09/04/2026

Code-A_(Phase-1)

***Corporate Office :*** AESL, 3rd Floor, Incuspaze Campus-2, Plot No. 13, Sector-18, Udyog Vihar, Gurugram, Haryana - 122015, ***Ph.***+91-1244168300

**MM : 720** Final Test Series(P1)_NEET2026_Test-08A **Time : 180 Min.**

## PHYSICS

**1.** (1)
**2.** (2)
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## CHEMISTRY

**46.** (3)
**69.** (4)

**47.** (4)
**48.** (3)
**49.** (2)
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## BOTANY

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## ZOOLOGY

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**178.** (3)
**179.** (3)

**157.** (4)

**158.** (2)

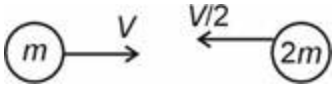
**180.** (1)

## Hints and Solutions

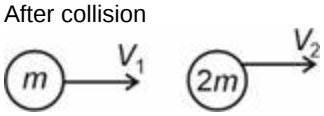
### PHYSICS

**(1)** **Answer :** (1)
**Solution:**
Violet light photon has more energy than blue light photon.

**(2)** **Answer :** (2)
**Solution:**
λ same ⇒ $p$ → same
∴ Before collision




After collision




⇒ Apply momentum conservation
$\vec{P}_i = \vec{P}_f$
⇒ $mv - \frac{2mv}{2} = mv_1 + 2mv_2$
⇒ $v_1 + 2v_2 = 0$ …(i)
⇒ For $e = 1$
$e = 1 = \frac{v_2 - v_1}{\frac{3V}{2}}$
⇒ $v_2 - v_1 = \frac{3v}{2}$ …(ii)
On solving equation (i) and equation (ii)
$3v_2 = \frac{3v}{2} \Rightarrow v_2 = \frac{v}{2}$ and $v_1 = -v$
∴ de-Broglie wave length for both will remain same.
⇒ For $e = \frac{1}{3}$
$e = \frac{1}{3} = \frac{v_2 - v_1}{\frac{3V}{2}} \Rightarrow v_2 - v_1 = \frac{v}{2}$ …(iii)
On solving equation (i) and equation (iii)
$3v_2 = \frac{v}{2} \Rightarrow v_2 = \frac{v}{6}$ and $v_1 = \frac{-v}{3}$

**(3)** **Answer :** (3)
**Solution:**
$_{92}\cup^{237} \xrightarrow[\text{emissions}]{7\alpha-\text{particle}} {}_{78}\cup^{209} \xrightarrow[\text{emissions}]{5\beta-\text{particle}} {}_{83}\text{Bi}^{209}$

**(4)** **Answer :** (2)
**Solution:**
$Y = \overline{\overline{A.\overline{AB}} \; . \; \overline{B.\overline{AB}}}$
$= \overline{\overline{A.\overline{AB}}} \; + \; \overline{\overline{B.\overline{AB}}}$
$= A.\overline{AB} \; + B.\overline{AB}$
$= A.\left(\overline{A} + \overline{B}\right) + B.\left(\overline{A} + \overline{B}\right)$
$= A\overline{B} + A\overline{A} + B\overline{A} + B\overline{B}$
$= A\overline{B} + \overline{A}B$

**(5)** **Answer :** (3)
**Solution:**
According to ohm's law
$R = \frac{V}{I} = \frac{10}{0.5} = 20\ \Omega$

**(6)** **Answer :** (2)
**Solution:**
By momentum conservation
$0 = \vec{P}_1 + \vec{P}_2$
$\left|\vec{P}_1\right| = \left|\vec{P}_2\right| = P(\text{let})$
And $\Delta mc^2 = (KE)_1 + (KE)_2$
$\Delta mc^2 = \frac{P_1^2}{2m_1} + \frac{P_2^2}{2m_2}$
$\Rightarrow \Delta mc^2 = \frac{P^2}{2\times\frac{M}{3}} + \frac{P^2}{2\times\frac{2M}{3}}$
$\Rightarrow \Delta mc^2 = \frac{9P^2}{4M}$
$\Rightarrow P^2 = \frac{4M\Delta mc^2}{9}$
$\Rightarrow P = \frac{2}{3}\sqrt{M\Delta mc^2}$
$\Rightarrow \frac{M}{3}v_1 = \frac{2}{3}\sqrt{M\Delta mc^2}$
$\Rightarrow v_1 = \sqrt{\frac{4\Delta mc^2}{M}}$

**(7)** **Answer :** (3)
**Solution:**
Wavelength of violet is minimum
So from $E = \frac{hc}{\lambda}$
Largest band gap is for violet.

**(8)** **Answer :** (2)
**Solution:**
$R \propto A^{\frac{1}{3}}$

**(9)** **Answer :** (2)
**Solution:**
Radiation energy $\propto T^4$
$\Rightarrow T_2 = 4T_1$
By Wein's displacement law, $\lambda \propto \frac{1}{T}$
$\lambda_2 \propto \frac{\lambda}{4} = 2500\ \text{Å}$
$\Rightarrow$ Energy corresponds to peak radiation $E = \frac{12500}{2500} = 5\ \text{eV}$
$\Rightarrow$ Stopping potential $V_S = 13.6\left[\frac{1}{4} - \frac{1}{16}\right] = 2.55\ \text{V}$
$\therefore$ Work function $\varphi = E - eV_S = 5 - 2.55 = 2.45$ eV

**(10)** **Answer :** (3)
**Solution:**
Apply momentum conservation
$0 = Mv + \frac{E}{c}$
$v = -\frac{E}{Mc}$
Recoil energy of nucleus = $\frac{1}{2}Mv^2 = \frac{E^2}{2Mc^2}$

**(11)** **Answer :** (3)
**Solution:**
α-particle cannot be attracted to nucleus.

**(12)** **Answer :** (1)
**Solution:**
$\lambda = \frac{h}{\sqrt{2m(KE)}}$
So, $\lambda_1 = \frac{h}{\sqrt{2mKE}}$, $\lambda_2 = \frac{h}{\sqrt{2\left(\frac{m}{4}\right)KE}}$

$\Rightarrow \frac{\lambda_1}{\lambda_2} = \frac{1}{2}$.

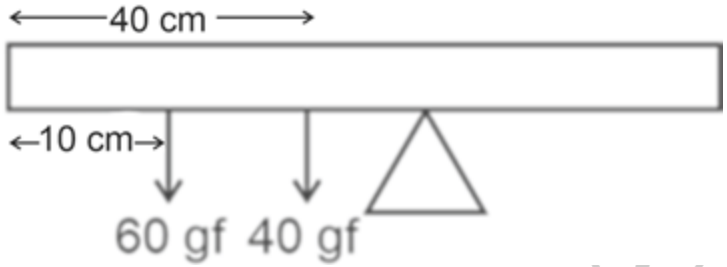
**(13) Answer :** (2)
**Solution:**
The mass per nucleon as well as energy released during the formation for different atoms are different.

