}} = \frac{\lambda_{air}}{\lambda_{water}} = \mu_{water}$$

$$\frac{0.60^\circ}{\theta_{water}} = \frac{4}{3} \Rightarrow \theta_{water} = 0.45^\circ$$

29. Answer (2)

Hint: Power factor equal to one means the circuit is in resonance condition.

Sol.: Overall power factor = 1 $\Rightarrow Z = R$

Hence $X_L = X_C$

$$X_c = \frac{1}{\omega C} = \frac{1}{100\times10\times10^{-3}} = 1\ \Omega$$

$\therefore$ $X_L = X_C = 1\ \Omega$

Power factor between A and B is 0.4, it means

$$\frac{R}{\sqrt{R^2 + X_L^2}} = 0.4$$

$R^2 = 0.16 \times (R^2 + 1)$

$\Rightarrow$ $R^2 = 0.16R^2 + 0.16$

$$R^2 = \frac{0.16}{0.84} \Rightarrow R = \frac{2}{\sqrt{21}}\ \Omega$$

30. Answer (2)

Hint and Sol.: Average power consumed in purely resistive circuit, $\langle P\rangle = I_{rms}^2 R$

In series RC circuit current leads the voltage by angle greater than 0° but less than 90°.

In purely capacitive circuit, current leads voltage by 90°. Similarly in purely inductive circuit, voltage leads current by 90°.

31. Answer (3)

Hint: Use equation $V = \sqrt{V_R^2 + (V_L - V_C)^2}$

Sol.: Given V = 200 V, V_L = 400 V, V_C = 300 V

$$V^2 = V_R^2 + (V_L - V_C)^2$$

$$200^2 = V_R^2 + 100^2 \Rightarrow V_R^2 = 100^2 \times 3$$

$$V_R = \sqrt{3}\times100\ \text{V}$$

32. Answer (3)

Hint and Sol.: A step-up transformer changes a low voltage into a high voltage and reduces the current by same proportion, thus complying with the law of conservation of energy.

33. Answer (1)

Hint: Assume that current density is uniform between the plates.

Sol.: Current density between the plates is $\sigma = \frac{I}{A}$

Current in the cylindrical region of radius r

$$I' = \sigma(\pi r^2) \Rightarrow I' = \frac{I}{\pi R^2}\times\pi r^2 = \frac{Ir^2}{R^2}$$

$$B = \frac{\mu_0 I'}{2\pi r} = \frac{\mu_0 I r^2}{2\pi r R^2} = \frac{\mu_0 I r}{2\pi R^2}$$

34. Answer (2)

Hint and Sol.: EM waves are transverse in nature and they do not require medium for their propagation.

35. Answer (3)

Hint: Speed of light in medium is $v = \frac{1}{\sqrt{\mu\varepsilon}}$

Sol.: Frequency remains unchanged

$$v' = \frac{1}{\sqrt{\mu\varepsilon}} = \frac{1}{\sqrt{\mu_0\times4\varepsilon_0}} = \frac{1}{2\sqrt{\mu_0\varepsilon_0}} = \frac{c}{2}$$

Also $v = \lambda \times f \Rightarrow v \propto \lambda$

$$\therefore \quad \frac{v'}{c} = \frac{\lambda'}{\lambda} \Rightarrow \lambda' = \frac{\frac{c}{2}}{c}\times\lambda$$

$$\lambda' = \frac{\lambda}{2}$$

36. Answer (2)

Hint: $P_{net} = P_1 + P_2$

Sol.: $P = \frac{1}{f} \Rightarrow f = \frac{1}{P}$

$P_{net} = P_1 + P_2 = 5 - 1 = 4$ D

$\therefore \quad f = \frac{1}{4}$ m or 25 cm

37. Answer (4)

Hint: Lateral magnification $m = \frac{h_i}{h_o} = \frac{v}{u}$

Sol.: Lens formula, $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

For a lens, f is constant

$\frac{v}{v} - \frac{v}{u} = \frac{v}{f} \Rightarrow \frac{v}{u} = 1 - \frac{v}{f}$

Magnification, $m = \frac{v}{u}$

$m = 1 - \frac{v}{f}$

$\Rightarrow \quad m = \left(-\frac{1}{f}\right)v + 1$

m vs v graph is a straight line with negative slope.

38. Answer (4)

Hint and Sol.: The lens creates a virtual image at the far point of the eye for objects at infinity.

Using $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

$\frac{1}{v} - \frac{1}{-\infty} = \frac{1}{f} \Rightarrow v = f$

It means focal length of the lens is same as far point of the eye.

$P = \frac{1}{f} \Rightarrow f = \frac{1}{P} \Rightarrow f = \frac{100}{-2.5}$ cm $\Rightarrow f = -40$ cm

For point distance = $|f| = 40$ cm

39. Answer (2)

Hint: Use formula $M = -\frac{f_o}{f_e}\left(1 + \frac{f_e}{D}\right)$

Sol.: Given $f_o = 120$ cm, $f_e = 5$ cm, $D = 25$ cm

$M = -\frac{120}{5}\left(1 + \frac{5}{25}\right)$

$= \frac{-24 \times 6}{5} = -28.8$

40. Answer (3)

Hint and Sol.: Interference is a wave phenomena and hence cannot be explained by ray optics, which deals only with straight line propagation of light whereas interference arises when two or more coherent waves overlap.

41. Answer (3)

Hint: Fringe width $\beta = \frac{\lambda D}{d}$

Sol.: In YDSE, $\beta = \frac{\lambda D}{d}$

In denser medium $\lambda \downarrow \Rightarrow \beta \downarrow$

Hence, fringes come closer

Frequency of light does not change while moving from one medium to another.

42. Answer (2)

Hint: Focal length of a lens increases when difference between the refractive indices of lens material and surrounding decreases.

Sol.: $\frac{1}{f} = \left(\frac{\mu_2}{\mu_1} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

In air,

$\frac{1}{f_0} = \left(\frac{\frac{3}{2}}{1} - 1\right)\left(\frac{1}{-R_1} - \frac{1}{R_2}\right)$

$\frac{1}{f_0} = \frac{1}{2}\left(\frac{1}{-R_1} - \frac{1}{R_2}\right)$ …(i)

In water,

$\frac{1}{f'} = \left(\frac{\frac{3}{2}}{\frac{4}{3}} - 1\right)\left(\frac{1}{-R_1} - \frac{1}{R_2}\right)$

$\frac{1}{f'} = \frac{1}{8}\left(\frac{1}{-R_1} - \frac{1}{R_2}\right)$ …(ii)

$\frac{\text{Equation (i)}}{\text{Equation (ii)}}$

$\frac{\frac{1}{f_0}}{\frac{1}{f'}} = \frac{\frac{1}{2}}{\frac{1}{8}}$

$\Rightarrow \quad \frac{f'}{f_0} = \frac{8}{2}$

$\Rightarrow \quad f' = 4f_0$

43. Answer (1)

Hint: Fringe width in a liquid of refractive index μ is given by $\beta = \frac{\lambda D}{\mu d}$

Sol.: Fringe width in vacuum

$$\beta = \frac{\lambda D}{d}$$

Fringe width in liquid (μ)

$$\beta' = \frac{\lambda D}{\mu d}$$

Given $11\beta' = \frac{\beta}{2}(6\times 2-1)$

$$11\frac{\lambda D}{\mu d} = \frac{\lambda D}{d\times 2}(11)$$

$\mu = 2$

44. Answer (4)

Hint: Path difference created due to thin glass sheet $\Delta x = t(\mu - 1)$

Sol.: Path difference between central maximum and first minima $= \frac{\lambda}{2}$.

Path difference created due to thin glass sheet $\Delta x = t(\mu - 1)$

$\therefore \quad \Delta x = \frac{\lambda}{2}$

$$t(\mu-1) = \frac{\lambda}{2}$$

$$t = \frac{\lambda}{2(\mu-1)}$$

45. Answer (3)

Hint: Use formula : $I = 4I_0\cos^2\frac{\phi}{2}$ and $\beta = \frac{\lambda D}{d}$

Sol.: Given $I = \frac{I_{max}}{2} = \frac{4I_0}{2} = 2I_0$

$$I = 4I_0\cos^2\left(\frac{\phi}{2}\right) \Rightarrow 2I_0 = 4I_0\cos^2\left(\frac{\phi}{2}\right)$$

$$\cos^2\left(\frac{\phi}{2}\right) = \frac{1}{2} \Rightarrow \phi = \frac{\pi}{2}$$

Phase difference $= \frac{2\pi}{\lambda}\times\Delta x$

$$\frac{\pi}{2} = \frac{2\pi}{\lambda}\Delta x \Rightarrow \Delta x = \frac{\lambda}{4}$$

$$\therefore \quad \frac{\lambda}{4} = \frac{yd}{D} \Rightarrow y = \frac{\lambda D}{4d}$$

$$y = \frac{8000\times10^{-10}\times1}{4\times0.8\times10^{-3}} = \frac{8\times10^{-10}\times10^{7}}{4\times8}$$

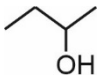
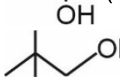
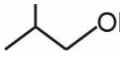
$y = 0.25 \times 10^{-3} = 0.25$ mm

[CHEMISTRY]

46. Answer (3)

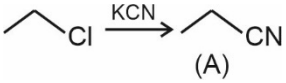
Hint: Primary alcohols give red colour in Victor Meyer's test while secondary alcohols give blue colour.

Sol.:

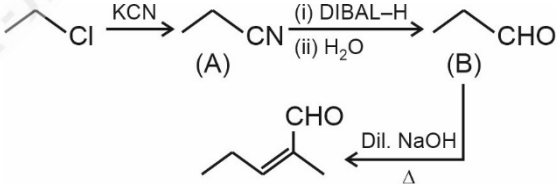
Alcohol	Colour in Victor Meyer's test
a.  (sec-Butyl alcohol) →	Blue
b.  (Neopentyl alcohol) →	Red
c.  (Isopropyl alcohol) →	Blue
d.  (Isobutyl alcohol) →	Red

Secondary alcohols give blue colour in Victor Meyer's test.

47. Answer (3)

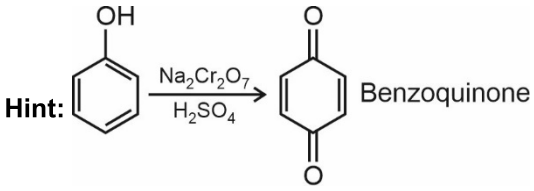
Hint: 

Sol.:

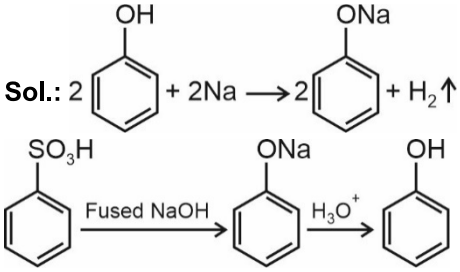


48. Answer (4)

Hint:



Sol.:



49. Answer (2)

Hint: Boiling point of propanone (acetone) is more than propanal.

Sol.: Methanal, ethanal and propanone are miscible with water in all proportions because they form hydrogen bond with water.

50. Answer (2)

Hint: Compounds containing $CH_3-\overset{\overset{O}{\|}}{C}-$ group or $CH_3-\underset{\underset{OH}{|}}{CH}-$ group will give positive iodoform test.

Sol.:

- Acetone $CH_3-\overset{\overset{O}{\|}}{C}-CH_3$, acetaldehyde $(CH_3-\overset{\overset{O}{\|}}{C}-H)$, ethyl alcohol (C_2H_5OH), isopropanol $(CH_3-\underset{\underset{OH}{|}}{\overset{\overset{H}{|}}{C}}-CH_3)$, acetophenone $(Ph-\overset{\overset{O}{\|}}{C}-CH_3)$ give positive iodoform test.
- Both acetaldehyde and ethyl alcohol will give positive iodoform test hence the pair cannot be distinguished by iodoform test.

51. Answer (3)

Hint: More is the –I effect of the groups more will be the acidity of the compound

Sol.: –I effect order : $-NO_2 > -CN > -F$

Acidic strength order:

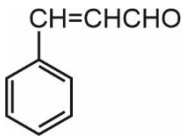
$NO_2CH_2COOH > NC-CH_2COOH > FCH_2COOH$

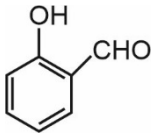
52. Answer (1)

Hint: $CH_3CH_2CH_2CH_2CHO$ is the structure of valeraldehyde.

Sol.:

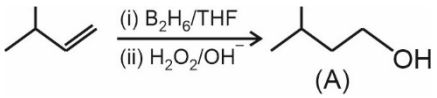
Valeraldehyde – $CH_3CH_2CH_2CH_2CHO$

Cinnamaldehyde – 

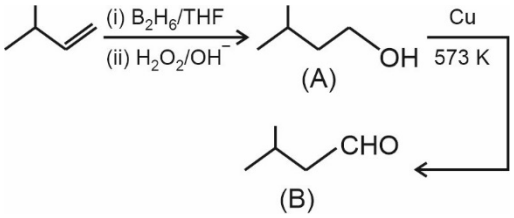
Salicylaldehyde – 

Mesityl oxide – $(CH_3)_2C = CHCOCH_3$

53. Answer (2)

Hint: 

Sol.:



54. Answer (2)

Hint: π-electron cloud stabilise the transition state in S_N2 reaction pathway.

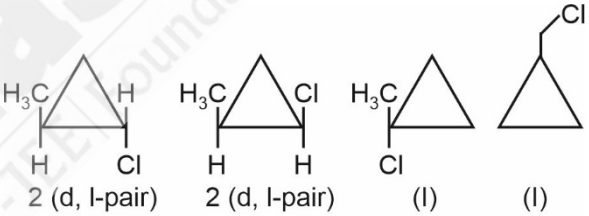
Sol.: Benzyl chloride is more reactive than allyl chloride as benzene ring is slightly better at π conjugation than isolated double bond.

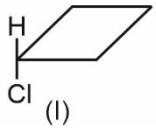
Secondary alkyl chloride will react at slowest rate because of steric reason.

55. Answer (3)

Hint: C_4H_7Cl will give three membered and four membered rings.

Sol.:



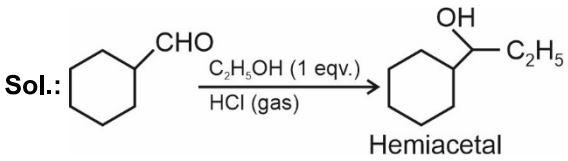


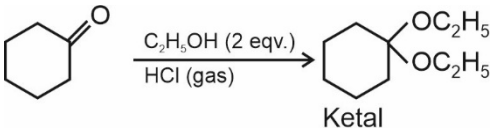
Total number of cyclic isomers = 7

56. Answer (4)

Hint: Aldehyde on reaction with one equivalent of alcohol in presence of acid catalyst gives hemiacetal.

Sol.:

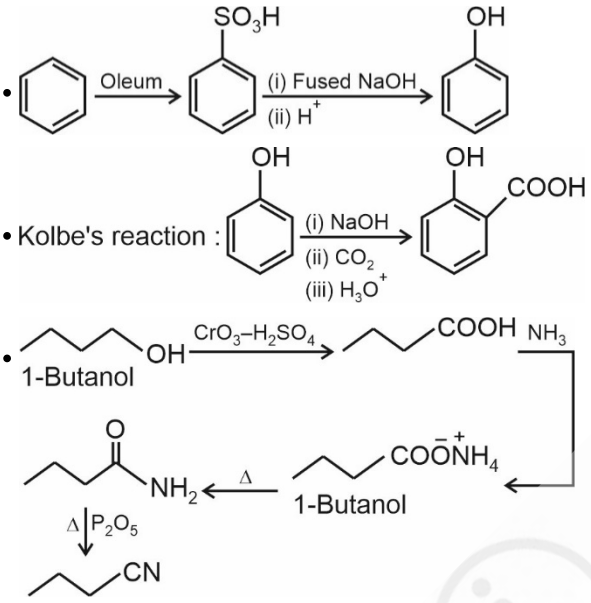




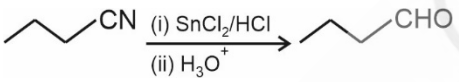
57. Answer (2)

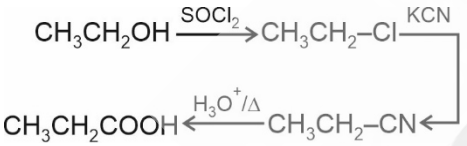
Hint: Starting material for Kolbe's reaction is phenol.

Sol.:

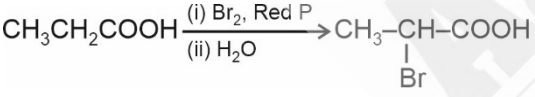


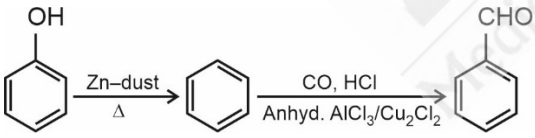
- Stephen reaction:



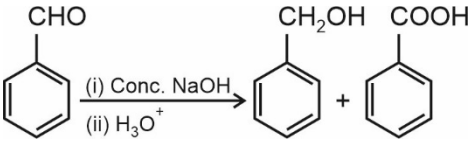
- 

- HVZ reaction

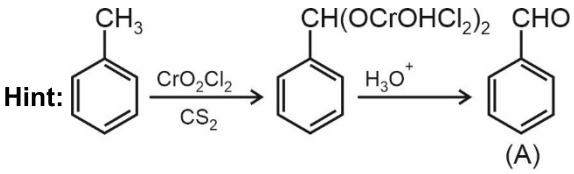


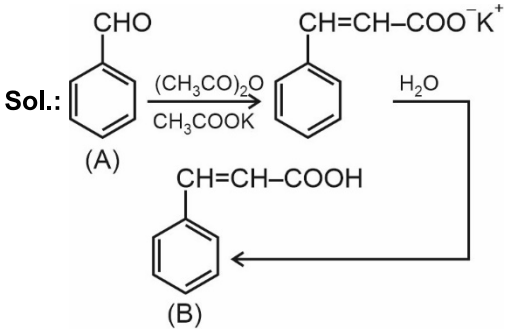
- 

- Cannizzaro reaction:



58. Answer (2)





59. Answer (4)

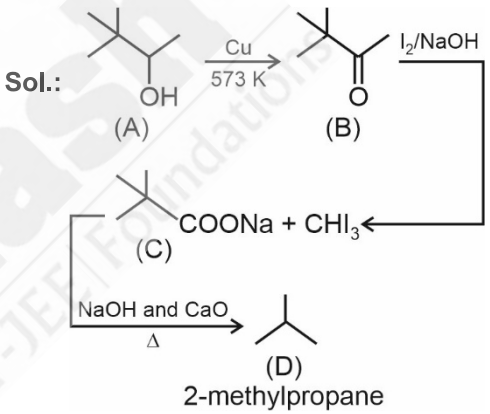
Hint: More is the electrophilicity of carbonyl carbon and lesser is the steric hindrance of the tetrahedral intermediate faster is the nucleophilic addition reaction.