**(14) Answer :** (3)
**Solution:**
Line of inclination of 45° have *u* and *v* equal, and both are equal when object is placed at 2*f* for a concave mirror, focal length $f = \frac{-U}{2}$.
Hence, 2*f* = 10 ⇒ *f* = 5 cm

**(15) Answer :** (4)
**Solution:**
In half wave rectification, frequency remains same.

**(16) Answer :** (4)
**Solution:**
In process of photoelectric emission, photoelectrons have kinetic energies varying from 0 to $(KE)_{max}$.

**(17) Answer :** (2)
**Solution:**




Here it is evident that torque due to both 60 gf and 40 gf will make the ruler turn anticlockwise.

**(18) Answer :** (3)
**Solution:**
By Einstein's equation
$ev_0 = hf - \varphi$
⇒ If *f* will double, then stopping potential will become more than doubled.

**(19) Answer :** (3)
**Solution:**
According to Bohr's model.
- Radius (*R*) $\propto \frac{n^2}{Z}$
- Potential energy (PE) $\propto \frac{Z^2}{n^2}$
- Linear momentum (*mv*) $\propto \frac{Z}{n}$
- Time period (*T*) $\propto \frac{r}{v} \propto \frac{n^3}{Z^2}$

**(20) Answer :** (1)
**Solution:**
$K = h\upsilon - h\nu_0$
$\frac{dK}{d\upsilon} = h = \tan\theta$

**(21) Answer :** (2)
**Solution:**
Number of electrons emitted ∝ number of photons incident ∝ Intensity
⇒ $\text{intensity} \propto \frac{1}{d^2}$
⇒ $\frac{N_2}{N_1} = \frac{4}{1}$
⇒ $N_2 = 4N_1$

**(22) Answer :** (3)
**Solution:**

$X^{200} \rightarrow Y^{120} + Z^{80}$

Energy released $E$ = $(BE)_{Product} - (BE)_{Reactant}$

= $120b + 80c - 200a$

**(23)** **Answer :** (4)

**Solution:**

Elements near $D$ have high mass number but they have low value of binding energy per nucleon.

Hence, they are more likely to go through fission process.

**(24)** **Answer :** (2)

**Solution:**

Electrons-majority (penta valent dopants)

**(25)** **Answer :** (2)

**Solution:**

In reverse biasing external field is in the direction of internal electric field so potential barrier will increase.

**(26)** **Answer :** (3)

**Solution:**

Both electrons and holes will acts as charge carrier in semiconductor.

**(27)** **Answer :** (4)

**Solution:**

$Y = \frac{FL}{A\Delta L} = \frac{FL}{A \times 0} = \infty$

**(28)** **Answer :** (2)

**Solution:**

Centipetal acceleration $a_c = \frac{v^2}{r}$

$\Rightarrow \frac{v^2}{r} \propto \left(\frac{z}{n}\right)^2 \times \frac{z}{n^2} \propto \frac{z^3}{n^4}$

$\Rightarrow \frac{(a_c)_{He^+}}{(a_c)_{Li^{2+}}} = \left(\frac{2}{3}\right)^3 = \frac{8}{27}$

**(29)** **Answer :** (3)

**Solution:**

Current through resistance of 1 kΩ

$i = \frac{25-12}{1 \times 10^3} = 13\ \text{mA}$

Current through 2 kΩ, $i' = \frac{12}{2 \times 10^3} = 6$ mA

Current through zener = 13 – 6 = 7 mA

**(30)** **Answer :** (1)

**Solution:**

Diffusion is due to the concentration difference.

**(31)** **Answer :** (2)

**Solution:**

$E_2(He^+) = -13.6 \times \frac{Z^2}{n^2}$

$= 13.6 \times \frac{(2)^2}{(2)^2} eV$

= – 13.6eV

$E_2$ = – KE

**(32)** **Answer :** (4)

**Solution:**

$^{216}X \rightarrow {}^{212}Y$ + α-particle + $Q$-value

$E_\alpha = \frac{212}{216} \times Q$

$\Rightarrow Q = \frac{216}{212} E$

$= \frac{54}{53} E$

**(33)** **Answer :** (4)

**Solution:** $\frac{1}{\lambda} = R\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$

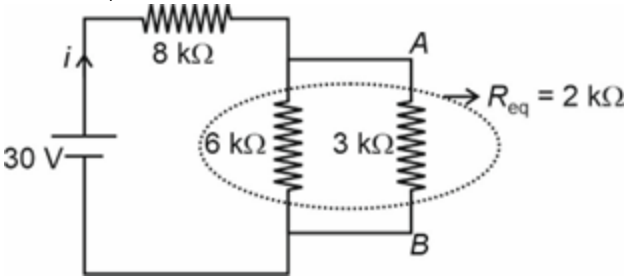
**(34) Answer :** (3)
**Solution:**

$\Delta l = \frac{Fl}{AY} \Rightarrow \Delta l \propto \frac{F}{A}$ [for same $l$ and $Y$]

$\therefore \frac{\Delta l_2}{\Delta l_1} = \frac{F_2}{F_1}\left(\frac{A_1}{A_2}\right) = \frac{2F}{F}\left[\frac{\pi r^2}{\pi(2r)^2}\right]$

$\Delta l_2 = \frac{1.5}{2} = 0.75$ cm

**(35) Answer :** (3)
**Solution:**
Diode is in forward biased
Therefore, circuit can be redraw as




$i = \frac{30}{10\times10^3} = 3\ mA$

$V_{AB} = iR_{eq} = 3\times10^{-3}\times2\times10^3 = 6\ V$

**(36) Answer :** (4)
**Solution:**
A diode conducts only in one direction and has two terminals.

**(37) Answer :** (2)
**Solution:**
According to Bohr's model, $mvr = \frac{nh}{2\pi}$

**(38) Answer :** (1)
**Solution:**

Energy of emitted photon, $\Delta E = 13.6\left[1-\frac{1}{n^2}\right]$

$= 13.6\left[1-\frac{1}{36}\right]$

$= 13.6\times\frac{35}{36}$

= 13.22 eV

**(39) Answer :** (2)
**Solution:**
$\sigma = ne\mu_e$

$\Rightarrow 9.6\times10^2 = n\times1.6\times10^{-19}\times4\times10^3\times10^{-4}$

$\Rightarrow n = \frac{9.6\times10^2}{1.6\times10^{-19}\times4\times10^{-1}} = \frac{6}{4}\times10^{22} = 1.5\times10^{22}\ m^{-3}$

**(40) Answer :** (4)
**Solution:**

The number of fission of uranium nucleus required per second $= \frac{Power}{\eta\times\text{Energy of one fission}}$