Sol.: Aliphatic aldehydes react faster than aromatic aldehydes.

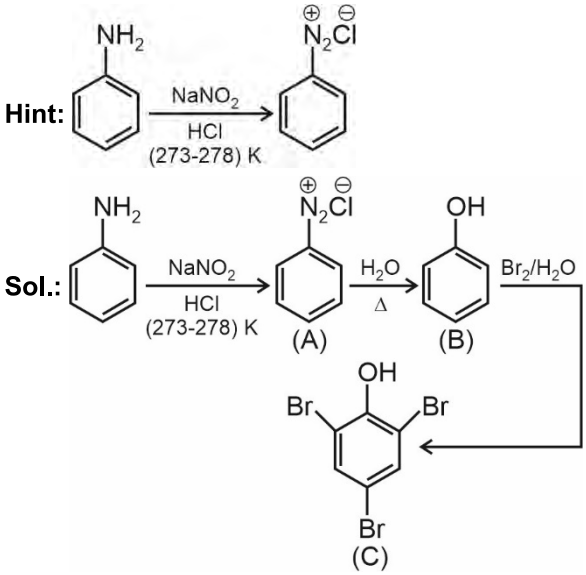
Ketones are least reactive towards nucleophilic addition reaction.

60. Answer (3)

Hint: Compound (B) contains keto-methyl group.



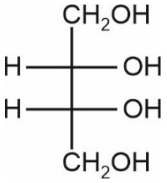
61. Answer (3)



62. Answer (3)

Hint: The compound which contains plane of symmetry is achiral and optically inactive due to internal compensation.

Sol.:

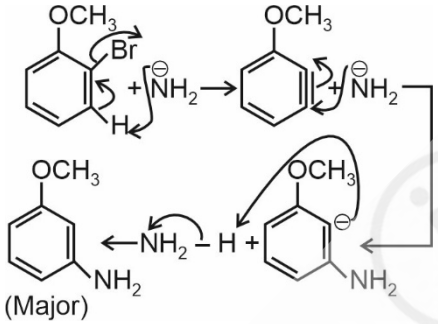


The compound contains plane of symmetry. It is achiral and optically inactive. It is a meso compound.

63. Answer (3)

Hint: The reaction follows benzyne mechanism

Sol.:



64. Answer (2)

Hint: The polar protic solvents are those whose hydrogen is directly attached with N, O etc atoms.

Sol.:  is polar aprotic solvent while CH_3OH (methanol) is polar protic solvent.

65. Answer (3)

Hint: Cleavage of C – O bond is difficult if it has double bond character.

Sol.: In diphenyl ether due to resonance C – O bond has double bond character hence this bond is most difficult to cleave by HI.

66. Answer (4)

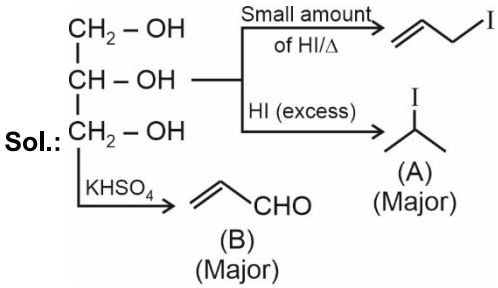
Hint: The compounds which are stronger acid than carbonic acid will liberate CO_2 on reaction with $NaHCO_3$.

Sol.: Benzoic acid, formic acid, phenylacetic acid and picric acid are stronger acid then H_2CO_3 while carbolic acid (phenol) is weaker acid than H_2CO_3.

67. Answer (4)

Hint: $KHSO_4$ is a dehydrating agent.

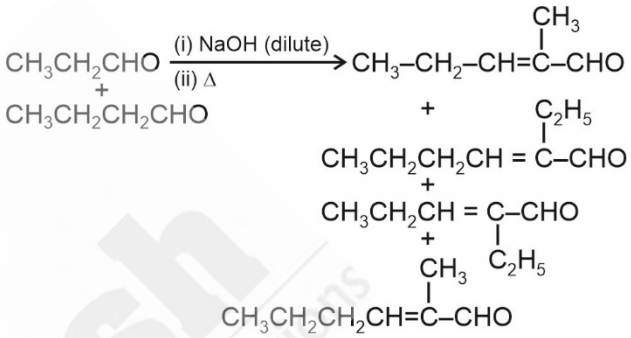
Sol.:



68. Answer (4)

Hint: In aldol condensation reaction of mixed aldehydes, α, β unsaturated aldehydes are formed.

Sol.:

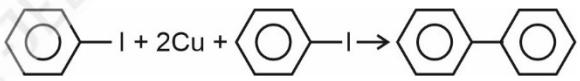


69. Answer (2)

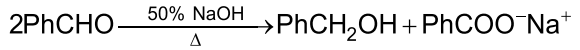
Hint: In Ullmann reaction, iodobenzene is converted to diphenyl

Sol.:

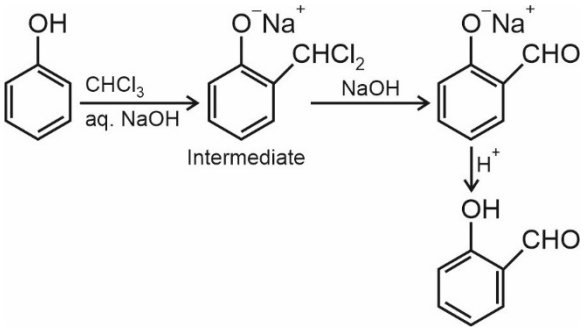
- Ullmann reaction



- Cannizzaro reaction



- Reimer-Tiemann reaction

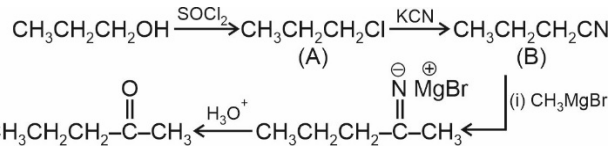


- Fittig reaction

70. Answer (3)

Hint: $CH_3CH_2CH_2OH \xrightarrow{SOCl_2} CH_3CH_2CH_2Cl$

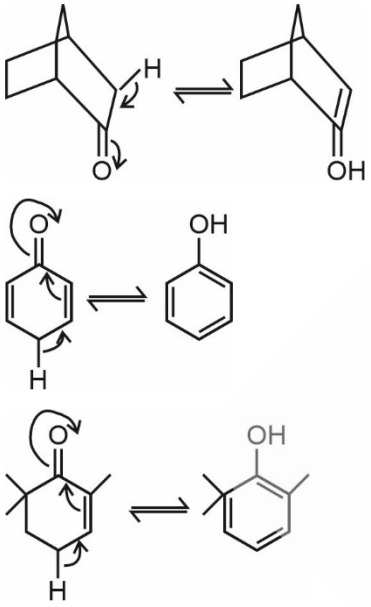
Sol.:



71. Answer (2)

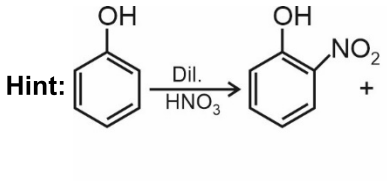
Hint: Compounds which contain enolisable hydrogen will show keto-enol tautomerism.

Sol.: Bridged hydrogen are not involved in keto-enol tautomerism.

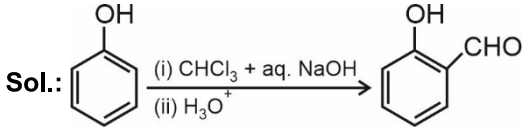


72. Answer (2)

Hint:



Sol.:



73. Answer (3)

Hint: More is the branching, lesser is surface area and lesser is vander Waals force of attraction and lesser is boiling point.

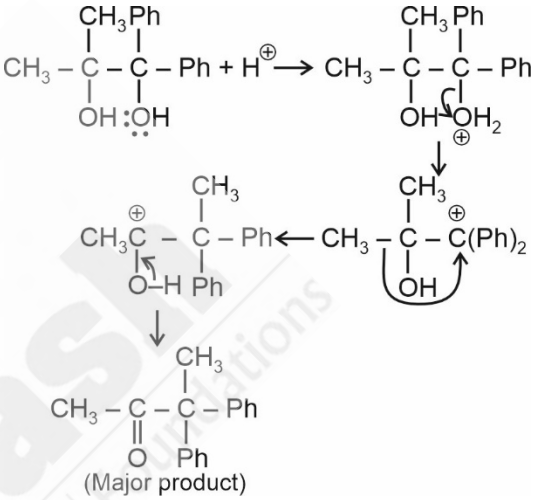
Sol.:

Molecule	Dipole moment/(D)
CH_3 –F	1.847
CH_3 – Cl	1.860
CH_3 – Br	1.830
CH_3 – I	1.636

74. Answer (2)

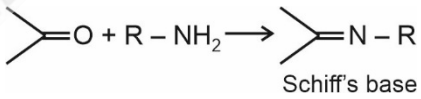
Hint: In first step, dehydration will lead to more stable carbocation.

Sol.:

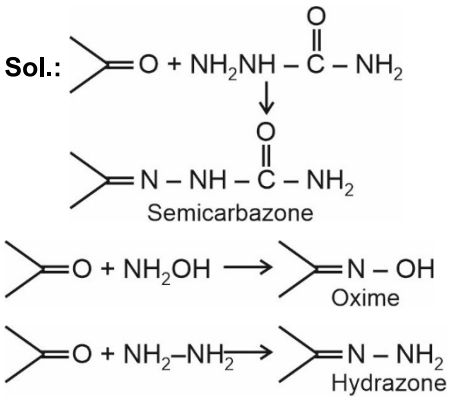


75. Answer (4)

Hint:



Sol.:

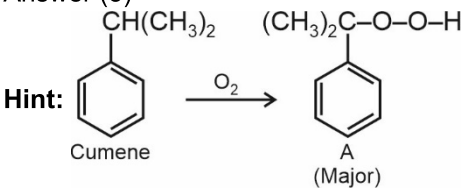


76. Answer (1)

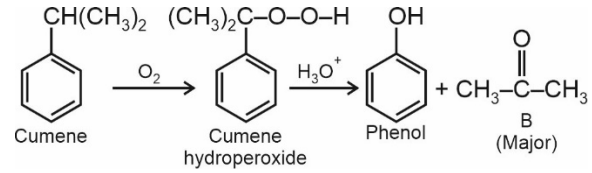
Hint: $CO + 2H_2 \xrightarrow[200\text{-}300\ atm,\ 573\text{-}673\ K]{ZnO-Cr_2O_3} CH_3OH$

Sol.: $C_6H_{12}O_6 \xrightarrow{Zymase} 2C_2H_5OH + 2CO_2$

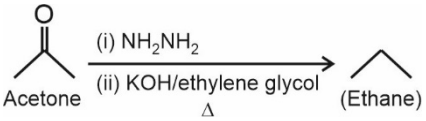
77. Answer (3)



Sol.:



- Wolff-Kishner reduction



78. Answer (2)

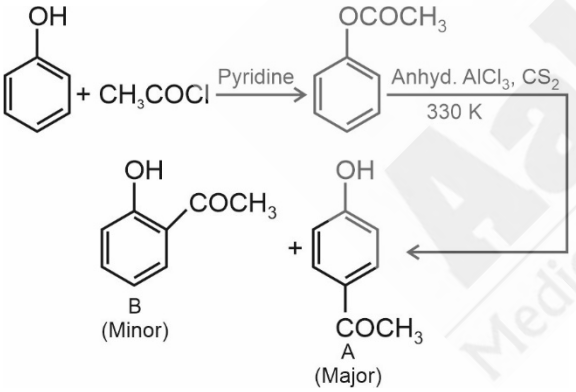
Hint: Electron withdrawing group stabilises the carbanion formed by the attack of nucleophile.

Sol.: More is the number of electron withdrawing group at o/p positions to the haloarene faster will be the nucleophilic substitution reaction.

79. Answer (1)

Hint: Phenyl esters undergo Fries rearrangements when heated with anhyd. $AlCl_3$ and CS_2.

Sol.:

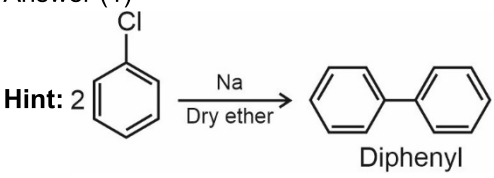


80. Answer (4)

Hint: For aldol condensation reaction, 2α hydrogen atoms are required.

Sol.: 2-Methylpropanal contains only one α-hydrogen atom hence it does not undergo aldol condensation reaction.

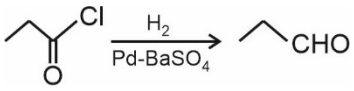
81. Answer (1)



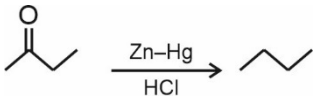
It is Fittig reaction

Sol.:

- Rosenmund recuction



- Clemmensen reduction

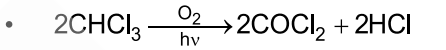


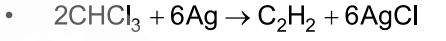
- Swarts reaction

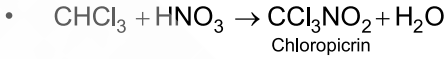
82. Answer (3)

Hint: $COCl_2$ is called carbonyl chloride.

Sol.:

- 

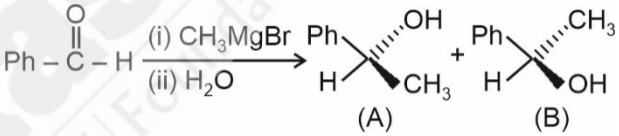
- 

- 

83. Answer (4)

Hint: The compound which on addition of Grignard reagent results in formation of chiral centre will result in formation of a pair of enantiomers.

Sol.:

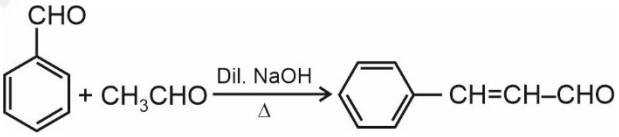


(A) and (B) are enantiomers.

84. Answer (1)

Hint: Ph–CH=CH–CHO is cinnamaldehyde

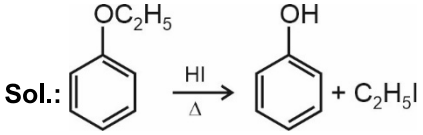
Sol.:



85. Answer (1)

Hint: Ethoxybenzene is called phenetole

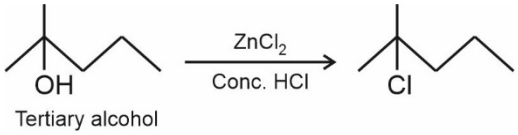
Sol.:



86. Answer (3)

Hint: Tertiary alcohols give immediate turbidity on reaction with Lucas reagent ($ZnCl_2$/HCl).

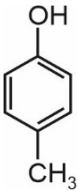
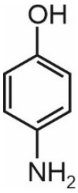
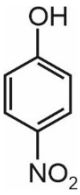
Sol.:



87. Answer (1)

Hint: electron withdrawing group present at para-position of phenol will increase its acidity and hence pK_a value will be less.

Sol.:

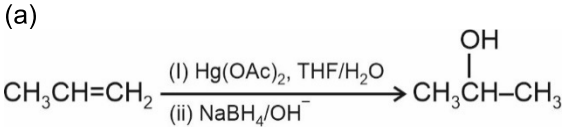
Compounds		pK_a
	–	10.2
	–	9.38
	–	10.3
	–	7.15

88. Answer (3)

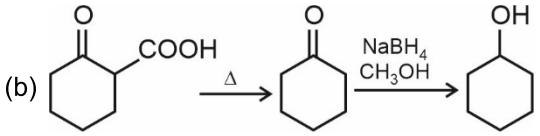
Hint: β-keto acid undergoes decarboxylation on heating in presence of acid catalyst.

Sol.:

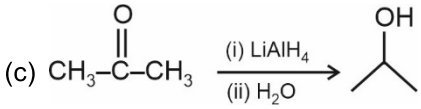
(a)



(b)



(c)



89. Answer (2)

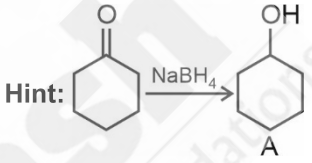
Hint: $6HCHO + 4NH_3 \rightarrow \underset{\text{Urotropin}}{(CH_2)_6N_4} + 6H_2O$

Sol.: $2HCHO \xrightarrow[NaOH]{\text{Conc.}} CH_3OH + HCOO^-$

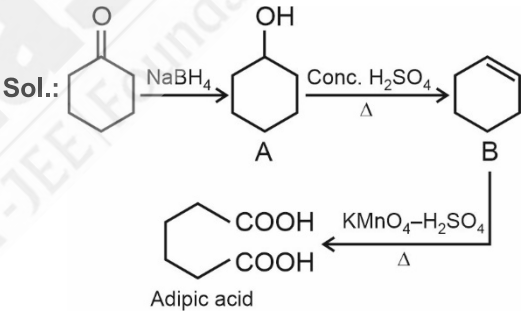
HCHO disproportionates to methanol and sodium formate.