$= \frac{32\times10^6}{0.8\times200\times1.6\times10^{-13}}$

= $1.25\times10^{18}$

**(41) Answer :** (2)
**Solution:**

By Bohr's quantization, $L = \frac{nh}{2\pi}$

$\therefore mvr = \frac{nh}{2\pi}$

And $r = \frac{mv}{qB}$

$\Rightarrow mv\left(\frac{mv}{qB}\right)=\frac{nh}{2\pi}$

$\Rightarrow v\propto\sqrt{n}$

$\Rightarrow \frac{V_5}{V_3}=\sqrt{\frac{5}{3}}$

**(42) Answer :** (1)

**Solution:**

By Einstein's photoelectric equation,

$(KE)_{max} = hf - hf_{th}$

$\Rightarrow (KE)_1 = h \times 4 \times 10^{12} - hf_{th}$ ...(i)

$(KE)_2 = h \times 3 \times 10^{12} - hf_{th}$ ...(ii)

Divide equation (i) by equation (ii)

$\frac{(KE)_1}{(KE)_2}=\frac{4\times10^{12}-f_{th}}{3\times10^{12}-f_{th}}$

$\Rightarrow \frac{3}{2}=\frac{4\times10^{12}-f_{th}}{3\times10^{12}-f_{th}}$

$\Rightarrow 9 \times 10^{12} - 3f_{th} = 8 \times 10^{12} - 2f_{th}$

$\Rightarrow f_{th} = 10^{12}$ Hz

**(43) Answer :** (2)

**Solution:**

Momentum change of one photon $=\frac{2h}{\lambda}$

Total change in momentum in one second $=n\times\frac{2h}{\lambda}$

$F=\frac{(\Delta P)_{total}}{\Delta t}$ = total change in momentum in one second

$5=\frac{n2h}{\lambda}$

$\Rightarrow n=\frac{5\lambda}{2h}=\frac{5\times3300\times10^{-9}}{2\times6.6\times10^{-34}}=12.5\times10^{27}\ photons/sec$

**(44) Answer :** (4)

**Solution:**

Apply momentum conservation

$0 + 0 = m_1v_1 - m_2v_2$

$\frac{v_1}{v_2}=\left(\frac{m_2}{m_1}\right)=\frac{\frac{4}{3}\pi r_2^3 d}{\frac{4}{3}\pi r_1^3 d}=\left(\frac{r_2}{r_1}\right)^3=\left(\frac{2}{1}\right)^3$

$v_1 : v_2 = 8 : 1$

**(45) Answer :** (1)

**Solution:**

$Y=\overline{\overline{A}+\overline{B}}$

$=\overline{\overline{A}}\cdot\overline{\overline{B}}$

$= A \bullet B$

= AND gate

**CHEMISTRY**

**(46) Answer :** (3)

**Solution:**

1.2 g molecule of $SO_2$ = 1.2 moles of $SO_2$

Mass of sulphur = 1.2 × 32 = 38.4 g

**(47) Answer :** (4)

**Hint:**

In equal masses of $O_2$ and $N_2$, $N_2$ will have more number of atoms.

**Solution:**

Molality and mole fraction are temperature independent quantities.

Mole of $O_2 = \frac{w}{32}$

Number of atoms in $O_2$ = $\frac{w}{32} \times N_A \times 2 = \frac{w}{16} N_A$

Number of atoms in $N_2$ = $\frac{w}{28} \times N_A \times 2$

$= \frac{w}{14} \times N_A$

**(48) Answer :** (3)

**Hint:**

$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + CO_2(g) + H_2O(l)$

Number of g. eq. of $CaCO_3$ = Number of g. eq. of HCl

**Solution:**

2 millimole of HCl = 1 mmol of $CaCO_3$

50 × 0.25 mmol of HCl = $\frac{1}{2}$ × 50 × 0.25 mm of $CaCO_3$

⇒ 6.25 mmol of $CaCO_3$

Weight of $CaCO_3$ = $\frac{6.25}{1000} \times 100$ = 0.625 g

**(49) Answer :** (2)

**Hint:**

Molarity = $\frac{Mass\ of\ solute \times 1000}{Molar\ mass\ of\ solute \times 250}$

**Solution:**

Molarity $Al_2(SO_4)_3 = \frac{68.4 \times 1000}{342 \times 250} = 0.8\ M$

Molarity of $Al^{3+}$ = 0.8 × 2 = 1.6 M

Molarity of $SO_4^{2-}$ = 0.8 × 3 = 2.4 M

**(50) Answer :** (1)

**Hint:**

All non-zero digits are significant

**Solution:**

| Number | Significant figure |
|---|---|
| 0.03 | 1 |
| 285 | 3 |
| 0.0050 | 2 |
| 20 eggs | Infinite |



**(51) Answer :** (3)

**Hint:**

Number of atoms = moles × $N_A$ × Atomicity

**Solution:**

a. $\frac{4.48}{22.4} \times N_A \times 2 = 0.4\ N_A$ atoms in CO

b. $\frac{3.4}{17} \times N_A \times 4 = 0.8\ N_A$ atoms in $NH_3$

c. $\frac{2.4 \times 10^{22}}{6 \times 10^{23}} \times N_A \times 2 = 0.08\ N_A$ atoms in hydrogen gas

d. $\frac{8.4}{84} \times N_A \times 6 = 0.6\ N_A$ atoms in baking soda

**(52) Answer :** (4)

**Hint:**

$Molality = \frac{Moles\ of\ solute}{Mass\ of\ solvent\ (in\ kg)}$

**Solution:**

Mole of solute = 0.2

Mole of $H_2O$ (solvent) = 0.8

Molality $= \frac{0.2}{0.8 \times 18} \times 1000$

= 13.88 m

**(53) Answer :** (3)

**Solution:**

$10^{15}$ is called peta

**(54) Answer :** (2)
**Solution:**
A is limiting reactant and 60 molecules of $A_3B_2$ will be formed.

**(55) Answer :** (3)
**Solution:**

| | C | H |
|---|---|---|
| Mass% | 80 | 20 |
| Mole | $\frac{80}{12}$<br>6.66 | $\frac{20}{1}$<br>20 |
| Simplest ratio : | $\frac{6.66}{6.66}$<br>1 | $\frac{20}{6.66}$<br>3 |

Empirical formula ⇒ $CH_3$

**(56) Answer :** (4)
**Hint:**
$M_1V_1 + M_2V_2 = M_3V_3$
**Solution:**
$20 \times 1 + 200 \times 0.25 = 220 \times M$
$20 + 50 = 220\ M$
$M = \frac{70}{220} = 0.32\ M$

**(57) Answer :** (1)
**Hint:**

$$\text{Molarity (M)} = \frac{\text{Number of moles of solute}}{\text{Volume of solution (in L)}}$$

$$\text{Molality (m)} = \frac{\text{Number of moles of solute}}{\text{Weight of solvent (in kg)}}$$

**Solution:**

$$M = \frac{30 \times 1000}{60 \times 100} \Rightarrow 5\ M$$

$$m = \frac{30 \times 1000}{60 \times 70} \Rightarrow 7.14\ m$$



**(58) Answer :** (4)
**Solution:**
(i) Law of definite proportion
A given compound always contains exactly the same proportion of elements by weight
(ii) Avogadro Law
Equal volumes of all gases at the same temperature and pressure should contain equal number of molecules
(iii) Gay Lussac's law of Gaseous volumes When gases combine or produced in a chemical reaction, they do so in a simple ratio by volume, provided all gases are at the same temperature and pressure

**(59) Answer :** (3)
**Solution:**

Average atomic mass of Boron $= \frac{(19\times 10) + (81\times 11)}{100}$
= 10.81 u

**(60) Answer :** (2)
**Hint:**
Percentage of an element
$= \frac{\text{Weight of element}}{\text{Weight of compound}} \times 100$
**Solution:**
Percentage of Be
$= \frac{\text{Number of Be atom in 1 molecule} \times 9}{\text{Molecular mass of compound}} \times 100$

$15 = \frac{x \times 9}{2700} \times 100$

$x = 45$

**(61) Answer :** (3)
**Solution:**
Eka – Aluminium is gallium
and Eka – silicon is germanium.

**(62) Answer :** (1)
**Solution:**
Zn, Cd and Hg do not belong to Dobereiner's Triads.

**(63) Answer :** (2)
**Hint:**
Group 1 elements form basic oxide.
**Solution:**
$Al_2O_3$ is amphoteric $Na_2O$ is basic, $SiO_2$ is acidic and $N_2O$ is neutral oxide.

**(64) Answer :** (4)
**Hint:**
Elements with atomic number more than that of uranium are transuranium elements.
**Solution:**
Lawrencium (Lr) is transuranium element.

**(65) Answer :** (4)
**Hint:**
According to Mendeleev's periodic law, the properties of the elements are a periodic function of their atomic weights.
**Solution:**
According to Modern periodic law, the properties of the elements are periodic functions of their atomic numbers.

**(66) Answer :** (4)
**Hint:**
Ce is first lanthanoid which is introduced in $6^{th}$ period.
**Solution:**
• Group 3 of longest groups with 32 elements.
• Seventh period can have maximum 32 elements.
• Halogens from group 17 are most electronegative.
• $3^{rd}$ and $4^{th}$ period have 8 and 18 elements respectively.

**(67) Answer :** (2)
**Hint:**
More is the ease of adding electron in an atom, more negative is $\Delta_{eg}H$ (kJ $mol^{-1}$)
**Solution:**

| | O | F | Cl | S |
|---|---|---|---|---|
| $\Delta_{eg}H$ (kj $mol^{-1}$) | –141 | –328 | –349 | –200 |

**(68) Answer :** (2)
**Hint:**
Along a period electronegativity increases.
**Solution:**
Down the group electronegativity decreases

| Element | Electronegativity (on Pauling scale) |
|---|---|
| B | 2.0 |
| C | 2.5 |
| Mg | 1.2 |
| Al | 1.5 |
| Si | 1.8 |
| P | 2.1 |
| Cl | 0.3 |
| O | 3.5 |

**(69) Answer :** (4)
**Solution:**
• Atomic number (Z) = Number of protons = number of electrons in neutral atom
Z = 57 = Number of protons
57 = Number of electrons
Number of neutrons = 138 – 57 = 81

**(70) Answer :** (1)
**Solution:**
$\nu = \frac{C}{\lambda} = \frac{3\times10^{8}}{700\times10^{-9}} = 4.3\times10^{14}\ \text{Hertz}$

**(71) Answer :** (3)
**Solution:**
For each metal, there is a characteristic minimum frequency below which photoelectric effect is not observed known as threshold frequency.

**(72) Answer :** (2)
**Solution:**
$h\nu = h\nu_0 + K.E.$
$K.E. = h(\nu - \nu_0)$
$= 6.626 \times 10^{-34} (10 \times 10^{14} - 6 \times 10^{14})$
$= 6.626 \times 10^{-34} \times 10^{14} \times 4$
$= 26.504 \times 10^{-20}$ J
$= 2.65 \times 10^{-19}$ J

**(73) Answer :** (4)
**Solution:**
a. $n_2 = 4$ to $n_1 = 1$

$\bar{\nu} = 109677\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)\ \text{cm}^{-1}$

$= R\left(\frac{1}{1} - \frac{1}{16}\right)$

$\bar{\nu} = R\left(\frac{15}{16}\right)$

b. $n_2 = 3$ to $n_1 = 2$

$\bar{\nu} = R\left(\frac{1}{4} - \frac{1}{9}\right)$

$\bar{\nu} = R\left(\frac{5}{36}\right)$

c. $n_2 = 5$ to $n_1 = 3$

$\bar{\nu} = R\left(\frac{1}{9} - \frac{1}{25}\right)$

$= R\left(\frac{16}{225}\right)$

d. $n_2 = 7$ to $n_1 = 4$

$\bar{\nu} = R\left(\frac{1}{16} - \frac{1}{49}\right) = \frac{33R}{784}$



**(74) Answer :** (3)
**Solution:**

P: $r_n = \frac{a_0\times n^2}{z}$, $a_0 = 52.9\ \text{pm}$

$= \frac{a_0\times4}{3} = \frac{4a_0}{3}$

Q: $E_n = \frac{-13.6\times z^2}{n^2}$

$= \frac{-13.6\times9}{4}$

$= \frac{9}{4}\times E_0\ \left(E_0 = -13.6\ \text{eV}\right)$

R: $= \frac{a_0\times n^2}{z}$

$= \frac{a_0\times9}{2}$

S: $= \frac{E_0 \times 4}{9}$

**(75) Answer :** (1)
**Solution:**

$\lambda = \frac{h}{\sqrt{2m \text{ K.E.}}}$

$= \frac{6.626 \times 10^{-34}}{\sqrt{2 \times 9.1 \times 10^{-31} \times 2 \times 10^{-25}}}$

$= \frac{6.626 \times 10^{-34+28}}{2 \times 3.016}$

$\lambda = 1.1 \times 10^{-6}$ m

**(76) Answer :** (2)
**Solution:**
The splitting of spectral lines in the presence of magnetic field is called 'Zeeman effect'.
The splitting of spectral lines in the presence of electric field is called 'Stark effect'.

**(77) Answer :** (1)
**Solution:**
Haf filled and fully filled subshells have extra stability due to symmetrical distribution of electrons and high exchange energy.

**(78) Answer :** (3)
**Solution:**

The valence shell electronic configuration of Sr is $5s^2$

$n = 5,\ l = 0,\ m = 0,\ s = \frac{+1}{2}$

**(79) Answer :** (1)
**Solution:**
• Isoelectronic species have same number of electrons.
• $CN^-$, CO, $NO^+$ and $N_2$ have 14 electrons each.

**(80) Answer :** (3)
**Solution:**
Energy $\propto (n+l)$
• For a, $n+l=6$
• For d, $n+l=6$
For same $n+l$ , greater value of n would have greater energy.
• For b, $n+l=4$
• For c, $n+l=4$

**(81) Answer :** (1)
**Solution:**

The number of degenerate orbitals in $2^{nd}$ excited state of hydrogen atom is 9 [3*s*, 3*p* and 3*d*].