90. Answer (1)

Hint:



Sol.:



Adipic acid

[BOTANY]

91. Answer (1)

Hint: *Lactobacillus* or LAB produces lactic acid by partially digesting milk. No CO_2 is released during lactic acid formation.

Sol.: A small amount of curd added to the fresh milk as inoculum or starter contains millions of LAB that perform lactic acid fermentation.

92. Answer (1)

Hint: LAB converts milk into curd.

Sol.: LAB plays a beneficial role in checking disease causing microbes in our stomach.

93. Answer (3)

Hint: Roquefort cheese is ripened by a genus that also forms penicillin.

Sol.: The 'Roquefort cheese' is ripened by a specific fungus called *Penicillium roquefortii*.

94. Answer (3)

Hint: Brewer's yeast is the same organism which is used for bread making.

Sol.: Penicillin is obtained from *Penicillium notatum*.

95. Answer (3)

Hint: Concentration of alcohol in rum is greater than 13%.

Sol.: Wine and Beer are non-distilled beverages.

96. Answer (4)

Hint: Fleming, Chain and Florey were awarded Nobel prize in 1945 for the discovery associated with antibiotic penicillin.

Sol.: Antibiotics produced by microbes are regarded as one of the most significant discoveries of the twentieth century.

97. Answer (1)

Hint: *Acetobacter aceti* is used for the commercial production of acetic acid used for vinegar preparation.

Sol.: *Aspergillus niger* – Citric acid and pectinase

Clostridium butylicum – Butyric acid for rancid butter

Streptococcus – Streptokinase

98. Answer (1)

Hint: The bottled fruit juices are clarified by the use of a kind of digesting enzyme.

Sol.: By the use of proteases and pectinases, bottled fruit juices are clarified.

99. Answer (3)

Hint: Fleming accidently discovered penicillin.

Sol.: Penicillin's full potential as an effective antibiotic was established by Chain and Florey.

100. Answer (3)

Hint: Statins have been commercialised as blood-cholesterol lowering agents.

Sol.: Cyclosporin A is used as an immunosuppressive agent in organ transplant patients and is produced by the fungus *Trichoderma polysporum*.

101. Answer (4)

Hint: Viruses, bacteria, fungi protozoans, viroids and prions are included in microbes.

Sol.: Bacterial colonies can be seen with naked eyes. Production of beverages on an industrial scale, requires fermentors. Viruses are obligate parasites.

102. Answer (2)

Hint: Statins are the blood-cholesterol lowering agents.

Sol.: *Monascus purpureus* produces statins, that have been commercialised as blood cholesterol lowering agents.

103. Answer (4)

Hint: High BOD indicates highly polluted water.

Sol.: Sewage should not be discharged into natural water bodies like rivers and streams directly because it contains a large amount of organic matter and microbes, many of which are pathogenic.

104. Answer (2)

Hint: The primary effluent is passed into large aeration tanks for secondary treatment.

Sol.: Primary treatment steps basically involve physical removal of particles-large and small-from the sewage through filtration and sedimentation. These are removed in stages: initially, floating debris is removed by sequential filtration. Then the grit are removed by sedimentation. All solids that settle form the primary sludge and the supernatant forms the effluent.

105. Answer (2)

Hint: While growing, aerobic microbes consume the major part of the organic matter in the effluent. This significantly reduces the BOD of effluent.

Sol.: Once the BOD of sewage or waste water is reduced significantly, the effluent is then passed into a setting tank where the bacterial flocs are allowed to sediment.

106. Answer (3)

Hint: Methanogens digest the sludge in anaerobic sludge digester.

Sol.: Major part of the activated sludge is pumped into large tanks called anaerobic sludge digesters. Here, methanogens digest the sludge to produce a mixture of gases such as methane, hydrogen sulphide and CO_2.

107. Answer (2)

Hint: *Rhizobium* is a symbiotic N_2-fixing bacterium.

Sol.:

Trichoderma	:	Its species are free-living fungi that are very common in the root ecosystems.
Nucleopolyhedrovirus	:	The majority of baculoviruses used as biological control agents are in this genus. They attack insects and other arthropods
Bacillus thuringiensis	:	Are helpful in the biocontrol of butterfly caterpillars.

108. Answer (2)

Hint: The main sources of biofertilizers are bacteria, fungi and cyanobacteria.

Solution: *Aulosira* is a non-symbiotic nitrogen fixer in the rice fields in India. Blue green algae adds organic matter to the soil and increase its fertility.

109. Answer (1)

Hint: X-Regulators, Y-Conformers, Z-Partial regulators.

Sol.: Regulators 'X' are able to maintain homeostasis by physiological means. Conformers 'Y' shows larger surface area relative to their volume. Thermoregulation is energetically expensive. Conformers are rarely found in polar regions.

110. Answer (3)

Hint.: Mortality = Number of death/Initial population density

Sol: If 12 individuals in a laboratory population of 150 fruitflies died during a specified time interval, say a week, the death rate in the population during that period is $\frac{12}{150} = 0.08$ individuals per fruitfly per week.

111. Answer (4)

Hint: Verhulst-Pearl Logistic Growth shows a sigmoid curve.

Sol.: Verhulst-Pearl Logistic Growth is described by the equation dN/dt = rN(K – N)/K.

112. Answer (1)

Hint: Interspecific interactions arise from the interaction of populations of two different species.

Sol.: For any species, the minimal requirement is of one more species on which it can feed. Predation, parasitism and commensalism share a common characteristic of the interacting species living closely together.

113. Answer (1)

Hint: *Calotropis* produces a highly poisonous compound.

Sol.: Weed *Calotropis* growing in abandoned fields produces highly poisonous cardiac glycosides and that is why you never see any cattle browsing on this plant.

114. Answer (3)

Hint: Connell's field experiment was on two different genera of barnacles.

Sol.: Connell's elegant field experiments showed that on the rocky sea coasts of Scotland, the larger and competitively superior barnacle *Balanus* dominates the intertidal area, and excludes the smaller barnacle *Chathamalus* from that zone. It is competitive exclusion.

115. Answer (3)

Hint: Niche of an organism represents the range of conditions that it can tolerate, the resources it utilises and its functional role in ecological system.

Sol.: Adaptation is any attribute of the organism that enables the organism to survive and reproduce in its habitat.

116. Answer (2)

Sol.: When certain exotic species are introduced into a geographical area, they become invasive and start spreading fast because the invaded land does not have their natural predators.

117. Answer (1)

Hint: Mammals are regulators

Sol.: Evolutionary biologists believe that the "success" of mammals is largely due to their ability to maintain a constant body temperature and thrive whether they live in Antarctica or in the Sahara desert.

118. Answer (4)

Hint: If the age distribution is plotted for a population, the resulting structure is called an age pyramid.

Sol.: For a population, the age pyramids generally show age distribution of males and females in the same diagram.

119. Answer (2)

Hint: Mortality is the number of deaths in the population during a given period.

Sol.:

Natality: The number of births during a given period in the population that are added to the initial density

Immigration: The number of individuals of the same species that have come into the habitat from elsewhere during the time period under consideration.

120. Answer (4)

Hint: Predation can be considered as nature's way of transferring to higher trophic levels the energy fixed by plants.

Sol.: Predators help in maintaining species diversity in a community, by reducing the intensity of competition among the competing prey species.

121. Answer (4)

Hint: A Mediterranean orchid employs sexual deceit.

Sol.: The Mediterranean orchid *Ophrys* employs 'sexual deceit' to get pollination done by a species of bee.

122. Answer (1)

Hint: The population size keeps changing with time, depending on various factors including food availability, predation pressure and adverse weather.

Sol.: Ideally, when resources in the habitat are unlimited, each species has the ability to realize fully its innate potential to grow in number, as Darwin observed while developing his theory of natural selection.

123. Answer (3)

Hint: Butterfly caterpillar feed on leaves.

Sol.: The butterfly acquires the chemical during its caterpillar stage by feeding on a poisonous weed.

124. Answer (1)

Hint: Exponential growth gives J-shaped curve when plotted graphically.

Sol.: The logistic growth describes a situation in which the resources in the environment are limited.

125. Answer (1)

Hint: 'r-selected species' have high fecundity.

Sol.: The species having high reproductive capacity is desired to maximise the reproductive fitness.

126. Answer (2)

Hint: Although animals eating plants are categorised separately as herbivores, they are, in a broad ecological context, not very different from predators.

Sol.: No population of any species in nature has at its disposal unlimited resources to permit exponential growth.

127. Answer (3)

Hint: Triangular age pyramid shows a growing population.

Sol.: Urn-shaped age pyramid shows a declining population growth.

128. Answer (1)

Hint: In protocooperation, both the interacting species are benefited.

Sol.: Mosquito is not considered a parasite as the female mosquito needs blood for reproduction only.

129. Answer (2)

Hint: Competitive co-existence prevents competitive exclusion.

Sol.: Resource partitioning or resource sharing by choosing different times for feeding or different foraging pattern promotes co-existence.

130. Answer (2)

Hint: Parasites have a complex life cycle, involving one or two intermediate hosts.

Sol.: Parasites do not have digestive system as they directly derive nourishment from their hosts.

131. Answer (2)

Hint: When N/K is exactly one, the influence of environmental resistance over the biotic potential equals zero.

Sol.: The graph of N will superimpose K (carrying capacity).

132. Answer (1)

Hint: Fig and fig wasp show mutualism.

Sol.: The evolution of the flower and its pollinator species is tightly linked with one another.

133. Answer (4)

Hint: Epiphytes on other plants is an example of commensalism.

Sol.: In parasitism and predation, one interacting species is benefited and the other is harmed.

Examples- *Cuscuta* on hedge plants.

Cuckoo laying its egg in the nest of crow.

134. Answer (4)

Sol.: Tiger census in National parks of India is usually based on pugmarks and faecal pellets.

135. Answer (1)

Hint: *Pisaster* is an important predator in the rocky intertidal communities of the American Pacific Coast.

Sol.: When all the starfish Pisaster were removed from an enclosed intertidal area, more than 10 species of invertebrates became extinct within a year because of interspecific competition.

[ZOOLOGY]

136. Answer (3)

Hint: Chronic respiratory disease

Sol.: Diseases which are easily transmitted from one person to another, are called infectious diseases.

- Typhoid, dysentery and dengue are infectious diseases.
- Emphysema is a non-infectious respiratory disease.

137. Answer (2)

Hint: Obtained from the latex of poppy plants.

Sol.: Morphine is extracted from the latex of poppy plant, *Papaver somniferum*. Morphine is an effective sedative and a painkiller, and is very useful in patients who have undergone surgery. Crack or cocaine has a potent stimulating action on CNS. Marijuana, generally taken by inhalation and oral ingestion, has hallucinating effect on CNS.

Heroin is a depressant.

138. Answer (3)

Hint: Oxygen deficiency occurs due to smoking.

Sol.: Smoking increases carbon monoxide (CO) content in blood and reduces the concentration of haembound oxygen. This causes oxygen deficiency in the body.

139. Answer (3)

Hint: Diagnostic technique

Sol.: Techniques like radiography (use of X-rays), CT (Computed Tomography) and MRI (Magnetic Resonance Imaging) are useful to detect cancers of the internal organs. The common approaches for treatment of cancer are surgery, radiation therapy and immunotherapy.

140. Answer (1)

Hint: Antibodies are not being formed in the body in such type of immunity.

Sol.: When a host is exposed to antigens, which may be in the form of living or dead microbes or other proteins, antibodies are produced in the host body. This type of immunity is called active immunity. The yellowish fluid colostrum secreted by mother has abundant antibodies (IgA) which provide natural passive immunity to protect the infant.

141. Answer (2)

Hint: Exclude the primary lymphoid organs

Sol.: The primary lymphoid organs are bone marrow and thymus. There is a lymphoid tissue located within the lining of the major tracts (respiratory, digestive and urogenital tracts) called MALT (Mucosa Associated Lymphoid Tissue). It constitutes about 50 per cent of the lymphoid tissue in human body.

142. Answer (1)

Hint: Non-specific type of defence

Sol.: Innate immunity is a non-specific type of defence, that is present at the time of birth. This is accomplished by providing different types of barriers to the entry of the foreign agents into our body. Certain types of leukocytes (WBCs) of our body like polymorpho-nuclear leukocytes (PMNL-neutrophils) and monocytes and natural killer cells (type of lymphocytes) in the blood as well as macrophages in tissues can phagocytose and destroy microbes.

143. Answer (4)

Hint: Anamnestic response

Sol.: Acquired immunity is pathogen specific. It is characterised by memory. This means, when our body encounters a pathogen for the first time, it produces a response called primary response which is of low intensity. Subsequent encounter with the same pathogen elicits a highly intensified secondary or anamnestic response. This is ascribed to the fact that our body appears to have memory of the first encounter.

144. Answer (2)

Hint: Vectors are carriers of pathogens causing diseases.

Sol.: Awareness about diseases and their effects on different bodily functions, vaccination (immunisation) against infectious diseases, proper disposal of wastes, control of vectors and maintenance of hygiene in food and water resources are necessary for achieving good health.

145. Answer (2)

Hint: Causes amoebic dysentery

Sol.: The pathogens can enter our body by various means, multiply and interfere with the normal vital activities, resulting in morphological and functional damage. Pathogens have to adapt to life within the environment of the host. For example, the pathogens that enter the gut must know a way of surviving in the stomach at low pH and resisting the various digestive enzymes.

E. histolytica resides in the large intestine.

146. Answer (1)

Hint: Part of acquired immunity.

Sol.: Innate immunity is a non-specific type of defence, that is present at the time of birth.

(i) **Physical barriers:** Skin on our body is the main barrier which prevents entry of the micro-organisms. Mucus coating of the epithelium lining the respiratory, gastrointestinal and urogenital tracts also help in trapping microbes entering our body.

(ii) **Physiological barriers:** Acid in the stomach, saliva in the mouth, tears from eyes-all prevent microbial growth.

The primary and secondary immune responses are carried out with the help of two special types of lymphocytes present in our blood, *i.e.*, B-lymphocytes and T-lymphocytes.

147. Answer (2)

Hint: It is also called anamnestic response

Sol. When our body encounters a pathogen for the first time, it produces a response called the primary immune response which is of low intensity. Subsequent encounter with the same pathogen elicits a highly intensified secondary or anamnestic response.

Immunoglobulins are glycoproteins. Antibody production is associated with acquired immunity.

Natural killer cells is a part of innate immunity.

148. Answer (1)

Hint: Higher vertebrates have a more evolved immune system as compared to lower organisms.

Sol.: Grafts from just any source - an animal, another primate, or any human being cannot be made since the grafts would be rejected sooner or later.

The body is able to differentiate 'self' and 'non-self' cells and the cell-mediated immune response is mainly responsible for the graft rejection.

Our immune system can produce an exaggerated immune response that is mediated by IgE antibodies.

Glucocorticoids, like cortisol, produce anti-inflammatory reactions.

Interferons act as cytokine barriers of innate immunity.

149. Answer (4)

Hint: Have depressant effect on CNS.

Sol.: Opioids bind to the specific opioid receptors present in our central nervous system and gastrointestinal tract.

150. Answer (2)

Hint: Choose a tranquiliser

Sol.: Drugs like barbiturates, amphetamines, benzodiazepines and other similar drugs, that are normally used as medicines to help patients cope with mental illnesses like depression and insomnia, are often abused. The sportsperson misuse narcotic analgesics, anabolic steroids, diuretics and certain hormones in sports to increase muscle strength and bulk and to promote aggressiveness.

151. Answer (4)

Hint: Exclude the physical carcinogens

Sol.: Ionising radiations like X-rays and gamma rays and non-ionizing radiations like UV rays cause DNA damage leading to neoplastic transformation. The chemical carcinogens present in tobacco smoke have been identified as a major cause of lung cancer. Cancer causing viruses called oncogenic viruses have genes called viral oncogenes.

152. Answer (2)

Hint: The most feared property of the malignant tumors.

Sol.: Cells sloughed from malignant tumors reach distant sites through blood, and wherever they get lodged in the body, they start a new tumor there. This property called metastasis is the most feared property of the malignant tumors.

Metagenesis is alternation of generation of body forms, seen in coelenterates. The physical transformation from one life stage to other, like in insects, is called metamorphosis.

Cancer cells lack the property of contact inhibition.

153. Answer (3)

Hint: Common cold is caused by Rhino viruses.

Sol.: AIDS stands for Acquired Immuno Deficiency Syndrome. This means deficiency of immune system acquired during the lifetime of an individual indicates that it is not a congenital disease. AIDS is caused by the Human Immunodeficiency Virus (HIV), a member of a group of viruses called retroviruses, which have an envelope enclosing the RNA genome.

154. Answer (3)

Hint: An aschelminth

Sol.: *Wuchereria* (*W. bancrofti* and *W. malayi*), the filarial worms, cause a slowly developing chronic inflammation of the organs in which they live for many years, usually the lymphatic vessels of the lower limbs and the disease is called elephantiasis or filariasis.

155. Answer (3)

Hint: Viral disease

Sol.: Sometimes, due to genetic and other unknown reasons, the body attacks self-cells. This results in damage to the body and is called auto-immune disease. Rheumatoid arthritis, myasthenia gravis and SLE (systemic lupus erythematous) affects many people in our society and they are auto-immune diseases; while small pox is a viral disease.

156. Answer (3)

Hint: Site of maturation of T-lymphocytes

Sol.: The primary lymphoid organs in humans are bone marrow and thymus where immature lymphocytes differentiate into antigen-sensitive lymphocytes.