**(82) Answer :** (1)
**Solution:**

The valence electronic configuration of Se is $4s^2 4p^4$
For p subshell, $l = 1$
Orbital angular momentum $= \sqrt{l(l+1)}\frac{h}{2\pi}$
$= \sqrt{2}\frac{h}{2\pi}$
$= \frac{h}{\sqrt{2}\pi}$

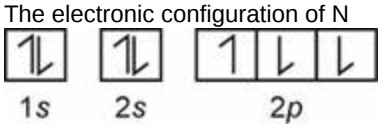
**(83) Answer :** (3)
**Solution:**

| Value of $l$ | Name of subshell |
|---|---|
| 0 | s |
| 1 | p |
| 2 | d |
| 3 | f |
| 4 | g |

a is 5g

b is 4s
c is 4d
d is 4f

**(84) Answer :** (2)
**Solution:**
The electronic configuration of N




is violating Hund's rule of maximum multiplicity.

**(85) Answer :** (3)
**Solution:**
$d_{xy}$, $d_{yz}$ and $d_{xz}$ are non-axial set of d orbitals i.e., they have electron density between the axes.

**(86) Answer :** (2)
**Solution:**
As the value of $\psi^2$ (r) is maximum when r tends to zero, the subshell must be s subshell.
Total number of radial nodes $= n - l - 1$
1 = n – 0 – 1
$\boxed{n = 2}$

**(87) Answer :** (4)
**Solution:**
Energy = $N_A \times h\nu$
$= 6.02 \times 10^{23} \times 6.626 \times 10^{-34} \times 3 \times 10^{14}$
$= 119.6 \times 10^{3}$ J
= 119.6 kJ

**(88) Answer :** (2)
**Solution:**
$n_2 = 6$ to $n_1 = 1$
Possible electronic transitions for visible region are
• 6 to 2
• 5 to 2
• 4 to 2
• 3 to 2

**(89) Answer :** (1)
**Solution:**

| Element | Ionization enthalpy (kJ/mol) |
|---|---|
| Mg | 737 |
| Al | 578 |

**(90) Answer :** (3)
**Solution:**
Z = 57 is La, lies in $6^{th}$ period and $3^{rd}$ group is a *d*-block element.

## BOTANY

**(91) Answer :** (2)
**Solution:**
First letter of the second word of biological name is small, as it represents the specific epithet.

**(92) Answer :** (2)
**Solution:**
Taxonomic categories showing hierarchial arrangement in ascending order is

| | | | |
|---|---|---|---|
| *Triticum* → | Poaceae → | Poales → | Monocotyledonae |
| ↓ | ↓ | ↓ | ↓ |
| Genus | Family | Order | Class |

**(93)** **Answer :** (3)
**Solution:**
Monkey, gorilla and gibbon are placed under the order, Primata.

**(94)** **Answer :** (3)
**Solution:**
The scientific name of wheat can be printed as *Triticum aestivum*.

**(95)** **Answer :** (3)
**Solution:**
*Canis* – dogs
*Panthera* – lion, leopard and tiger
*Felis* – cats

**(96)** **Answer :** (4)
**Solution:**
Both mango and wheat belong to the division Angiosperms.

**(97)** **Answer :** (3)
**Solution:**
Standard rules for binomial nomenclature were established by Carolus Linnaeus.

**(98)** **Answer :** (2)
**Hint:**
In phylogenetic classification system, equal weightage is not given to vegetative and sexual characters.
**Solution:**
Vegetative characters are more easily affected by environment that is why it is unacceptable in modern classification systems.

**(99)** **Answer :** (4)
**Solution:**
Members of Phycomycetes are found in aquatic habitats and on decaying wood in moist and damp places or as obligate parasites on plants.

**(100)** **Answer :** (3)
**Solution:**
*Neurospora* is used extensively in biochemical and genetic work.

**(101)** **Answer :** (2)
**Hint:**
Morels and truffles belong to class Ascomycetes.
**Solution:**
In ascomycetes, mycelium is branched and septate. The asexual spores are produced exogenously. Sexual spores are called ascospores which are produced endogenously.

**(102)** **Answer :** (3)
**Solution:**
The most notable disease caused by prions is bovine spongiform encephalopathy (BSE), commonly called mad cow disease in cattle.

**(103)** **Answer :** (2)
**Solution:**
*Rhizopus* is also known as bread mould and *Albugo* is a parasitic fungi on mustard.

**(104)** **Answer :** (3)
**Solution:**
Sexual reproduction in fungi has three stages
(a) Plasmogamy : Fusion of protoplasm of male and female gametes.
(b) Karyogamy : Fusion of nuclei
(c) Meiosis : Reductional division

**(105)** **Answer :** (3)
**Hint:**
Ascospores are sexual spores.
**Solution:**
Zoospores, sporangiospores and conidia are asexual spores. Ascospores are sexual spores produced by members of Ascomycetes.

**(106)** **Answer :** (2)
**Solution:**
Sexual reproduction is absent in the members of Deuteromycetes.

*Colletotrichum*, *Alternaria* and *Trichoderma* are the members of Deuteromycetes.

**(107) Answer :** (4)
**Hint:**
They bear the integumented megasporangium.
**Solution:**
Gymnosperms are the vascular plants with an exposed ovule. As the ovule is not covered by an ovary wall, after fertilization the seeds are exposed to the environment forming naked seeds.

**(108) Answer :** (4)
**Solution:**
Potato spindle tuber disease is caused by viroids and it was found to be free RNA with low molecular weight.

**(109) Answer :** (4)
**Solution:**
*Volvox* and *Spirogyra* are green algae. *Volvox* shows oogamous reproduction whereas *Spirogyra* shows isogamous reproduction.

**(110) Answer :** (2)
**Solution:**
*Sphagnum* is also called as peat or cotton or bog moss.

**(111) Answer :** (4)
**Solution:**
Bentham and Hooker were the proponents of natural system of classification.

**(112) Answer :** (2)
**Solution:**
Kelps are profusely branched brown algae.

**(113) Answer :** (4)
**Solution:**
Highly reduced male gametophytes are also present in angiosperms living in different habitats.
They are called pollen grains and they do not help to reduce the water loss in gymnosperms.

**(114) Answer :** (3)
**Solution:**
For plants, scientific names are based on agreed principles and criteria, which are provided by ICBN.
'Dogs', 'cats' are taxa at same level, *i.e*., common name while 'mammals' represent taxa at different level, *i.e.*, class.

**(115) Answer :** (4)
**Solution:**
Systema – The systematic arrangement of organisms.
Classification – The process by which anything is grouped into convenient categories based on some easily observable characters.
Taxon – A group of organisms that are classified as a unit.
Nomenclature – The naming of living organisms is such that a particular organism is known by the same name all over the world.

**(116) Answer :** (3)
**Solution:**
Euglenoids have pigments identical to those present in the higher plants. When deprived of sunlight they behave like heterotrophs by predating on some other smaller organisms.

**(117) Answer :** (4)
**Solution:**
Five kingdom classification placed *Paramoecium* and *Amoeba* under kingdom Protista. Earlier classification system included *Chlamydomanas* and *Spirogyra* under algae.

**(118) Answer :** (3)
**Solution:**
The correct order w.r.t. complexity of body organisation in the five kingdom classification is
e. Monera
a. Protista
b. Fungi
d. Plantae
c. Animalia

**(119) Answer :** (2)
**Solution:**

Sac fungi and club fungi represents ascomycetes and basidiomycetes, respectively.
Asexual spores are generally not found in members of Basidiomycetes.
Sex organ is absent in members of Basidiomycetes.

**(120) Answer :** (4)
**Solution:**
Kingdom Protista includes unicellular eukaryotes. Chrysophytes, Dinoflagellates and Euglenoids have chlorophyll containing members.

**(121) Answer :** (1)
**Solution:**
The walls of diatoms are embedded with sillica and thus the walls are indestructible. Due to this, diatoms have left behind large amount of cell wall deposits in their habitats.

**(122) Answer :** (1)
**Solution:**
TMV and bacteriophages are viruses; they are not mentioned in R.H. Whittaker's classification system because they are not considered truly 'living', if we understand living as organisms that have a cell structure.Both have protein coat called capsid made of small subunit called capsomeres.

**(123) Answer :** (2)
**Solution:**
*Sphagnum* (moss), *Selaginella* (a pteridophyte) and *Cycas* (a gymnosperm) share common features such as the zygote undergoes mitotic division to form the embryo.

**(124) Answer :** (2)
**Solution:**
Non-vascular embryophytes are attached to the soil through unicellular or multicellular branched rhizoids. Mosses have multicellular branched rhizoids.

**(125) Answer :** (2)
**Solution:**
Chloroplasts are of various shapes in green algae.
Some members of Chlorophyceae may store food in the form of oil droplets.

**(126) Answer :** (2)
**Solution:**
Rhodophyceae and Phaeophyceae can be found in brackish and salt water. Members of both the groups can reproduce vegetatively by fragmentation. Chlorophyll *a*, *c*, carotenoids and xanthophyll are pigments found in Phaeophyceae members.

**(127) Answer :** (4)
**Solution:**
The **correct** sequence of events occurring in the life cycle of mosses is
• Sex organs are produced at the apex of leafy gametophyte. (S)
↓
• Development of sporophyte consisting of foot, seta and capsule. (P)
↓
• Formation of spores by meiosis. (R)
↓
• Dispersal of spores. (Q)

**(128) Answer :** (3)
**Solution:**

| | | |
|---|---|---|
| *Equisetum* | – | Sporophylls form distinct compact structures called strobili or cones |
| *Pinus* | – | Roots have fungal association in the form of mycorhiza |
| *Cycas* | – | Plants have unbranched stem and coralloid roots |
| *Polytrichum* | – | The second stage of gametophytic plant body bear sex organs |

**(129) Answer :** (2)
**Solution:**
Members of kingdom plantae show autotrophics mode of nutrition.
Male gametes are non-motile in angiosperms.

**(130) Answer :** (2)
**Solution:**
*Porphyra* has stored food as floridean starch and photosynthetic organ is leaf-like frond.

**(131) Answer :** (1)
**Solution:**

Members of rhodophyceae have r-phycoerythrin as major pigment. Their cell wall is composed of cellulose, pectin and polysulphate esters.

**(132) Answer :** (1)
**Solution:**
Gemma is green, multicellular, asexual bud which develop in small receptacles called gemma cups.

**(133) Answer :** (4)
**Solution:**
Seed habit is an event seen in gymnosperms and angiosperms.
Events precursor to seed habit is seen in heterosporous pteridophyte species.

**(134) Answer :** (3)
**Solution:**
In gymnosperm, the megaspores are enclosed within the megasporangium.

**(135) Answer :** (4)
**Solution:**
*Adiantum* belongs to Pteropsida.

## ZOOLOGY

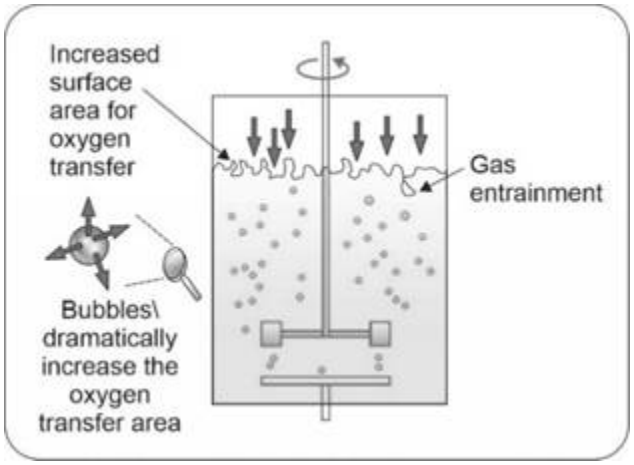
**(136) Answer :** (2)
**Solution:**
Not all cloning vectors integrate into the host cell's chromosomal DNA after transformation; most common plasmids are extra-chromosomal DNAs that replicate independently of the host chromosome.

**(137) Answer :** (3)
**Hint:**
Agarose gel allows smaller fragments of DNA to travel more quickly.
**Solution:**
Gel electrophoresis is a technique that is used to separate DNA fragments on the basis of size and conformation.

**(138) Answer :** (3)
**Hint:**
Isolation of desired DNA fragment
**Solution:**
Recombinant DNA technology involves several steps in a specific sequence such as isolation of DNA, fragmentation of DNA by restriction endonucleases, isolation of desired DNA fragment, ligation of the DNA fragment into a vector, transferring the rDNA into the host, culturing the host cells in a medium at a large scale and extraction of the desired product.
Later, the product has to be formulated with suitable preservatives.

**(139) Answer :** (3)
**Hint:**
Blue-white colonies
**Solution:**
Selection of recombinants due to inactivation of antibiotics is a cumbersome procedure because it requires simultaneous plating on two plates having different antibiotics. Therefore, alternative selectable markers have been developed which differentiate recombinants from non-recombinants on the basis of their ability to produce colour in the presence of a chromogenic substrate. In this, a recombinant DNA is inserted within the coding sequence of an enzyme, β-galactosidase. Insertional inactivation of β-galactosidase gives white coloured colonies and without its insertional inactivation, we get blue coloured colonies. As it provides us with visible colour effect, it makes selection of recombinants quite easy.

**(140) Answer :** (4)
**Hint:**
Gas entrainment
**Solution:**




**(141) Answer :** (2)

**Hint:**

Palindromic sequence of *Eco*RI

**Solution:**

Enzyme *Eco*RI cuts the strand of DNA a little away from the centre of the palindromic site forming sticky ends.

**(142) Answer :** (3)

**Hint:**

DNA ligase

**Solution:**

DNA ligases, also known as molecular glue, belong to class VI of enzymes. They catalyse the linking together of alien DNA and cloning vector.