After maturation, the lymphocytes migrate to secondary lymphoid organs like spleen, lymph nodes, tonsils, Peyer's patches of small intestine and appendix.

157. Answer (1)

Hint: Identify a bacterial disease

Sol.: *Salmonella typhi* is a pathogenic bacterium which causes typhoid fever in human beings. Bacteria *Yersinia pestis* is the causative agent of plague. Malaria is caused by protozoan. Elephantiasis and ascariasis are caused by nematodes.

158. Answer (4)

Hint: Exclude the most widespread species in the world

Sol.: *Plasmodium*, a tiny protozoan, is responsible for malaria. Different species of *Plasmodium* (*P. vivax, P. malariae* and *P. falciparum*) are responsible for different types of malaria. Of these, the malignant malaria is caused by *Plasmodium falciparum*.

159. Answer (4)

Hint: Typhoid fever

Sol.: *Salmonella typhi* is a pathogenic bacterium which causes typhoid fever in human beings. These pathogens generally enter the small intestine through food and water contaminated with them and migrate to other organs through blood. Sustained high fever (39°C to 40°C), weakness, stomach pain, constipation, headache and loss of appetite are some of the common symptoms of this disease.

Microsporum causes ringworm.

Toxoplasma is a protozoan parasite.

160. Answer (4)

Hint: Exclude the viral disease

Sol.: The use of vaccines and immunisation programmes have enabled us to completely eradicate a deadly disease like small pox. A large number of other infectious diseases like polio, diphtheria, pneumonia and tetanus have been controlled to a large extent by the use of vaccines.

There is currently no vaccine to prevent HIV infection.

161. Answer (1)

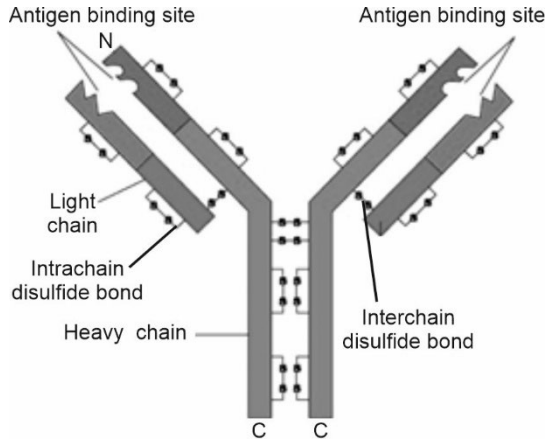
Hint: Increased sensitivity to the environment

Sol.: Somehow, modern-day life style has resulted in lowering of immunity and more sensitivity to allergens - more and more children in metro cities of India suffer from allergies and asthma due to sensitivity to the environment. This could be because of the protected environment provided early in life.

162. Answer (1)

Hint: Equal to the number of floating ribs in a man.

Sol.:



163. Answer (4)

Hint: Exclude the physiological barrier

Sol.: Tumor cells have been shown to avoid detection and destruction by immune system. Therefore, the patients are given substances called biological response modifiers, such as α-interferon, which activates their immune system and helps in destroying the tumor.

Cytokine barriers: Virus-infected cells secrete proteins called interferons which protect non-infected cells from further viral infection.

Tears from eyes are categorized as physiological barrier of innate immunity.

164. Answer (2)

Hint: Through contaminated inanimate objects

Sol.: Ringworms are generally acquired from soil or by using towels, clothes or even the comb of infected individuals. Many fungi belonging to the genera *Microsporum*, *Trichophyton* and *Epidermophyton* are responsible for ringworms which is one of the most common infectious diseases in man. Appearance of dry, scaly lesions on various parts of the body such as skin, nails and scalp are the main symptoms of this disease.

Malaria spreads through the bite of an infected female *Anopheles*. Polio, typhoid, ascariasis, *etc*., spread through faeco-oral route. Pneumonia, common cold, *etc*., spread through droplets.

165. Answer (4)

Hint: Equal to the number of bones in index finger of humans.

Sol.: *Ascaris*, an intestinal parasite, causes ascariasis. Symptoms of this disease include internal bleeding, muscular pain, fever, anaemia and blockage of the intestinal passage. The eggs of the parasite are excreted along with the faeces of infected individuals which contaminate soil, water, plants, *etc*. A healthy person acquires this infection through contaminated water, vegetables, fruits, *etc*.

166. Answer (3)

Hint: Choose the confirmatory test for typhoid

Sol.: Typhoid fever could be confirmed by Widal test. A classic case in medicine, that of Mary Mallon nicknamed Typhoid Mary, is worth mentioning. She was a cook by profession and was a typhoid carrier who continued to spread typhoid for several years through the food she prepared.

MRI and biopsy are performed for diagnosing cancer.

PCR is performed to detect disease at early stage.

167. Answer (3)

Hint: Many organisms belonging to the genera *Microsporum* cause ringworms.

Sol.: Chikungunya – Virus

Diphtheria – Bacteria

Malaria – Protozoa

Ringworm – Fungi

168. Answer (4)

Hint: Cellular barrier of innate immunity.

Sol.:

(i) **Physical barriers:** Skin on our body is the main barrier which prevents entry of the micro-organisms. Mucus coating of the epithelium lining the respiratory, gastrointestinal and urogenital tracts helps in trapping microbes entering our body.

(ii) **Physiological barriers:** Acid in the stomach, saliva in the mouth and tears from eyes-all prevent microbial growth.

(iii) **Cellular barriers:** Certain types of leukocytes (WBCs) of our body like polymorpho-nuclear leukocytes (PMNL-neutrophils) and monocytes and natural killer cells (type of lymphocytes) in the blood as well as macrophages in tissues can phagocytose and destroy microbes.

169. Answer (4)

Hint: A potent vasoconstrictor

Sol.: The exaggerated response of the immune system to certain antigens present in the environment is called allergy. Symptoms of allergic reactions include sneezing, watery eyes, runny nose and difficulty in breathing. The use of drugs like anti-histamine, adrenaline and steroids quickly reduce the symptoms of allergy. Histamine and serotonin cause allergic reaction.

170. Answer (2)

Hint: Thymus gland

Sol.: The thymus is a lobed organ located near the heart and beneath the breastbone. The thymus is quite large at the time of birth but keeps reducing in size with age and by the time puberty is attained, it reduces to a very small size. Both bone-marrow and thymus provide micro-environments for the development and maturation of T-lymphocytes.

171. Answer (1)

Hint: Equal to the number of ear ossicles present in one ear of a man

Sol.:

- When the mosquito bites another human, sporozoites are injected with the bite.
- The parasite reproduces asexually in liver cells of the human host.
- Parasites reproduce asexually in RBCs bursting and releasing haemozoin.
- Female *Anopheles* is the vector of the malarial parasite.

Gametocytes develop in RBCs of the human host.

172. Answer (4)

Hint: Genetic disorders run across generations.

Sol.: Mind and mental state can affect our health. Health is affected by:-

(i) Genetic disorders – Deficiencies with which a child is born and deficiencies/defects which the child inherits from parents from birth

(ii) Infections

(iii) Life style including food and water we take, rest and exercise we give to our bodies, habits that we have or lack, *etc*.

Consumption of anti-oxidants is considered healthy.

173. Answer (1)

Hint: Discovered blood circulation

Sol.: Health, for a long time, was considered as a state of body and mind where there was a balance of certain 'humors'. This is what early Greeks like Hippocrates as well as Indian Ayurveda system of medicine asserted. This idea was arrived at by pure reflective thought. The discovery of blood circulation by William Harvey using experimental method and the demonstration of normal body temperature in individuals with blackbile using thermometer disapproved the 'good humor' hypothesis of health. Alfred Wallace and Darwin gave the theory of evolution.

174. Answer (1)

Hint: Filariasis

Sol.: *Wuchereria* (*W. bancrofti* and *W. malayi*), the filarial worms cause a slowly developing chronic inflammation of the organs in which they live for many years, usually the lymphatic vessels of the lower limbs and the disease is called elephantiasis or filariasis. The genital organs are also often affected, resulting in gross deformities. The pathogens are transmitted to a healthy person through the bite of an infected female mosquito (*Culex*) vector. Ascariasis and amoebic dysentery spread through contaminated food and water.

175. Answer (4)

Hint: Kills T-helper cells

Sol.: HIV enters into helper T-lymphocytes, replicates and produces progeny viruses. The progeny viruses released in the blood attack other helper T-lymphocytes. This repetition leads to a progressive decrease in the number of helper-T lymphocytes in the body of the infected person. During this period, the person suffers from bouts of fever, diarrhoea and weight loss.

176. Answer (3)

Hint: Exclude a viral infection

Sol.: Smoking is associated with increased incidences of cancer of lungs, urinary bladder and throat, bronchitis, emphysema, coronary heart disease, gastric ulcer, *etc*.

Hepatitis-B primarily spreads *via* contact with infected blood and body fluids through sharing of infected syringes and from infected mother to her baby.

177. Answer (2)

Hint: Incorrect for cocaine

Sol.: Coca alkaloid or cocaine is obtained from the coca plant *Erythroxylum coca*, native to South America. It interferes with the transport of the neuro-transmitter dopamine. Cocaine, commonly called coke or crack, is usually snorted. It has a potent stimulating action on central nervous system, producing a sense of euphoria and increased energy. Excessive dosage of cocaine causes hallucinations.

178. Answer (4)

Hint: Heroin is chemically diacetylmorphine.

Sol.: Heroin, commonly called smack, is chemically diacetylmorphine which is a white, odourless, bitter and crystalline compound. It is obtained by acetylation of morphine, which is extracted from the latex of poppy plant.

179. Answer (1)

Hint: Contact inhibition.

Sol.: Cancerous cells grow very rapidly, invading and damaging the surrounding normal tissues. As these cells actively divide and grow, they also starve the normal cells by competing for vital nutrients.

Cancerous cells show high telomerase activity.

180. Answer (3)

Hint: Repeated use of drug increases its amount for same effect

Sol.: With repeated use of drugs, the tolerance level of the receptors present in our body increases. Consequently the receptors respond only to high dosage of drugs leading to greater intake and addition.

❑ ❑ ❑

All India Aakash Test Series for NEET - 2026

TEST - 3 (Code-B)

Click here for Code-A Sol.

Test Date : 09/11/2025

ANSWERS

1.	(3)	37.	(3)	73.	(3)	109.	(1)	145.	(1)
2.	(4)	38.	(4)	74.	(3)	110.	(3)	146.	(2)
3.	(1)	39.	(2)	75.	(3)	111.	(1)	147.	(4)
4.	(2)	40.	(4)	76.	(3)	112.	(4)	148.	(4)
5.	(3)	41.	(4)	77.	(4)	113.	(4)	149.	(3)
6.	(3)	42.	(2)	78.	(2)	114.	(1)	150.	(3)
7.	(2)	43.	(1)	79.	(2)	115.	(2)	151.	(4)
8.	(4)	44.	(4)	80.	(4)	116.	(2)	152.	(2)
9.	(4)	45.	(2)	81.	(3)	117.	(2)	153.	(4)
10.	(2)	46.	(1)	82.	(2)	118.	(1)	154.	(1)
11.	(3)	47.	(2)	83.	(2)	119.	(3)	155.	(1)
12.	(2)	48.	(3)	84.	(1)	120.	(2)	156.	(4)
13.	(1)	49.	(1)	85.	(3)	121.	(1)	157.	(4)
14.	(3)	50.	(3)	86.	(2)	122.	(1)	158.	(4)
15.	(3)	51.	(1)	87.	(2)	123.	(3)	159.	(1)
16.	(2)	52.	(1)	88.	(4)	124.	(1)	160.	(3)
17.	(2)	53.	(4)	89.	(3)	125.	(4)	161.	(3)
18.	(1)	54.	(3)	90.	(3)	126.	(4)	162.	(3)
19.	(2)	55.	(1)	91.	(1)	127.	(2)	163.	(3)
20.	(4)	56.	(4)	92.	(1)	128.	(4)	164.	(2)
21.	(1)	57.	(1)	93.	(3)	129.	(1)	165.	(4)
22.	(2)	58.	(2)	94.	(3)	130.	(2)	166.	(2)
23.	(1)	59.	(3)	95.	(3)	131.	(3)	167.	(4)
24.	(2)	60.	(1)	96.	(4)	132.	(3)	168.	(1)
25.	(3)	61.	(4)	97.	(1)	133.	(1)	169.	(2)
26.	(3)	62.	(2)	98.	(1)	134.	(1)	170.	(1)
27.	(3)	63.	(3)	99.	(3)	135.	(4)	171.	(2)
28.	(4)	64.	(2)	100.	(3)	136.	(3)	172.	(2)
29.	(2)	65.	(2)	101.	(4)	137.	(1)	173.	(4)
30.	(1)	66.	(3)	102.	(2)	138.	(4)	174.	(1)
31.	(2)	67.	(2)	103.	(4)	139.	(2)	175.	(2)
32.	(3)	68.	(4)	104.	(2)	140.	(3)	176.	(1)
33.	(2)	69.	(4)	105.	(2)	141.	(4)	177.	(3)
34.	(4)	70.	(4)	106.	(3)	142.	(1)	178.	(3)
35.	(2)	71.	(3)	107.	(2)	143.	(1)	179.	(2)
36.	(4)	72.	(2)	108.	(2)	144.	(4)	180.	(3)

HINTS & SOLUTIONS

[PHYSICS]

1. Answer (3)

Hint: Use formula : $I = 4I_0\cos^2\frac{\phi}{2}$ and $\beta = \frac{\lambda D}{d}$

Sol.: Given $I = \frac{I_{max}}{2} = \frac{4I_0}{2} = 2I_0$

$I = 4I_0\cos^2\left(\frac{\phi}{2}\right) \Rightarrow 2I_0 = 4I_0\cos^2\left(\frac{\phi}{2}\right)$

$\cos^2\left(\frac{\phi}{2}\right) = \frac{1}{2} \Rightarrow \phi = \frac{\pi}{2}$

Phase difference $= \frac{2\pi}{\lambda}\times\Delta x$

$\frac{\pi}{2} = \frac{2\pi}{\lambda}\Delta x \Rightarrow \Delta x = \frac{\lambda}{4}$

$\therefore \quad \frac{\lambda}{4} = \frac{yd}{D} \Rightarrow y = \frac{\lambda D}{4d}$

$y = \frac{8000\times10^{-10}\times1}{4\times0.8\times10^{-3}} = \frac{8\times10^{-10}\times10^{7}}{4\times8}$

$y = 0.25 \times 10^{-3} = 0.25$ mm

2. Answer (4)

Hint: Path difference created due to thin glass sheet $\Delta x = t(\mu - 1)$

Sol.: Path difference between central maximum and first minima $= \frac{\lambda}{2}$.

Path difference created due to thin glass sheet $\Delta x = t(\mu - 1)$

$\therefore \quad \Delta x = \frac{\lambda}{2}$

$t(\mu - 1) = \frac{\lambda}{2}$

$t = \frac{\lambda}{2(\mu - 1)}$

3. Answer (1)

Hint: Fringe width in a liquid of refractive index μ is given by $\beta = \frac{\lambda D}{\mu d}$

Sol.: Fringe width in vacuum

$\beta = \frac{\lambda D}{d}$

Fringe width in liquid (μ)

$\beta' = \frac{\lambda D}{\mu d}$

Given $11\beta' = \frac{\beta}{2}(6\times2-1)$

$11\frac{\lambda D}{\mu d} = \frac{\lambda D}{d\times2}(11)$

$\mu = 2$

4. Answer (2)

Hint: Focal length of a lens increases when difference between the refractive indices of lens material and surrounding decreases.

Sol.: $\frac{1}{f} = \left(\frac{\mu_2}{\mu_1} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

In air,

$\frac{1}{f_0} = \left(\frac{\frac{3}{2}}{1} - 1\right)\left(\frac{1}{-R_1} - \frac{1}{R_2}\right)$

$\frac{1}{f_0} = \frac{1}{2}\left(\frac{1}{-R_1} - \frac{1}{R_2}\right)$ ...(i)

In water,

$\frac{1}{f'} = \left(\frac{\frac{3}{2}}{\frac{4}{3}} - 1\right)\left(\frac{1}{-R_1} - \frac{1}{R_2}\right)$

$\frac{1}{f'} = \frac{1}{8}\left(\frac{1}{-R_1} - \frac{1}{R_2}\right)$ ...(ii)

$\frac{\text{Equation (i)}}{\text{Equation (ii)}}$

$\frac{\frac{1}{f_0}}{\frac{1}{f'}} = \frac{\frac{1}{2}}{\frac{1}{8}}$

$\Rightarrow \quad \frac{f'}{f_0} = \frac{8}{2}$

$\Rightarrow \quad f' = 4f_0$

5. Answer (3)

Hint: Fringe width $\beta = \frac{\lambda D}{d}$

Sol.: In YDSE, $\beta = \frac{\lambda D}{d}$

In denser medium $\lambda\downarrow \Rightarrow \beta\downarrow$

Hence, fringes come closer

Frequency of light does not change while moving from one medium to another.

6. Answer (3)

Hint and Sol.: Interference is a wave phenomena and hence cannot be explained by ray optics, which deals only with straight line propagation of light whereas interference arises when two or more coherent waves overlap.

7. Answer (2)

Hint: Use formula $M = -\frac{f_o}{f_e}\left(1+\frac{f_e}{D}\right)$

Sol.: Given f_o = 120 cm, f_e = 5 cm, D = 25 cm

$$M = -\frac{120}{5}\left(1+\frac{5}{25}\right)$$

$$= \frac{-24\times 6}{5} = -28.8$$

8. Answer (4)

Hint and Sol.: The lens creates a virtual image at the far point of the eye for objects at infinity.