Restriction endonucleases, also known as molecular scissors, help in cutting the DNA at specific locations.

**(143) Answer :** (4)

**Solution:**

Downstream processing is separation and purification of products after the completion of the biosynthetic stage.

**(144) Answer :** (4)

**Solution:**

Retrovirus mediated gene transfer is an indirect method. Electroporation is a biophysical phenomenon in which cell membrane permeability is increased through the application of external pulsed electric field.

**(145) Answer :** (4)

**Solution:**

If n = Number of restriction sites in a DNA, then the number of fragments obtained from a linear DNA after restriction digestion = n + 1.

While for circular plasmid DNA, it is equal to n.

**(146) Answer :** (1)

**Solution:**

Transgenic animals are formed by introducing foreign genes therefore they can't be used to study lineage or ancestry.

**(147) Answer :** (2)

**Solution:**

α-1-antitrypsin is a protein that protects the body tissues from being damaged and it is used to treat emphysema.

**(148) Answer :** (3)

**Solution:**

In 1997, the first transgenic cow, Rosie, produced human protein-enriched milk (2.4 g/L). The milk contained the human alpha-lactalbumin and was nutritionally a more balanced product for human babies than the natural cow milk.

**(149) Answer :** (3)

**Solution:**

Probe is a single stranded DNA or RNA, tagged with a radioactive molecule. It is allowed to hybridise to its complementary DNA in a clone of cells followed by detection using autoradiography.

**(150) Answer :** (3)

**Solution:**

In some children, ADA deficiency can be cured by bone marrow transplantation; in others, it can be treated by enzyme replacement therapy, in which functional ADA is given to the patient by injection. But the problem with both of these approaches is that they are not completely curative.

**(151) Answer :** (4)

**Solution:**

For the multiplication of any alien piece of DNA in an organism, it needs to be a part of a chromosome which has a specific sequence known as origin of replication.

**(152) Answer :** (2)

**Solution:**

*Bacillus thuringiensis* forms protein crystals during a particular phase of its growth. These crystals contain a toxic insecticidal protein. This *Bt* toxin protein exists as an inactive protoxin but once an insect ingests the inactive toxin, it is converted into an active form of toxin due to the alkaline pH of the insect's gut which solubilises the crystals. The activated toxin binds to the surface of midgut epithelial cells and creates pores that cause cell swelling and lysis, eventually causing death of the insect.

**(153) Answer :** (2)

**Solution:**

Somatic hybridisation is accomplished by fusion of two protoplasts of different varieties of plants.

**(154) Answer :** (2)

**Solution:**

Insulin is made of polypeptide chains. So, it gets digested by the protein digesting enzymes.

**(155) Answer :** (1)

**Hint:**

This acronym stands for Genetic Engineering Approval Committee.

**Solution:**

GEAC monitors genetic engineering programs in India and makes decisions regarding the validity of GM research and the safety of introducing GM organisms in India.

**(156) Answer :** (2)

**Solution:**

The image 'A' represents precipitated DNA.
The image 'B' represents spooling of DNA.
Purified DNA is precipitated out after the addition of chilled ethanol.
The DNA extracted in this way is crude. It contains impurities, such as proteins, that make the DNA visible to the naked eyes.
Pure DNA is virtually colourless and cannot be seen by naked eyes, hence dye is required during gel electrophoresis for visualization.
Elution is extraction of DNA from agarose gel.

**(157) Answer :** (4)

**Solution:**

| | | |
|---|---|---|
| Southern blotting | – | Used for DNA detection |
| Western blotting | – | Used for protein detection |
| Autoradiography | – | It is a nuclear hybridization technique |
| ELISA | – | Based on the principle of antigen-antibody interaction |

**(158) Answer :** (2)

**Solution:**

Co-667 is a high-yielding variety of soyabean. Bt soyabean has also been developed.
In a healthy human, blood generally lacks proteases and nucleases to prevent self-digestion of blood proteins.
The genome of HIV is ssRNA. Thus, RNases cannot be used for its isolation.

**(159) Answer :** (3)

**Solution:**

M. S. Swaminathan initiated the collaboration with Norman Borlaug, which culminated in the form of 'Green Revolution in India' through introduction of Mexican varieties of wheat in India.
During this revolution, the increased yields were partly due to the use of improved crop varieties, but mainly due to the use of better management practices and use of agrochemicals.

**(160) Answer :** (4)

**Solution:**

For tissue culturing, the nutrient medium must provide a carbon source (such as sucrose, which is a disaccharide) and also inorganic salts, vitamins, amino acids and growth regulators like auxins and cytokinins.

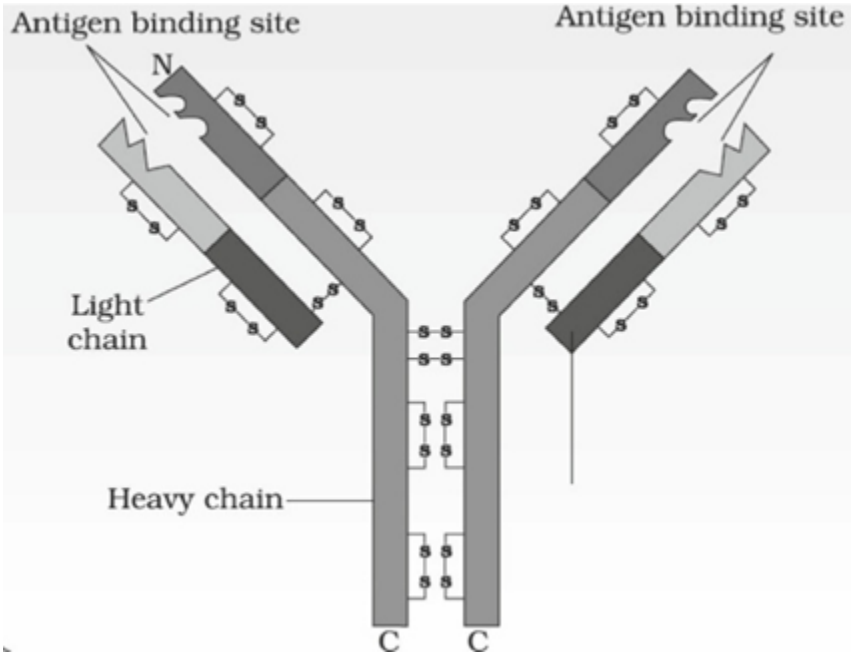
**(161) Answer :** (1)

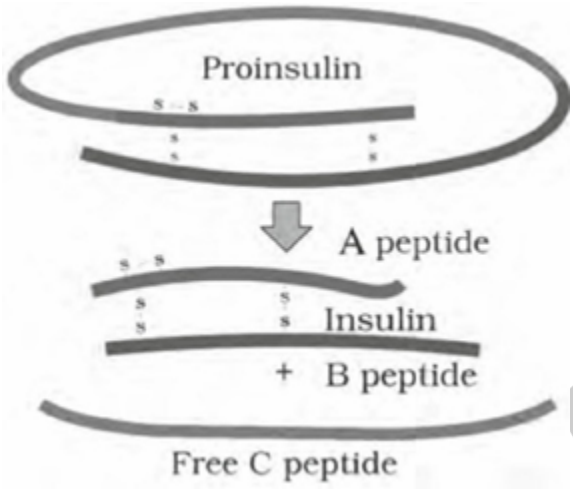
**Solution:**

Any plant part can generate a whole new plant because plant cells are totipotent.

**(162) Answer :** (2)

**Solution:**






**(163) Answer :** (4)

**Solution:**

The proteins encoded by the genes *cryIAc* and *cryIIAb* control the cotton bollworms, while that of *cryIAb* controls corn borers. Some strains of *Bacillus thuringiensis* produce proteins that kill certain insects such as lepidopterans (tobacco budworm, armyworm), coleopterans (beetles) and dipterans (flies, mosquitoes).

**(164) Answer :** (4)

**Solution:**

RNAi takes place in all eukaryotic organisms as a method of cellular defense. This method involves silencing of a specific mRNA due to formation of dsRNA molecule formed by binding of complementary RNA molecule to the original mRNA and further splicing.

**(165) Answer :** (3)

**Solution:**

Advantages of recombinant therapeutics are:
a. Mass production is possible.
b. Safe and more effective drugs are obtained.
c. They do not induce unwanted immunological responses, as is common in case of similar products isolated from non-human sources.

**(166) Answer :** (3)

**Solution:**

A patent is granted for:
a. An invention
b. An improvement in an earlier invention.
c. The process of generating a product.

d. New concept or design

**(167) Answer :** (4)

**Solution:**

Transgenic bacteria are micro-organisms whose DNA has been modified to carry foreign genes that allow them to produce useful products like medicines or enzymes.

First recombinant DNA → Produced in 1972 by using the plasmid of *Salmonella typhimurium*.

*Taq* polymerase is not heat-labile.

First restriction endonuclease was isolated from *Haemophilus influenzae*.

By 1969, Herbert Boyer performed studies on restriction enzymes of *E*. c*oli*.

**(168) Answer :** (4)

**Solution:**

Traditional hybridisation procedures used in plant and animal breeding, very often lead to inclusion and multiplication of undesirable genes along with the desired genes.

The techniques of genetic engineering, which include the creation of recombinant DNA, use of gene cloning and gene transfer, overcome this limitation and allow us to isolate and introduce only one or a set of desirable genes without introducing undesirable genes into the target organism.

**(169) Answer :** (2)

**Solution:**

Biotechnology deals with the techniques of using live organisms or enzymes from organisms to produce products and processes useful to humans. In this sense, making bread or wine, which are all microbe-mediated processes, could also be thought as a form of biotechnology.

Many other processes/techniques can be included under biotechnology. For example, *in vitro* fertilisation leading to a 'test-tube' baby, synthesising a gene and using it, developing a DNA vaccine, correcting a defective gene, *etc*.

**(170) Answer :** (3)

**Solution:**

Biopiracy is referred to as use of bio-resources by multinational companies and other organisations without proper authorisation from the countries and people concerned without compesatory payment.

**(171) Answer :** (3)

**Solution:**

Among eukaryotic host vector systems, the most common is the baker's yeast, *Saccharomyces cerevisiae*, from which YAC has been derived through genetic engineering.

**(172) Answer :** (3)

**Solution:**

Primers are short oligonucleotides.

PCR involves 3 temperature-dependent steps. These three steps are:

Denaturation: It is performed at 94°C.

Annealing: It is performed between 50°C and 60°C.

Primer extension: It is performed at 72°C.

Both forward and reverse primers are used in PCR for the extension step.

**(173) Answer :** (3)

**Solution:**

*Eco*RI digestion gives two bands of 3 kb and 2 kb.

→ Thus, *Eco*RI has two restriction sites on the plasmid.

*Hind*III digestion gives one band of 5 kb.

→ *Thus*, *Hind*III has only one restriction site, and it linearises the plasmid.

*Eco*RI + *Hind*III digestion gives three bands of 2 kb, 1.5 kb, 1.5 kb.

→ The 2 kb fragment remains unchanged, so *Hind*III does not cut this fragment.

→ The 3 kb fragment is cut into two equal fragments of 1.5 kb each.

Therefore, *Hind*III cuts exactly at the midpoint of the 3 kb *Eco*RI fragment.

**(174) Answer :** (2)

**Solution:**

Genetic engineering has disarmed pathogens and converted them into safe vectors that retain their gene-delivery ability without pathogenic effects.

*Agrobacterium tumifaciens* transfers T-DNA into plant cells using its *Ti* plasmid, causing tumour formation.

Retroviruses can insert their genetic material into animal cell genomes.

*Agrobacterium* induces tumour formation only in dicot plants, not in all plants.

**(175) Answer :** (3)

**Solution:**

Recombinant pBR322 with *BamH*I insertion will be $amp^R + tet^s$.

Thus, colonies will be seen on the ampicillin plate, but no growth will be observed on the tetracycline plate.

**(176) Answer :** (4)

**Solution:**

Bt-cotton and Bt-corn are transgenic crops carrying *cry* genes for insect resistance.
Golden rice is a genetically engineered rice variety.
Pomato is a somatic hybrid produced by somatic hybridization of potato and tomato.

**(177) Answer :** (2)

**Solution:**

The primary role of the $CaCl_2$ treatment followed by heat shock in laboratory transformation is to make the bacterial cell membrane permeable to the plasmid DNA.

The positively charged $Ca^{2+}$ bind to the negatively charged phosphate backbone of the DNA and the negatively charged lipopolysaccharides on the bacterial outer membrane, neutralizing the repulsion between them and allowing the DNA to get close to the cell surface.
A brief, sudden increase in temperature (typically to 42°C for a short duration) followed by immediate cooling on ice is thought to create temporary pores in the bacterial cell wall/membrane.

**(178) Answer :** (3)

**Solution:**

When a restriction enzyme recognizes a DNA sequence, it hydrolyzes the bond between adjacent nucleotides and cuts through the DNA molecule. Restriction enzymes break phosphodiester bonds between the phosphate and the pentose sugar in sugar-phosphate backbone at the specific site.

**(179) Answer :** (3)

**Solution:**

Restriction enzymes do not act on the bacteria's own DNA because the host bacterium has a modification system (specifically, an enzyme called methylase) that chemically alters its own DNA, primarily by adding methyl groups to the specific recognition sequences.
This methylation modifies the chemical structure of the recognition site, making it unidentifiable to the restriction enzymes.

**(180) Answer :** (1)

**Solution:**

The restriction enzyme that produces blunt ends and is derived from the bacterium *Serratia marcescens* is *Sma* I.
Its recognition sequence is 5′-CCCGGG-3′, cutting between the C and G in the middle of the sequence (5′-CCC↓GGG-3′).
*Sal* I is derived from *Streptomyces albus*.