Using $\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$

$$\frac{1}{v}-\frac{1}{-\infty}=\frac{1}{f} \Rightarrow v = f$$

It means focal length of the lens is same as far point of the eye.

$$P = \frac{1}{f} \Rightarrow f = \frac{1}{P} \Rightarrow f = \frac{100}{-2.5}\text{ cm} \Rightarrow f = -40\text{ cm}$$

For point distance = $|f|$ = 40 cm

9. Answer (4)

Hint: Lateral magnification $m = \frac{h_i}{h_o} = \frac{v}{u}$

Sol.: Lens formula, $\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$

For a lens, f is constant

$$\frac{v}{v}-\frac{v}{u}=\frac{v}{f} \Rightarrow \frac{v}{u}=1-\frac{v}{f}$$

Magnification, $m = \frac{v}{u}$

$$m = 1-\frac{v}{f}$$

$$\Rightarrow m = \left(-\frac{1}{f}\right)v + 1$$

m vs v graph is a straight line with negative slope.

10. Answer (2)

Hint: $P_{net} = P_1 + P_2$

Sol.: $P = \frac{1}{f} \Rightarrow f = \frac{1}{P}$

$P_{net} = P_1 + P_2 = 5 - 1 = 4$ D

$$\therefore f = \frac{1}{4}\text{ m or 25 cm}$$

11. Answer (3)

Hint: Speed of light in medium is $v = \frac{1}{\sqrt{\mu\varepsilon}}$

Sol.: Frequency remains unchanged

$$v' = \frac{1}{\sqrt{\mu\varepsilon}} = \frac{1}{\sqrt{\mu_0\times 4\varepsilon_0}} = \frac{1}{2\sqrt{\mu_0\varepsilon_0}} = \frac{c}{2}$$

Also $v = \lambda \times f \Rightarrow v \propto \lambda$

$$\therefore \frac{v'}{c} = \frac{\lambda'}{\lambda} \Rightarrow \lambda' = \frac{\frac{c}{2}}{c}\times\lambda$$

$$\lambda' = \frac{\lambda}{2}$$

12. Answer (2)

Hint and Sol.: EM waves are transverse in nature and they do not require medium for their propagation.

13. Answer (1)

Hint: Assume that current density is uniform between the plates.

Sol.: Current density between the plates is $\sigma = \frac{I}{A}$

Current in the cylindrical region of radius r

$$I' = \sigma(\pi r^2) \Rightarrow I' = \frac{I}{\pi R^2}\times\pi r^2 = \frac{Ir^2}{R^2}$$

$$B = \frac{\mu_0 I'}{2\pi r} = \frac{\mu_0 I r^2}{2\pi r R^2} = \frac{\mu_0 I r}{2\pi R^2}$$

14. Answer (3)

Hint and Sol.: A step-up transformer changes a low voltage into a high voltage and reduces the current by same proportion, thus complying with the law of conservation of energy.

15. Answer (3)

Hint: Use equation $V = \sqrt{V_R^2 + (V_L - V_C)^2}$

Sol.: Given V = 200 V, V_L = 400 V, V_C = 300 V

$V^2 = V_R^2 + (V_L - V_C)^2$

$200^2 = V_R^2 + 100^2 \Rightarrow V_R^2 = 100^2 \times 3$

$V_R = \sqrt{3} \times 100$ V

16. Answer (2)

Hint and Sol.: Average power consumed in purely resistive circuit, $\langle P \rangle = I_{rms}^2 R$

In series RC circuit current leads the voltage by angle greater than 0° but less than 90°.

In purely capacitive circuit, current leads voltage by 90°. Similarly in purely inductive circuit, voltage leads current by 90°.

17. Answer (2)

Hint: Power factor equal to one means the circuit is in resonance condition.

Sol.: Overall power factor = 1 $\Rightarrow Z = R$

Hence $X_L = X_C$

$$X_c = \frac{1}{\omega C} = \frac{1}{100 \times 10 \times 10^{-3}} = 1\ \Omega$$

$\therefore$ $X_L = X_C = 1\ \Omega$

Power factor between A and B is 0.4, it means

$$\frac{R}{\sqrt{R^2 + X_L^2}} = 0.4$$

$R^2 = 0.16 \times (R^2 + 1)$

$\Rightarrow R^2 = 0.16R^2 + 0.16$

$$R^2 = \frac{0.16}{0.84} \Rightarrow R = \frac{2}{\sqrt{21}}\ \Omega$$

18. Answer (1)

Hint: $\mu_{water} = \frac{\lambda_{air}}{\lambda_{water}}$

Sol.: Angular fringe width is given by

$$\theta = \frac{\lambda}{d} \Rightarrow \theta \propto \lambda$$

$$\frac{\theta_{air}}{\theta_{water}} = \frac{\lambda_{air}}{\lambda_{water}} = \mu_{water}$$

$$\frac{0.60^\circ}{\theta_{water}} = \frac{4}{3} \Rightarrow \theta_{water} = 0.45^\circ$$

19. Answer (2)

Hint and Sol.: Width of central maximum, $W = \frac{2\lambda D}{a}$

$\Rightarrow$ W is inversely proportional to slit width a

20. Answer (4)

Hint: Use, Malus law:- $I = I_0 \cos^2\theta$

Sol.: $I_0 \rightarrow \left| \rightarrow \frac{I_0}{2} \right| \rightarrow I_1 \left| \rightarrow I_2 \right.$

A B C

$$I_1 = \frac{I_0}{2}\cos^2(30^\circ) = \frac{I_0}{2} \times \frac{3}{4} = \frac{3I_0}{8}$$

$$I_2 = I_1 \cos^2(45^\circ) = \frac{3I_0}{8} \times \frac{1}{2} = \frac{3I_0}{16}$$

21. Answer (1)

Hint: Maximum possible path difference between the two sources is 3λ

Sol.: Maximum path difference = 3λ which can be achieved on the line joining the two sources.

Path differences corresponding to dark fringes will be $\frac{\lambda}{2}, \frac{3\lambda}{2}, \frac{5\lambda}{2}$

$\therefore$ Dark rings due to these will be 3 on screen.

22. Answer (2)

Hint: Only transverse waves can be polarized.

Sol.: Sound wave is longitudinal, so it cannot be polarized.

23. Answer (1)

Hint and Sol.: Fringe width $\beta = \frac{\lambda D}{d} \Rightarrow \beta \propto \frac{1}{d}$

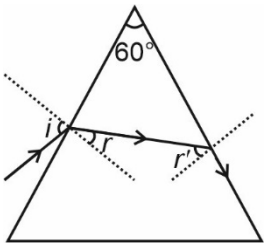
$$\beta' = \frac{\beta}{2} = \frac{0.2}{2} = 0.1 \text{ cm}$$

24. Answer (2)

Hint: For TIR, the angle of incidence at second face should be equal to the critical angle.

Sol.: For just TIR at second face

$$r' = c = \sin^{-1}\left(\frac{1}{\mu}\right)$$



From prism geometry:

$$r + r' = A = 60^\circ \Rightarrow r = 60^\circ - \sin^{-1}\left(\frac{1}{\mu}\right)$$

Apply Snell's law at the first face:

$1 \times \sin i = \mu \times \sin r$

$$\sin i = \mu \times \sin\left[60^\circ - \sin^{-1}\left(\frac{1}{\mu}\right)\right]$$

$$\therefore \quad i = \sin^{-1}\left[\mu \sin\left(60^\circ - \sin^{-1}\left(\frac{1}{\mu}\right)\right)\right]$$

25. Answer (3)

Hint: Use formula of magnification.

$$M = \frac{-L}{f_o} \times \frac{D}{f_e}$$

Sol.: In normal adjustment, the formula of magnification for compound microscope is given by $M = \frac{-L}{f_o} \times \frac{D}{f_e}$

Putting values, we get

$$M = \frac{-40}{2} \times \frac{25}{4} = -125$$

Hence assertion is correct

As evident from the formula, magnification is dependent on tube length, hence reason is incorrect.

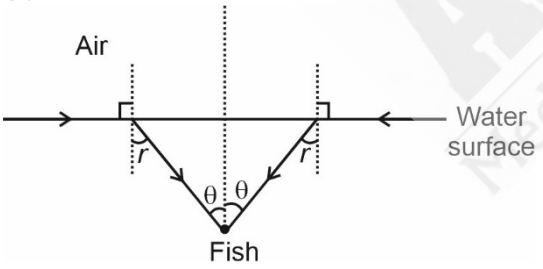
26. Answer (3)

Hint and Sol.: Only a real image can be formed form on a screen. According to the given situation, only a convex lens can achieve the desired outcome.

27. Answer (3)

Hint: Take the angle of incidence to be 90°, for the fish to see complete sky.

Sol.:



$1 \times \sin 90^\circ = \mu \times \sin r \Rightarrow 1 = \sqrt{2} \sin r$

$r = 45^\circ$

From geometry, $r = \theta$

Total angle subtended at the fish's eye = 2θ

$= 2 \times 45^\circ = 90^\circ$

28. Answer (4)

Hint and Sol.:

- Focal length of a lens is dependent on refractive index which in turn depends on wavelength of light used.
- Frequency of light remains same, hence $v \propto \lambda$. Thus, when a light wave enters from a rarer to denser medium, its speed as well as wavelength decrease.

29. Answer (2)

Hint: Use formula : $I = I_{max} \cos^2\left(\frac{\phi}{2}\right)$

Sol.: Intensity formula in YDSE is

$$I = I_{max} \cos^2\left(\frac{\phi}{2}\right)$$

Given $I = \frac{I_{max}}{2}$

$$\therefore \quad \frac{I_{max}}{2} = I_{max} \cos^2\left(\frac{\phi}{2}\right)$$

$$\cos\frac{\phi}{2} = \frac{1}{\sqrt{2}} \Rightarrow \phi = \frac{\pi}{2}$$

In general, $\phi = \frac{\pi}{2}, \frac{3\pi}{2}, \frac{5\pi}{2} \ldots$

Since, $\Delta\phi = \frac{2\pi}{\lambda}\Delta x \Rightarrow \Delta x = \frac{\lambda}{4}, \frac{3\lambda}{4}, \frac{5\lambda}{4} \ldots$

30. Answer (1)

Hint: Use formula $\delta_{min} = 2i - A$

Sol.: Given $A = 60^\circ$, $\delta_{min} = A$

$\delta_{min} = 2i - A$

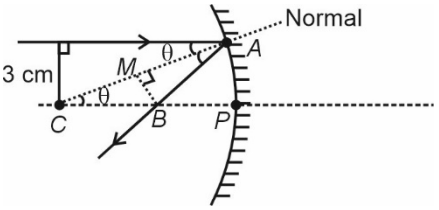
$60^\circ = 2i - 60^\circ$

$\Rightarrow \quad i = 60^\circ$

31. Answer (2)

Hint: Use law of reflection $Li = Lr$ and geometry to solve the given question.

Sol.:



$CP = CA$ = radius of curvature = 5 cm

$\theta = 37^\circ$

Due to congruent triangles, $CM = MA$

$$CM = \frac{CA}{2} = \frac{5}{2} \text{ cm}$$

In ΔBMC, $CB\cos\theta = CM$

$$CB = \frac{\frac{5}{2}}{\cos 37^\circ} = \frac{5 \times 5}{2 \times 4} = \frac{25}{8} \text{ cm}$$

$$\therefore \quad PB = CP - CB = 5 - \frac{25}{8} = \frac{15}{8} \text{ cm}$$

32. Answer (3)

Hint: Use equations $\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$ and $m=\frac{h_i}{h_o}=\frac{v}{u}$

Sol.: $\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$

$\Rightarrow \frac{1}{v}-\frac{1}{-20}=\frac{1}{10}$

$\Rightarrow \frac{1}{v}=\frac{1}{10}-\frac{1}{20}$

v = 20 cm

$m=\frac{h_i}{h_o}=\frac{v}{u}$

$\Rightarrow \frac{h_i}{1}=\frac{20}{-20}$

$\Rightarrow h_i = -1$ cm

Taking given coordinate system into consideration, the coordinates of image is (20 cm, – 1 cm)

33. Answer (2)

Hint and Sol.:

$1\times\sin i=\mu\sin r \Rightarrow 1\times\sin 30^\circ=\frac{3}{2}\times\sin r$

$\sin r=\frac{1}{3} \Rightarrow r\neq 60^\circ$

In a glass slab, emergent ray is parallel to incident ray but laterally shifted and lateral shift increases with increase in thickness of the slab.

34. Answer (4)

Hint: Properties of γ-rays.

Sol.: γ-rays are produced in nuclear reactions.

γ-rays have wavelength from about 10^{-10} m to 10^{-14} m

35. Answer (2)

Hint and Sol.: The correct form of Gauss's law for magnetism is $\oint \vec{B}\cdot d\vec{A}=0$

36. Answer (4)

Hint: For an EM wave $\hat{E}\perp\hat{B}\perp\hat{v}$

Sol.: $\hat{E}+\hat{B}$ will lie in the plane of $\hat{E}$, $\hat{B}$ and hence, it will be perpendicular to $\hat{v}$.

$\therefore \quad \left(\hat{E}+B\right)\cdot\hat{v}=0$

37. Answer (3)

Hint and Sol.: Microwaves are used in RADAR systems due to their ability to penetrate through most atmospheric conditions like rain, clouds, smoke and also because their wavelengths are suitable for reflecting off objects of interest.

38. Answer (4)

Hint: Speed of EM wave, $v=\frac{\omega}{K}$

Sol.: Using equation, $v=\frac{\omega}{K}$, we get speed of the given EM wave as

$\frac{3\times10^7}{0.05}=6\times10^8$ m s^{-1}

This speed is greater than speed of light in vacuum, which is not possible.

39. Answer (2)

Hint: Power consumed, $P = V_{rms}\, I_{rms}\cos\phi$

Sol.: Given, $\phi = 60^\circ$, V_{rms} = 100 V, $I_{peak} = \sqrt{2}$ A

$I_{rms}=\frac{I_{peak}}{\sqrt{2}}=\frac{\sqrt{2}}{\sqrt{2}}=1$ A

$P = V_{rms}\times I_{rms}\cos\phi$

$= 100 \times 1 \times \cos 60^\circ = 50$ W

40. Answer (4)

Hint: Use equation $V=i\sqrt{R^2+X_L^2}$

Sol.: Given i = 1 A, R = 100 Ω, L = 1 H, V = 200 V

Impedance $z=\sqrt{R^2+(2\pi fL)^2}$

$z=\frac{V}{i}=200\ \Omega$

$200=\sqrt{100^2+(2\pi f)^2}$

$\Rightarrow$ $40000 = 10000 + 4\pi^2 f^2$

$f=\sqrt{\frac{30000}{4\pi^2}}=\frac{100}{2\pi}\sqrt{3}=\frac{50\sqrt{3}}{\pi}$ Hz

41. Answer (4)

Hint: At resonance, $X_L = X_C$ and impedance becomes minimum.

Sol.: At resonance, $X_L = X_C$. Hence, voltage across L and C are equal in magnitude, but they are 180 degrees out of phase and therefore cancel each other.

42. Answer (2)

Hint: $X_c=\frac{1}{\omega C}=\frac{1}{2\pi fC}$; $X_L=\omega L=2\pi fL$

Sol.: For inductor, graph of X_L vs f is a straight line, hence the circuit should contain inductor only.

43. Answer (1)

Hint and Sol.: In pure capacitive circuit power factor is $\cos\theta = 0$

As, $\theta = 90°$

44. Answer (4)

Hint: $\langle i \rangle = \dfrac{\int_{t_1}^{t_2} i\,dt}{\int_{t_1}^{t_2} dt} = \dfrac{\int_{t_1}^{t_2} i\,dt}{(t_2 - t_1)}$

Sol.: $\langle i \rangle = \dfrac{\int_{t_1}^{t_2} i\,dt}{(t_2 - t_1)} = \dfrac{\int_{1}^{5} (2+3t)dt}{5-1}$

$$\langle i \rangle = \frac{1}{4}\left(2t + \frac{3t^2}{2}\right)_1^5 = \frac{1}{4}\left[2\times(5-1) + \frac{3}{2}(5^2 - 1^2)\right]$$

$$= \frac{1}{4}[8 + 36] = 11 \text{ mA}$$

45. Answer (2)

Hint and Sol.: $i_{rms} = \left[\dfrac{\int_0^T i^2 dt}{\int_0^T dt}\right]^{\frac{1}{2}}$

$$i_{rms}^2 = \frac{\int_0^T (i_1 + i_2 \sin\omega t + i_3 \cos\omega t)^2 dt}{\int_0^T dt}$$

Mean of $\sin^2(\omega t)$ and $\cos^2(\omega t)$ is $\frac{1}{2}$ and mean of $\sin(\omega t)$ and $\cos(\omega t)$ over one cycle is zero.

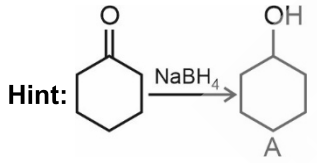
Solving this, we will get

$$i_{rms} = \left(i_1^2 + \frac{i_2^2}{2} + \frac{i_3^2}{2}\right)^{\frac{1}{2}}$$

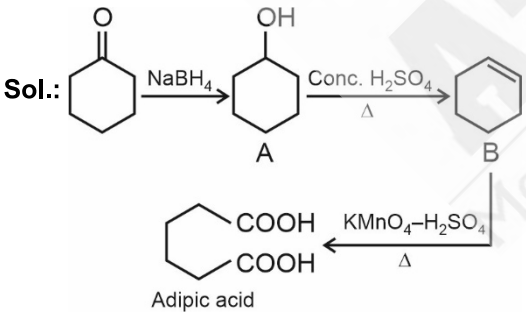
[CHEMISTRY]

46. Answer (1)

Hint:



Sol.:



47. Answer (2)

Hint: $6HCHO + 4NH_3 \rightarrow \underset{\text{Urotropin}}{(CH_2)_6N_4} + 6H_2O$

Sol.: $2HCHO \xrightarrow[NaOH]{\text{Conc.}} CH_3OH + HCOO^-$

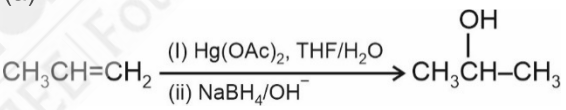
HCHO disproportionates to methanol and sodium formate.

48. Answer (3)

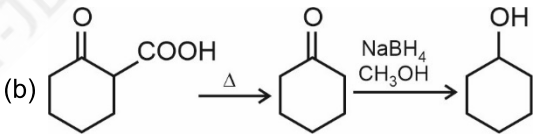
Hint: β-keto acid undergoes decarboxylation on heating in presence of acid catalyst.

Sol.:

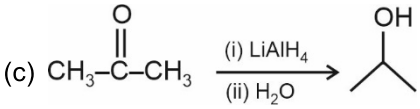
(a)



(b)



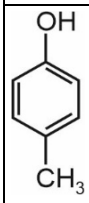
(c)

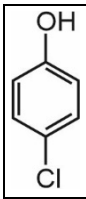
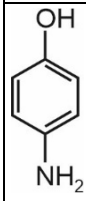
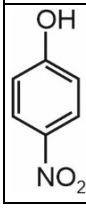


49. Answer (1)

Hint: electron withdrawing group present at para-position of phenol will increase its acidity and hence pK_a value will be less.

Sol.:

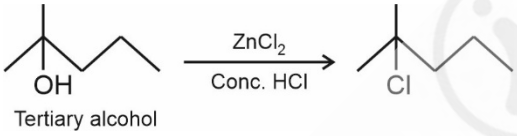
Compounds		pK_a
	–	10.2

	–	9.38
	–	10.3
	–	7.15

50. Answer (3)

Hint: Tertiary alcohols give immediate turbidity on reaction with Lucas reagent ($ZnCl_2$/HCl).

Sol.:

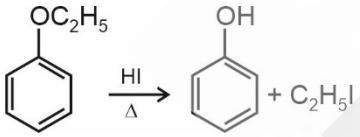


Tertiary alcohol

51. Answer (1)

Hint: Ethoxybenzene is called phenetole

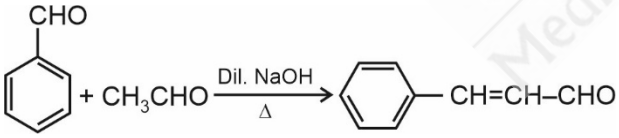
Sol.:



52. Answer (1)

Hint: Ph–CH=CH–CHO is cinnamaldehyde

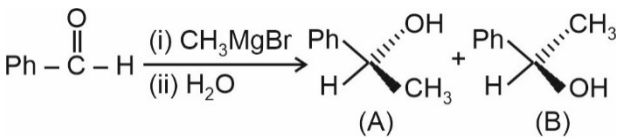
Sol.:



53. Answer (4)

Hint: The compound which on addition of Grignard reagent results in formation of chiral centre will result in formation of a pair of enantiomers.

Sol.:



(A) and (B) are enantiomers.

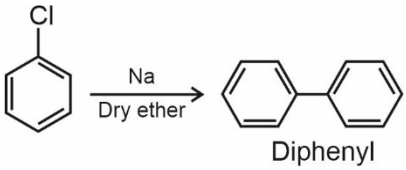
54. Answer (3)

Hint: $COCl_2$ is called carbonyl chloride.

Sol.:

- $2CHCl_3 \xrightarrow[h\nu]{O_2} 2COCl_2 + 2HCl$
- $2CHCl_3 + 6Ag \rightarrow C_2H_2 + 6AgCl$
- $CHCl_3 + HNO_3 \rightarrow \underset{\text{Chloropicrin}}{CCl_3NO_2} + H_2O$

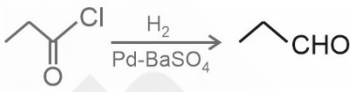
55. Answer (1)

Hint: 2 

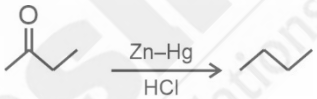
It is Fittig reaction

Sol.:

- Rosenmund recuction



- Clemmensen reduction



- Swarts reaction

$CH_3CH_2 - Br \xrightarrow{AgF} CH_3CH_2 - F$

56. Answer (4)

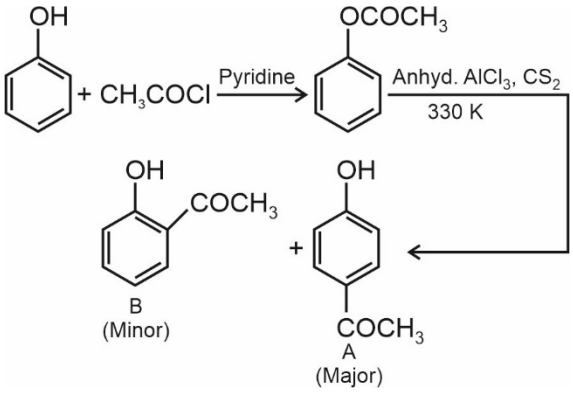
Hint: For aldol condensation reaction, 2α hydrogen atoms are required.

Sol.: 2-Methylpropanal contains only one α-hydrogen atom hence it does not undergo aldol condensation reaction.

57. Answer (1)

Hint: Phenyl esters undergo Fries rearrangements when heated with anhyd. $AlCl_3$ and CS_2.

Sol.:



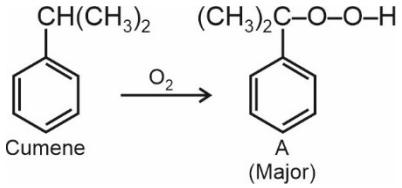
58. Answer (2)

Hint: Electron withdrawing group stabilises the carbanion formed by the attack of nucleophile.

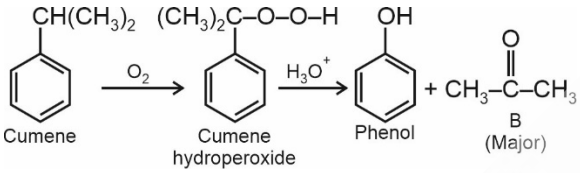
Sol.: More is the number of electron withdrawing group at o/p positions to the haloarene faster will be the nucleophilic substitution reaction.

59. Answer (3)

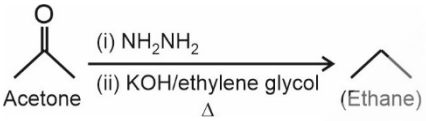
Hint:



Sol.:



- Wolff-Kishner reduction



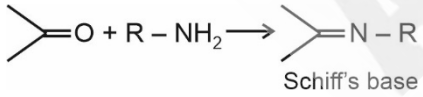
60. Answer (1)

Hint: $CO + 2H_2 \xrightarrow[200\text{-}300\ atm,\ 573\text{-}673\ K]{ZnO-Cr_2O_3} CH_3OH$

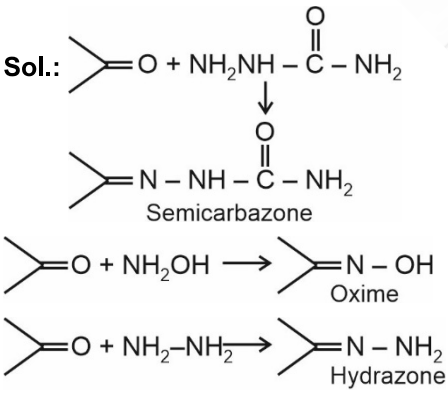
Sol.: $C_6H_{12}O_6 \xrightarrow{Zymase} 2C_2H_5OH + 2CO_2$

61. Answer (4)

Hint:



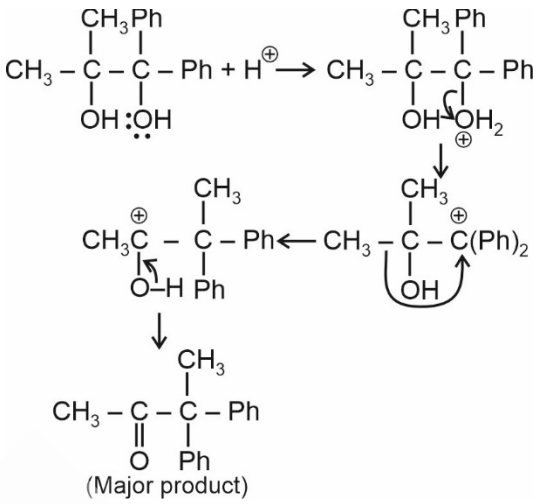
Sol.:



62. Answer (2)

Hint: In first step, dehydration will lead to more stable carbocation.

Sol.:



63. Answer (3)

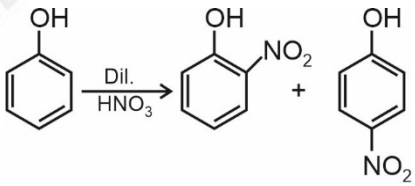
Hint: More is the branching, lesser is surface area and lesser is vander Waals force of attraction and lesser is boiling point.

Sol.:

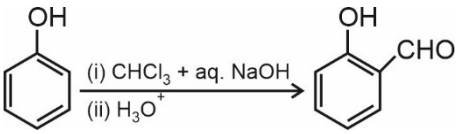
Molecule	Dipole moment/(D)
CH_3 –F	1.847
CH_3 – Cl	1.860
CH_3 – Br	1.830
CH_3 – I	1.636

64. Answer (2)

Hint:



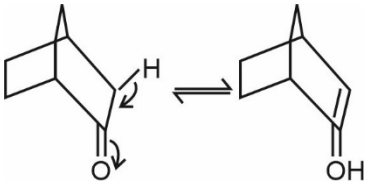
Sol.:

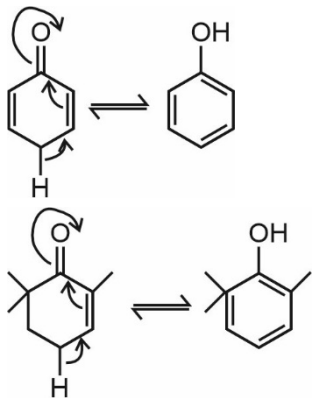


65. Answer (2)

Hint: Compounds which contain enolisable hydrogen will show keto-enol tautomerism.

Sol.: Bridged hydrogen are not involved in keto-enol tautomerism.

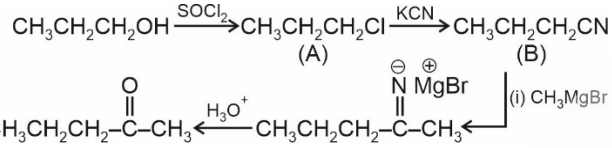




66. Answer (3)

Hint: $CH_3CH_2CH_2OH \xrightarrow{SOCl_2} CH_3CH_2CH_2Cl$

Sol.:

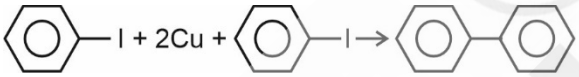


67. Answer (2)

Hint: In Ullmann reaction, iodobenzene is converted to diphenyl

Sol.:

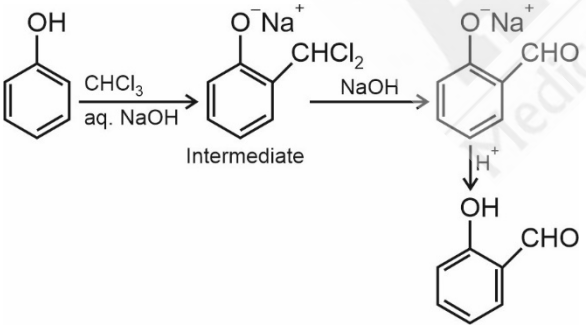
- Ullmann reaction



- Cannizzaro reaction

$$2PhCHO \xrightarrow[\Delta]{50\%\ NaOH} PhCH_2OH + PhCOO^-Na^+$$

- Reimer-Tiemann reaction

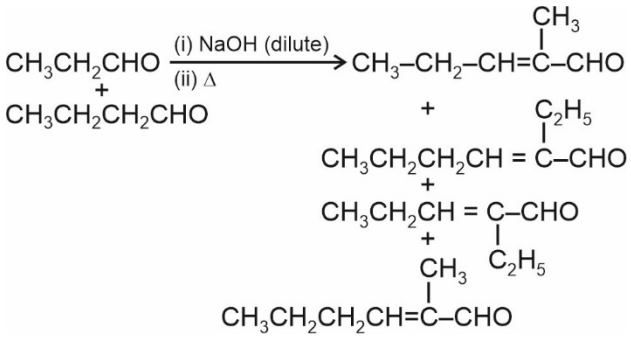


- Fittig reaction

68. Answer (4)

Hint: In aldol condensation reaction of mixed aldehydes, α, β unsaturated aldehydes are formed.

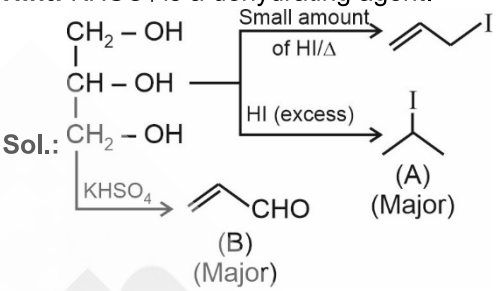
Sol.:



69. Answer (4)

Hint: $KHSO_4$ is a dehydrating agent.

Sol.:



70. Answer (4)

Hint: The compounds which are stronger acid than carbonic acid will liberate CO_2 on reaction with $NaHCO_3$.

Sol.: Benzoic acid, formic acid, phenylacetic acid and picric acid are stronger acid then H_2CO_3 while carbolic acid (phenol) is weaker acid than H_2CO_3.

71. Answer (3)

Hint: Cleavage of C – O bond is difficult if it has double bond character.

Sol.: In diphenyl ether due to resonance C – O bond has double bond character hence this bond is most difficult to cleave by HI.

72. Answer (2)

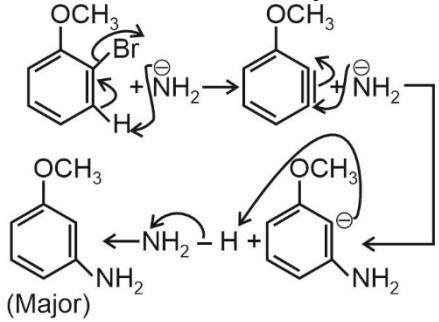
Hint: The polar protic solvents are those whose hydrogen is directly attached with N, O etc atoms.

Sol.:  is polar aprotic solvent while CH_3OH (methanol) is polar protic solvent.

73. Answer (3)

Hint: The reaction follows benzyne mechanism

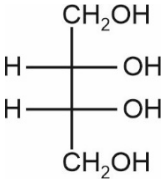
Sol.:



74. Answer (3)

Hint: The compound which contains plane of symmetry is achiral and optically inactive due to internal compensation.

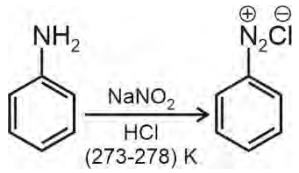
Sol.:



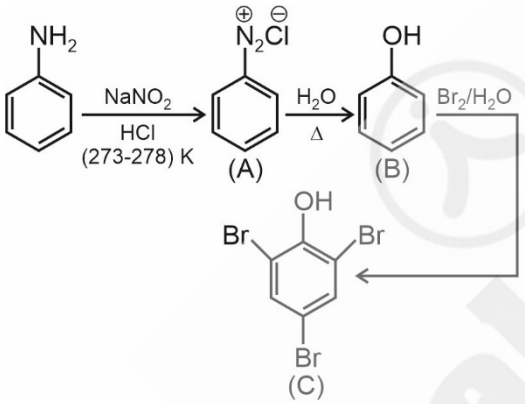
The compound contains plane of symmetry. It is achiral and optically inactive. It is a meso compound.

75. Answer (3)

Hint:



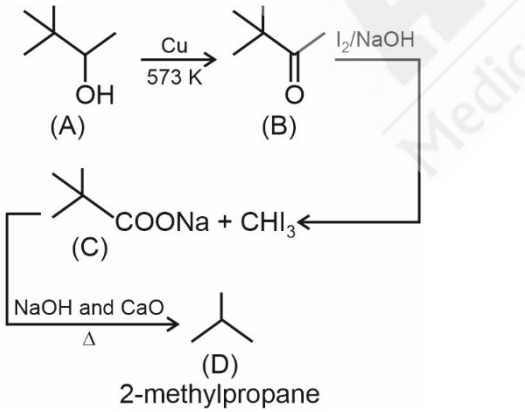
Sol.:



76. Answer (3)

Hint: Compound (B) contains keto-methyl group.

Sol.:



77. Answer (4)

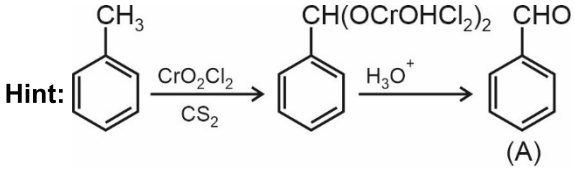
Hint: More is the electrophilicity of carbonyl carbon and lesser is the steric hindrance of the tetrahedral intermediate faster is the nucleophilic addition reaction.

Sol.: Aliphatic aldehydes react faster than aromatic aldehydes.

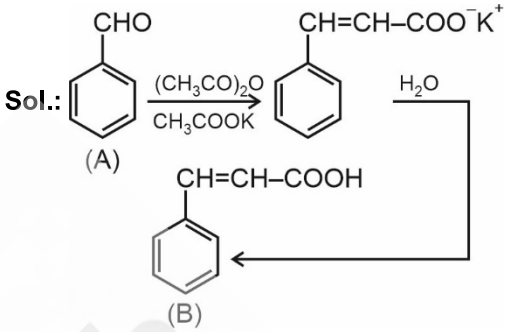
Ketones are least reactive towards nucleophilic addition reaction.

78. Answer (2)

Hint:



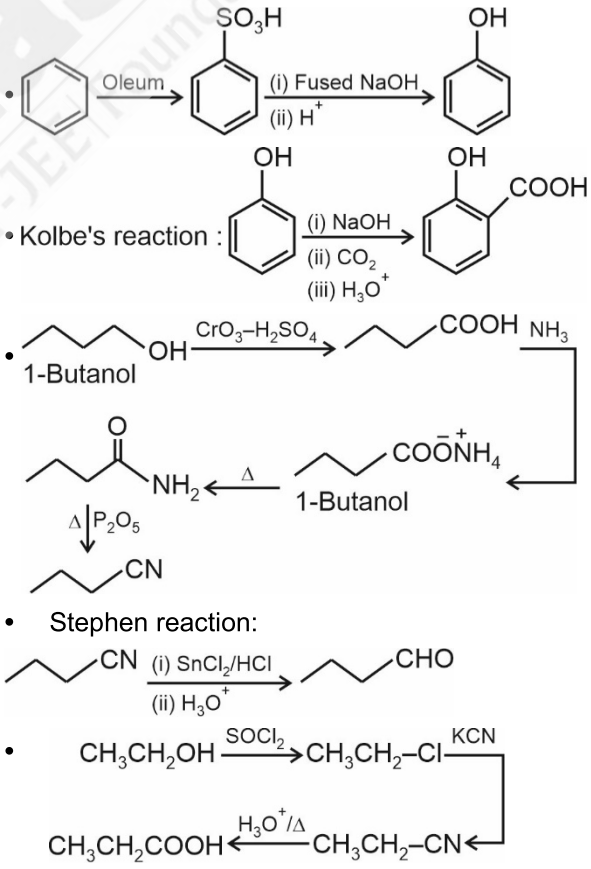
Sol.:



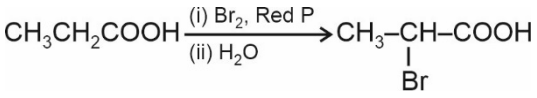
79. Answer (2)

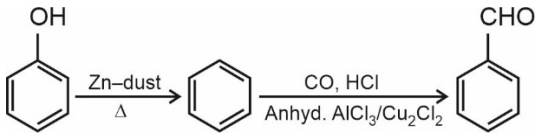
Hint: Starting material for Kolbe's reaction is phenol.

Sol.:

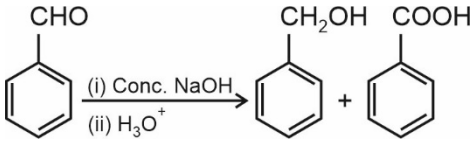


- HVZ reaction



- 

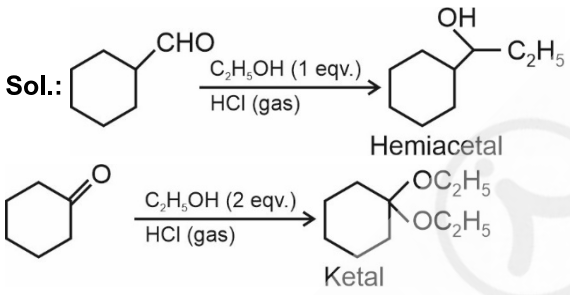
- Cannizzaro reaction:



80. Answer (4)

Hint: Aldehyde on reaction with one equivalent of alcohol in presence of acid catalyst gives hemiacetal.

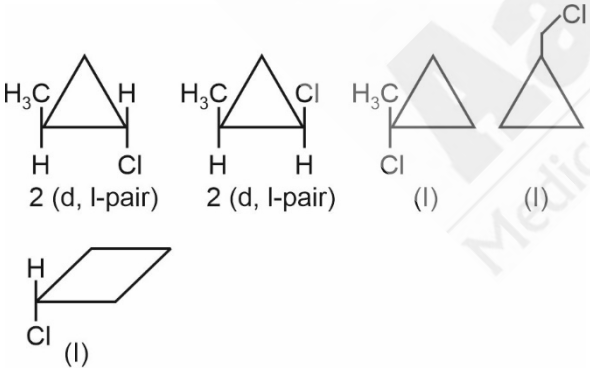
Sol.:



81. Answer (3)

Hint: C_4H_7Cl will give three membered and four membered rings.

Sol.:



Total number of cyclic isomers = 7

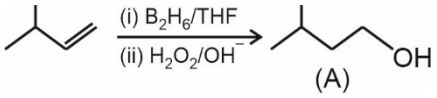
82. Answer (2)

Hint: π-electron cloud stabilise the transition state in S_N2 reaction pathway.

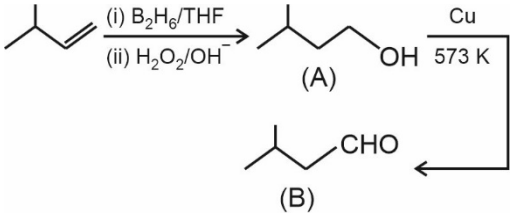
Sol.: Benzyl chloride is more reactive than allyl chloride as benzene ring is slightly better at π conjugation than isolated double bond.

Secondary alkyl chloride will react at slowest rate because of steric reason.

83. Answer (2)

Hint: 

Sol.:

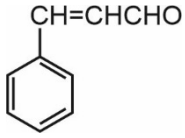


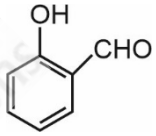
84. Answer (1)

Hint: $CH_3CH_2CH_2CH_2CHO$ is the structure of valeraldehyde.

Sol.:

Valeraldehyde – $CH_3CH_2CH_2CH_2CHO$

Cinnamaldehyde – 

Salicylaldehyde – 

Mesityl oxide – $(CH_3)_2C = CHCOCH_3$

85. Answer (3)

Hint: More is the –I effect of the groups more will be the acidity of the compound

Sol.: –I effect order : $–NO_2 > –CN > –F$

Acidic strength order:

$NO_2CH_2COOH > NC–CH_2COOH > FCH_2COOH$

86. Answer (2)

Hint: Compounds containing $CH_3–\overset{\overset{O}{\|}}{C}–$ group or $CH_3–\underset{\underset{OH}{|}}{CH}–$ group will give positive iodoform test.

Sol.:

- Acetone $CH_3–\overset{\overset{O}{\|}}{C}–CH_3$, acetaldehyde $(CH_3–\overset{\overset{O}{\|}}{C}–H)$, ethyl alcohol (C_2H_5OH), isopropanol $(CH_3–\underset{\underset{OH}{|}}{\overset{\overset{H}{|}}{C}}–CH_3)$, acetophenone $(Ph–\overset{\overset{O}{\|}}{C}–CH_3)$ give positive iodoform test.
- Both acetaldehyde and ethyl alcohol will give positive iodoform test hence the pair cannot be distinguished by iodoform test.

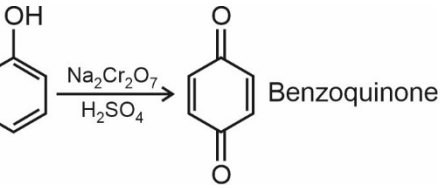
87. Answer (2)

Hint: Boiling point of propanone (acetone) is more than propanal.

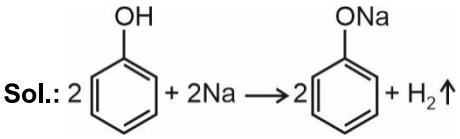
Sol.: Methanal, ethanal and propanone are miscible with water in all proportions because they form hydrogen bond with water.

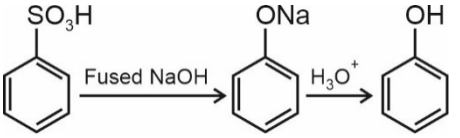
88. Answer (4)

Hint:



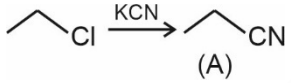
Sol.:



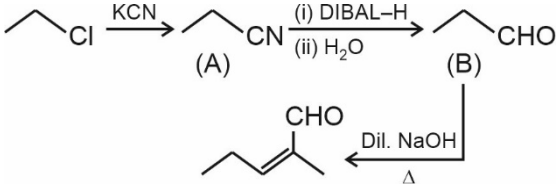


89. Answer (3)

Hint:



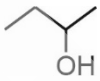
Sol.:



90. Answer (3)

Hint: Primary alcohols give red colour in Victor Meyer's test while secondary alcohols give blue colour.

Sol.:

	Alcohol	Colour in Victor Meyer's test
a.	 (sec-Butyl alcohol) →	Blue
b.	 (Neopentyl alcohol) →	Red
c.	 (Isopropyl alcohol) →	Blue
d.	 (Isobutyl alcohol) →	Red

Secondary alcohols give blue colour in Victor Meyer's test.

[BOTANY]

91. Answer (1)

Hint: *Lactobacillus* or LAB produces lactic acid by partially digesting milk. No CO_2 is released during lactic acid formation.

Sol.: A small amount of curd added to the fresh milk as inoculum or starter contains millions of LAB that perform lactic acid fermentation.

92. Answer (1)

Hint: LAB converts milk into curd.

Sol.: LAB plays a beneficial role in checking disease causing microbes in our stomach.

93. Answer (3)

Hint: Roquefort cheese is ripened by a genus that also forms penicillin.

Sol.: The 'Roquefort cheese' is ripened by a specific fungus called *Penicillium roquefortii*.

94. Answer (3)

Hint: Brewer's yeast is the same organism which is used for bread making.

Sol.: Penicillin is obtained from *Penicillium notatum*.

95. Answer (3)

Hint: Concentration of alcohol in rum is greater than 13%.

Sol.: Wine and Beer are non-distilled beverages.

96. Answer (4)

Hint: Fleming, Chain and Florey were awarded Nobel prize in 1945 for the discovery associated with antibiotic penicillin.

Sol.: Antibiotics produced by microbes are regarded as one of the most significant discoveries of the twentieth century.

97. Answer (1)

Hint: *Acetobacter aceti* is used for the commercial production of acetic acid used for vinegar preparation.

Sol.: *Aspergillus niger* – Citric acid and pectinase

Clostridium butylicum – Butyric acid for rancid butter

Streptococcus – Streptokinase

98. Answer (1)

Hint: The bottled fruit juices are clarified by the use of a kind of digesting enzyme.

Sol.: By the use of proteases and pectinases, bottled fruit juices are clarified.

99. Answer (3)

Hint: Fleming accidently discovered penicillin.

Sol.: Penicillin's full potential as an effective antibiotic was established by Chain and Florey.

100. Answer (3)

Hint: Statins have been commercialised as blood-cholesterol lowering agents.

Sol.: Cyclosporin A is used as an immunosuppressive agent in organ transplant patients and is produced by the fungus *Trichoderma polysporum*.

101. Answer (4)

Hint: Viruses, bacteria, fungi protozoans, viroids and prions are included in microbes.

Sol.: Bacterial colonies can be seen with naked eyes. Production of beverages on an industrial scale, requires fermentors. Viruses are obligate parasites.

102. Answer (2)

Hint: Statins are the blood-cholesterol lowering agents.

Sol.: *Monascus purpureus* produces statins, that have been commercialised as blood cholesterol lowering agents.

103. Answer (4)

Hint: High BOD indicates highly polluted water.

Sol.: Sewage should not be discharged into natural water bodies like rivers and streams directly because it contains a large amount of organic matter and microbes, many of which are pathogenic.

104. Answer (2)

Hint: The primary effluent is passed into large aeration tanks for secondary treatment.

Sol.: Primary treatment steps basically involve physical removal of particles-large and small-from the sewage through filtration and sedimentation. These are removed in stages: initially, floating debris is removed by sequential filtration. Then the grit are removed by sedimentation. All solids that settle form the primary sludge and the supernatant forms the effluent.

105. Answer (2)

Hint: While growing, aerobic microbes consume the major part of the organic matter in the effluent. This significantly reduces the BOD of effluent.

Sol.: Once the BOD of sewage or waste water is reduced significantly, the effluent is then passed into a setting tank where the bacterial flocs are allowed to sediment.

106. Answer (3)

Hint: Methanogens digest the sludge in anaerobic sludge digester.

Sol.: Major part of the activated sludge is pumped into large tanks called anaerobic sludge digesters. Here, methanogens digest the sludge to produce a mixture of gases such as methane, hydrogen sulphide and CO_2.

107. Answer (2)

Hint: *Rhizobium* is a symbiotic N_2-fixing bacterium.

Sol.:

Trichoderma	:	Its species are free-living fungi that are very common in the root ecosystems.
Nucleopolyhedrovirus	:	The majority of baculoviruses used as biological control agents are in this genus. They attack insects and other arthropods
Bacillus thuringiensis	:	Are helpful in the biocontrol of butterfly caterpillars.

108. Answer (2)

Hint: The main sources of biofertilizers are bacteria, fungi and cyanobacteria.

Solution: *Aulosira* is a non-symbiotic nitrogen fixer in the rice fields in India. Blue green algae adds organic matter to the soil and increase its fertility.

109. Answer (1)

Hint: X-Regulators, Y-Conformers, Z-Partial regulators.

Sol.: Regulators 'X' are able to maintain homeostasis by physiological means. Conformers 'Y' shows larger surface area relative to their volume. Thermoregulation is energetically expensive. Conformers are rarely found in polar regions.

110. Answer (3)

Hint.: Mortality = Number of death/Initial population density

Sol: If 12 individuals in a laboratory population of 150 fruitflies died during a specified time interval, say a week, the death rate in the population during that period is $\frac{12}{150} = 0.08$ individuals per fruitfly per week.

111. Answer (1)

Hint: *Pisaster* is an important predator in the rocky intertidal communities of the American Pacific Coast.

Sol.: When all the starfish Pisaster were removed from an enclosed intertidal area, more than 10 species of invertebrates became extinct within a year because of interspecific competition.

112. Answer (4)

Sol.: Tiger census in National parks of India is usually based on pugmarks and faecal pellets.

113. Answer (4)

Hint: Epiphytes on other plants is an example of commensalism.

Sol.: In parasitism and predation, one interacting species is benefited and the other is harmed.

Examples- *Cuscuta* on hedge plants.

Cuckoo laying its egg in the nest of crow.

114. Answer (1)

Hint: Fig and fig wasp show mutualism.

Sol.: The evolution of the flower and its pollinator species is tightly linked with one another.

115. Answer (2)

Hint: When N/K is exactly one, the influence of environmental resistance over the biotic potential equals zero.

Sol.: The graph of N will superimpose K (carrying capacity).

116. Answer (2)

Hint: Parasites have a complex life cycle, involving one or two intermediate hosts.

Sol.: Parasites do not have digestive system as they directly derive nourishment from their hosts.

117. Answer (2)

Hint: Competitive co-existence prevents competitive exclusion.

Sol.: Resource partitioning or resource sharing by choosing different times for feeding or different foraging pattern promotes co-existence.

118. Answer (1)

Hint: In protocooperation, both the interacting species are benefited.

Sol.: Mosquito is not considered a parasite as the female mosquito needs blood for reproduction only.

119. Answer (3)

Hint: Triangular age pyramid shows a growing population.

Sol.: Urn-shaped age pyramid shows a declining population growth.

120. Answer (2)

Hint: Although animals eating plants are categorised separately as herbivores, they are, in a broad ecological context, not very different from predators.

Sol.: No population of any species in nature has at its disposal unlimited resources to permit exponential growth.

121. Answer (1)

Hint: 'r-selected species' have high fecundity.

Sol.: The species having high reproductive capacity is desired to maximise the reproductive fitness.

122. Answer (1)

Hint: Exponential growth gives J-shaped curve when plotted graphically.

Sol.: The logistic growth describes a situation in which the resources in the environment are limited.

123. Answer (3)

Hint: Butterfly caterpillar feed on leaves.

Sol.: The butterfly acquires the chemical during its caterpillar stage by feeding on a poisonous weed.

124. Answer (1)

Hint: The population size keeps changing with time, depending on various factors including food availability, predation pressure and adverse weather.

Sol.: Ideally, when resources in the habitat are unlimited, each species has the ability to realize fully its innate potential to grow in number, as Darwin observed while developing his theory of natural selection.

125. Answer (4)

Hint: A Mediterranean orchid employs sexual deceit.

Sol.: The Mediterranean orchid *Ophrys* employs 'sexual deceit' to get pollination done by a species of bee.

126. Answer (4)

Hint: Predation can be considered as nature's way of transferring to higher trophic levels the energy fixed by plants.

Sol.: Predators help in maintaining species diversity in a community, by reducing the intensity of competition among the competing prey species.

127. Answer (2)

Hint: Mortality is the number of deaths in the population during a given period.

Sol.:

Natality: The number of births during a given period in the population that are added to the initial density

Immigration: The number of individuals of the same species that have come into the habitat from elsewhere during the time period under consideration.

128. Answer (4)

Hint: If the age distribution is plotted for a population, the resulting structure is called an age pyramid.

Sol.: For a population, the age pyramids generally show age distribution of males and females in the same diagram.

129. Answer (1)

Hint: Mammals are regulators

Sol.: Evolutionary biologists believe that the "success" of mammals is largely due to their ability to maintain a constant body temperature and thrive whether they live in Antarctica or in the Sahara desert.

130. Answer (2)

Sol.: When certain exotic species are introduced into a geographical area, they become invasive and start spreading fast because the invaded land does not have their natural predators.

131. Answer (3)

Hint: Niche of an organism represents the range of conditions that it can tolerate, the resources it utilises and its functional role in ecological system.

Sol.: Adaptation is any attribute of the organism that enables the organism to survive and reproduce in its habitat.

132. Answer (3)

Hint: Connell's field experiment was on two different genera of barnacles.

Sol.: Connell's elegant field experiments showed that on the rocky sea coasts of Scotland, the larger and competitively superior barnacle *Balanus* dominates the intertidal area, and excludes the smaller barnacle *Chathamalus* from that zone. It is competitive exclusion.

133. Answer (1)

Hint: *Calotropis* produces a highly poisonous compound.

Sol.: Weed *Calotropis* growing in abandoned fields produces highly poisonous cardiac glycosides and that is why you never see any cattle browsing on this plant.

134. Answer (1)

Hint: Interspecific interactions arise from the interaction of populations of two different species.

Sol.: For any species, the minimal requirement is of one more species on which it can feed. Predation, parasitism and commensalism share a common characteristic of the interacting species living closely together.

135. Answer (4)

Hint: Verhulst-Pearl Logistic Growth shows a sigmoid curve.

Sol.: Verhulst-Pearl Logistic Growth is described by the equation $dN/dt = rN(K - N)/K$.

[ZOOLOGY]

136. Answer (3)

Hint: Repeated use of drug increases its amount for same effect

Sol.: With repeated use of drugs, the tolerance level of the receptors present in our body increases. Consequently the receptors respond only to high dosage of drugs leading to greater intake and addition.

137. Answer (1)

Hint: Contact inhibition.

Sol.: Cancerous cells grow very rapidly, invading and damaging the surrounding normal tissues. As these cells actively divide and grow, they also starve the normal cells by competing for vital nutrients.

Cancerous cells show high telomerase activity.

138. Answer (4)

Hint: Heroin is chemically diacetylmorphine.

Sol.: Heroin, commonly called smack, is chemically diacetylmorphine which is a white, odourless, bitter and crystalline compound. It is obtained by acetylation of morphine, which is extracted from the latex of poppy plant.

139. Answer (2)

Hint: Incorrect for cocaine

Sol.: Coca alkaloid or cocaine is obtained from the coca plant *Erythroxylum coca*, native to South America. It interferes with the transport of the neuro-transmitter dopamine. Cocaine, commonly called coke or crack, is usually snorted. It has a potent stimulating action on central nervous system, producing a sense of euphoria and increased energy. Excessive dosage of cocaine causes hallucinations.

140. Answer (3)

Hint: Exclude a viral infection

Sol.: Smoking is associated with increased incidences of cancer of lungs, urinary bladder and throat, bronchitis, emphysema, coronary heart disease, gastric ulcer, *etc*.

Hepatitis-B primarily spreads *via* contact with infected blood and body fluids through sharing of infected syringes and from infected mother to her baby.

141. Answer (4)

Hint: Kills T-helper cells

Sol.: HIV enters into helper T-lymphocytes, replicates and produces progeny viruses. The progeny viruses released in the blood attack other helper T-lymphocytes. This repetition leads to a progressive decrease in the number of helper-T lymphocytes in the body of the infected person. During this period, the person suffers from bouts of fever, diarrhoea and weight loss.

142. Answer (1)

Hint: Filariasis

Sol.: *Wuchereria* (*W. bancrofti* and *W. malayi*), the filarial worms cause a slowly developing chronic inflammation of the organs in which they live for many years, usually the lymphatic vessels of the lower limbs and the disease is called elephantiasis or filariasis. The genital organs are also often affected, resulting in gross deformities. The pathogens are transmitted to a healthy person through the bite of an infected female mosquito (*Culex*) vector. Ascariasis and amoebic dysentery spread through contaminated food and water.

143. Answer (1)

Hint: Discovered blood circulation

Sol.: Health, for a long time, was considered as a state of body and mind where there was a balance of certain 'humors'. This is what early Greeks like Hippocrates as well as Indian Ayurveda system of medicine asserted. This idea was arrived at by pure reflective thought. The discovery of blood circulation by William Harvey using experimental method and the demonstration of normal body temperature in individuals with blackbile using thermometer disapproved the 'good humor' hypothesis of health. Alfred Wallace and Darwin gave the theory of evolution.

144. Answer (4)

Hint: Genetic disorders run across generations.

Sol.: Mind and mental state can affect our health. Health is affected by:-

(i) Genetic disorders – Deficiencies with which a child is born and deficiencies/defects which the child inherits from parents from birth

(ii) Infections

(iii) Life style including food and water we take, rest and exercise we give to our bodies, habits that we have or lack, *etc*.

Consumption of anti-oxidants is considered healthy.

145. Answer (1)

Hint: Equal to the number of ear ossicles present in one ear of a man

Sol.:

- When the mosquito bites another human, sporozoites are injected with the bite.
- The parasite reproduces asexually in liver cells of the human host.
- Parasites reproduce asexually in RBCs bursting and releasing haemozoin.
- Female *Anopheles* is the vector of the malarial parasite.

Gametocytes develop in RBCs of the human host.

146. Answer (2)

Hint: Thymus gland

Sol.: The thymus is a lobed organ located near the heart and beneath the breastbone. The thymus is quite large at the time of birth but keeps reducing in size with age and by the time puberty is attained, it reduces to a very small size. Both bone-marrow and thymus provide micro-environments for the development and maturation of T-lymphocytes.

147. Answer (4)

Hint: A potent vasoconstrictor

Sol.: The exaggerated response of the immune system to certain antigens present in the environment is called allergy. Symptoms of allergic reactions include sneezing, watery eyes, runny nose and difficulty in breathing. The use of drugs like anti-histamine, adrenaline and steroids quickly reduce the symptoms of allergy. Histamine and serotonin cause allergic reaction.

148. Answer (4)

Hint: Cellular barrier of innate immunity.

Sol.:

(i) **Physical barriers:** Skin on our body is the main barrier which prevents entry of the micro-organisms. Mucus coating of the epithelium lining the respiratory, gastrointestinal and urogenital tracts helps in trapping microbes entering our body.

(ii) **Physiological barriers:** Acid in the stomach, saliva in the mouth and tears from eyes-all prevent microbial growth.

(iii) **Cellular barriers:** Certain types of leukocytes (WBCs) of our body like polymorpho-nuclear leukocytes (PMNL-neutrophils) and monocytes and natural killer cells (type of lymphocytes) in the blood as well as macrophages in tissues can phagocytose and destroy microbes.

149. Answer (3)

Hint: Many organisms belonging to the genera *Microsporum* cause ringworms.

Sol.: Chikungunya – Virus

Diphtheria – Bacteria

Malaria – Protozoa

Ringworm – Fungi

150. Answer (3)

Hint: Choose the confirmatory test for typhoid

Sol.: Typhoid fever could be confirmed by Widal test. A classic case in medicine, that of Mary Mallon nicknamed Typhoid Mary, is worth mentioning. She was a cook by profession and was a typhoid carrier who continued to spread typhoid for several years through the food she prepared.

MRI and biopsy are performed for diagnosing cancer.

PCR is performed to detect disease at early stage.

151. Answer (4)

Hint: Equal to the number of bones in index finger of humans.

Sol.: *Ascaris*, an intestinal parasite, causes ascariasis. Symptoms of this disease include internal bleeding, muscular pain, fever, anaemia and blockage of the intestinal passage. The eggs of the parasite are excreted along with the faeces of infected individuals which contaminate soil, water, plants, *etc*. A healthy person acquires this infection through contaminated water, vegetables, fruits, *etc*.

152. Answer (2)

Hint: Through contaminated inanimate objects

Sol.: Ringworms are generally acquired from soil or by using towels, clothes or even the comb of infected individuals. Many fungi belonging to the genera *Microsporum*, *Trichophyton* and *Epidermophyton* are responsible for ringworms which is one of the most common infectious diseases in man. Appearance of dry, scaly lesions on various parts of the body such as skin, nails and scalp are the main symptoms of this disease.

Malaria spreads through the bite of an infected female *Anopheles*. Polio, typhoid, ascariasis, *etc*., spread through faeco-oral route. Pneumonia, common cold, *etc*., spread through droplets.

153. Answer (4)

Hint: Exclude the physiological barrier

Sol.: Tumor cells have been shown to avoid detection and destruction by immune system. Therefore, the patients are given substances called biological response modifiers, such as α-interferon, which activates their immune system and helps in destroying the tumor.

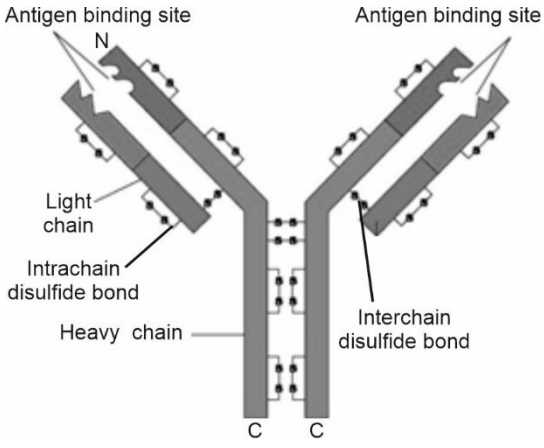
Cytokine barriers: Virus-infected cells secrete proteins called interferons which protect non-infected cells from further viral infection.

Tears from eyes are categorized as physiological barrier of innate immunity.

154. Answer (1)

Hint: Equal to the number of floating ribs in a man.

Sol.:



155. Answer (1)

Hint: Increased sensitivity to the environment

Sol.: Somehow, modern-day life style has resulted in lowering of immunity and more sensitivity to allergens - more and more children in metro cities of India suffer from allergies and asthma due to sensitivity to the environment. This could be because of the protected environment provided early in life.

156. Answer (4)

Hint: Exclude the viral disease

Sol.: The use of vaccines and immunisation programmes have enabled us to completely eradicate a deadly disease like small pox. A large number of other infectious diseases like polio, diphtheria, pneumonia and tetanus have been controlled to a large extent by the use of vaccines.

There is currently no vaccine to prevent HIV infection.

157. Answer (4)

Hint: Typhoid fever

Sol.: *Salmonella typhi* is a pathogenic bacterium which causes typhoid fever in human beings. These pathogens generally enter the small intestine through food and water contaminated with them and migrate to other organs through blood. Sustained high fever (39°C to 40°C), weakness, stomach pain, constipation, headache and loss of appetite are some of the common symptoms of this disease.

Microsporum causes ringworm.

Toxoplasma is a protozoan parasite.

158. Answer (4)

Hint: Exclude the most widespread species in the world

Sol.: *Plasmodium*, a tiny protozoan, is responsible for malaria. Different species of *Plasmodium* (*P. vivax, P. malariae* and *P. falciparum*) are responsible for different types of malaria. Of these, the malignant malaria is caused by *Plasmodium falciparum*.

159. Answer (1)

Hint: Identify a bacterial disease

Sol.: *Salmonella typhi* is a pathogenic bacterium which causes typhoid fever in human beings. Bacteria *Yersinia pestis* is the causative agent of plague. Malaria is caused by protozoan. Elephantiasis and ascariasis are caused by nematodes.

160. Answer (3)

Hint: Site of maturation of T-lymphocytes

Sol.: The primary lymphoid organs in humans are bone marrow and thymus where immature lymphocytes differentiate into antigen-sensitive lymphocytes.

After maturation, the lymphocytes migrate to secondary lymphoid organs like spleen, lymph nodes, tonsils, Peyer's patches of small intestine and appendix.

161. Answer (3)

Hint: Viral disease

Sol.: Sometimes, due to genetic and other unknown reasons, the body attacks self-cells. This results in damage to the body and is called auto-immune disease. Rheumatoid arthritis, myasthenia gravis and SLE (systemic lupus erythematous) affects many people in our society and they are auto-immune diseases; while small pox is a viral disease.

162. Answer (3)

Hint: An aschelminth

Sol.: *Wuchereria* (*W. bancrofti* and *W. malayi*), the filarial worms, cause a slowly developing chronic inflammation of the organs in which they live for many years, usually the lymphatic vessels of the lower limbs and the disease is called elephantiasis or filariasis.

163. Answer (3)

Hint: Common cold is caused by Rhino viruses.

Sol.: AIDS stands for Acquired Immuno Deficiency Syndrome. This means deficiency of immune system acquired during the lifetime of an individual indicates that it is not a congenital disease. AIDS is caused by the Human Immunodeficiency Virus (HIV), a member of a group of viruses called retroviruses, which have an envelope enclosing the RNA genome.

164. Answer (2)

Hint: The most feared property of the malignant tumors.

Sol.: Cells sloughed from malignant tumors reach distant sites through blood, and wherever they get lodged in the body, they start a new tumor there. This property called metastasis is the most feared property of the malignant tumors.

Metagenesis is alternation of generation of body forms, seen in coelenterates. The physical transformation from one life stage to other, like in insects, is called metamorphosis.

Cancer cells lack the property of contact inhibition.

165. Answer (4)

Hint: Exclude the physical carcinogens

Sol.: Ionising radiations like X-rays and gamma rays and non-ionizing radiations like UV rays cause DNA damage leading to neoplastic transformation. The chemical carcinogens present in tobacco smoke have been identified as a major cause of lung cancer. Cancer causing viruses called oncogenic viruses have genes called viral oncogenes.

166. Answer (2)

Hint: Choose a tranquiliser

Sol.: Drugs like barbiturates, amphetamines, benzodiazepines and other similar drugs, that are normally used as medicines to help patients cope with mental illnesses like depression and insomnia, are often abused. The sportsperson misuse narcotic analgesics, anabolic steroids, diuretics and certain hormones in sports to increase muscle strength and bulk and to promote aggressiveness.

167. Answer (4)

Hint: Have depressant effect on CNS.

Sol.: Opioids bind to the specific opioid receptors present in our central nervous system and gastrointestinal tract.

168. Answer (1)

Hint: Higher vertebrates have a more evolved immune system as compared to lower organisms.

Sol.: Grafts from just any source - an animal, another primate, or any human being cannot be made since the grafts would be rejected sooner or later.

The body is able to differentiate 'self' and 'non-self' cells and the cell-mediated immune response is mainly responsible for the graft rejection.

Our immune system can produce an exaggerated immune response that is mediated by IgE antibodies.

Glucocorticoids, like cortisol, produce anti-inflammatory reactions.

Interferons act as cytokine barriers of innate immunity.

169. Answer (2)

Hint: It is also called anamnestic response

Sol. When our body encounters a pathogen for the first time, it produces a response called the primary immune response which is of low intensity. Subsequent encounter with the same pathogen elicits a highly intensified secondary or anamnestic response.

Immunoglobulins are glycoproteins. Antibody production is associated with acquired immunity.

Natural killer cells is a part of innate immunity.

170. Answer (1)

Hint: Part of acquired immunity.

Sol.: Innate immunity is a non-specific type of defence, that is present at the time of birth.

(i) **Physical barriers:** Skin on our body is the main barrier which prevents entry of the micro-organisms. Mucus coating of the epithelium lining the respiratory, gastrointestinal and urogenital tracts also help in trapping microbes entering our body.

(ii) **Physiological barriers:** Acid in the stomach, saliva in the mouth, tears from eyes-all prevent microbial growth.

The primary and secondary immune responses are carried out with the help of two special types of lymphocytes present in our blood, *i.e.*, B-lymphocytes and T-lymphocytes.

171. Answer (2)

Hint: Causes amoebic dysentery

Sol.: The pathogens can enter our body by various means, multiply and interfere with the normal vital activities, resulting in morphological and functional damage. Pathogens have to adapt to life within the environment of the host. For example, the pathogens that enter the gut must know a way of surviving in the stomach at low pH and resisting the various digestive enzymes.

E. histolytica resides in the large intestine.

172. Answer (2)

Hint: Vectors are carriers of pathogens causing diseases.

Sol.: Awareness about diseases and their effects on different bodily functions, vaccination (immunisation) against infectious diseases, proper disposal of wastes, control of vectors and maintenance of hygiene in food and water resources are necessary for achieving good health.

173. Answer (4)

Hint: Anamnestic response

Sol.: Acquired immunity is pathogen specific. It is characterised by memory. This means, when our body encounters a pathogen for the first time, it produces a response called primary response which is of low intensity. Subsequent encounter with the same pathogen elicits a highly intensified secondary or anamnestic response. This is ascribed to the fact that our body appears to have memory of the first encounter.

174. Answer (1)

Hint: Non-specific type of defence

Sol.: Innate immunity is a non-specific type of defence, that is present at the time of birth. This is accomplished by providing different types of barriers to the entry of the foreign agents into our body. Certain types of leukocytes (WBCs) of our body like polymorpho-nuclear leukocytes (PMNL-neutrophils) and monocytes and natural killer cells (type of lymphocytes) in the blood as well as macrophages in tissues can phagocytose and destroy microbes.

175. Answer (2)

Hint: Exclude the primary lymphoid organs

Sol.: The primary lymphoid organs are bone marrow and thymus. There is a lymphoid tissue located within the lining of the major tracts (respiratory, digestive and urogenital tracts) called MALT (Mucosa Associated Lymphoid Tissue). It constitutes about 50 per cent of the lymphoid tissue in human body.

176. Answer (1)

Hint: Antibodies are not being formed in the body in such type of immunity.

Sol.: When a host is exposed to antigens, which may be in the form of living or dead microbes or other proteins, antibodies are produced in the host body. This type of immunity is called active immunity. The yellowish fluid colostrum secreted by mother has abundant antibodies (IgA) which provide natural passive immunity to protect the infant.

177. Answer (3)

Hint: Diagnostic technique

Sol.: Techniques like radiography (use of X-rays), CT (Computed Tomography) and MRI (Magnetic Resonance Imaging) are useful to detect cancers of the internal organs. The common approaches for treatment of cancer are surgery, radiation therapy and immunotherapy.

178. Answer (3)

Hint: Oxygen deficiency occurs due to smoking.

Sol.: Smoking increases carbon monoxide (CO) content in blood and reduces the concentration of haembound oxygen. This causes oxygen deficiency in the body.

179. Answer (2)

Hint: Obtained from the latex of poppy plants.

Sol.: Morphine is extracted from the latex of poppy plant, *Papaver somniferum*. Morphine is an effective sedative and a painkiller, and is very useful in patients who have undergone surgery. Crack or cocaine has a potent stimulating action on CNS. Marijuana, generally taken by inhalation and oral ingestion, has hallucinating effect on CNS.

Heroin is a depressant.

180. Answer (3)

Hint: Chronic respiratory disease

Sol.: Diseases which are easily transmitted from one person to another, are called infectious diseases.

- Typhoid, dysentery and dengue are infectious diseases.
- Emphysema is a non-infectious respiratory disease.

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