DATE : 03/05/2026

Test Booklet Code

12

KAILASH

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Sector-18, Udyog Vihar, Gurugram, Haryana - 122015.

Answers & Solutions for NEET (UG)-2026

Time : 3 hrs.

M.M. : 720

Important Instructions:

1. The test is of **3 hours** duration and the Test Booklet contains **180** multiple choice questions (Four options with a single correct answer) from **Physics, Chemistry and Biology (Botany and Zoology).**
2. Each question carries **4 marks**. For each correct response, the candidate will get **4 marks**. For every wrong response, **1 mark** shall be deducted from the total scores. The maximum marks are **720**.
3. Use **Blue / Black Ball Point Pen only** for writing particulars on this page / marking responses on Answer Sheet.
4. Rough work is to be done in the space provided for this purpose in the Test Booklet only.
5. On completion of the test, the candidate must handover the Answer Sheet to the Invigilator before leaving the Room / Hall. The candidates are allowed to take away this Test Booklet with them.
6. The CODE for this Booklet is **12**.
7. The candidates should ensure that the Answer Sheet is not folded. Do not make any stray marks on the Answer Sheet. Do not write your Roll No. anywhere else except in the specified space in the Test Booklet/Answer Sheet. Use of white fluid for correction is **NOT** permissible on the Answer Sheet.
8. Each candidate must show on demand his/her Admission Card to the Invigilator.
9. No candidate, without special permission of the Centre Superintendent or Invigilator, would leave his/her seat.
10. Use of Electronic/Manual Calculator is prohibited.
11. The candidates are governed by all Rules and Regulations of the examination with regard to their conduct in the Examination Hall. All cases of unfair means will be dealt with as per Rules and Regulations of this examination.
12. No part of the **Test Booklet** and **Answer Sheet** shall be detached under any circumstances.
13. The candidates will write the Correct Test Booklet Code as given in the Test Booklet / Answer Sheet in the Attendance Sheet.

PHYSICS

1. A 100-turn closely wound circular coil of radius 5 cm has a magnetic field of 3.14×10^{-3} T at its centre. The current flowing through the coil, and the magnitude of the magnetic moment of this coil are, respectively :

(Take $\mu_0 = 4\pi \times 10^{-7}$ T m/A)

(1) 2.5 A, 2 A m^2

(2) 2.5 A, 20 A m^2

(3) 2 A, 4 A m^2

(4) 2 A, 10 A m^2

Answer (1)

Sol. Magnetic field of a circular loop:

$$B_0 = \frac{\mu_0 Ni}{2R}$$

$$i = \frac{2RB_0}{\mu_0 N} = \frac{2 \times 5 \times 10^{-2} \times 3.14 \times 10^{-3}}{4\pi \times 10^{-7} \times 100}$$

$i = 2.5$ A

Magnetic moment

$M = NiA$

$= 100 \times 2.5 \times 3.14 \times (5 \times 10^{-2})^2$ $[\because A = \pi R^2]$

$= 2$ A m^2

2. Match List I with List II.

	List-I		List-II
A.	$E = h\nu$	I.	de Broglie wavelength
B.	Diffraction and Interference	II.	Particle nature of light
C.	$\lambda = h/p$	III.	Wave nature of light
D.	Compton effect	IV.	Energy of photon

Choose the **correct** answer from the options given below.

(1) A-IV, B-III, C-I, D-II

(2) A-I, B-IV, C-III, D-II

(3) A-IV, B-I, C-II, D-III

(4) A-IV, B-III, C-II, D-I

Answer (1)

Sol. A. $E = h\nu$ is energy of photon

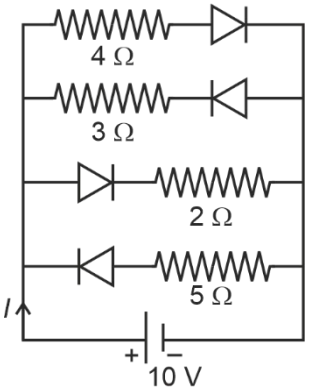
B. Diffraction and interference confirm wave nature of light

C. $\lambda = \frac{h}{p}$ is de Broglie wavelength of particle.

D. Compton effect confirms particle nature of light.

3. The current *I* in the circuit shown below is:

(All diodes are ideal and identical)



(1) $\frac{5}{3}$ A

(2) $\frac{15}{2}$ A

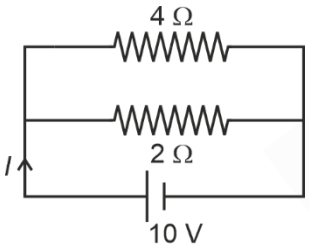
(3) $\frac{1}{3}$ A

(4) $\frac{5}{9}$ A

Answer (2)

Sol. For ideal diode, forward resistance = 0 and reverse biased resistance = ∞

∴ Circuit can be redrawn as,



$$I = \frac{10}{2} + \frac{10}{4}$$

$$= \frac{30}{4}$$

$$= \frac{15}{2} \text{ A}$$

4. The speed of light in vacuum is taken as unity. If light takes 6 min 40 s to reach the Earth from the Sun, the distance between the Sun and the Earth in new unit is:

(1) 3×10^8

(2) 3×10^{10}

(3) 400

(4) 500

Answer (3)

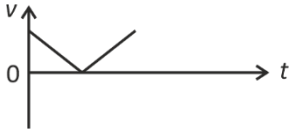
Sol. Time, t = 6 min 40 s

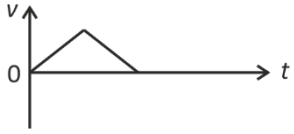
= 360 + 40 = 400 s

Distance in new system $d = vt$

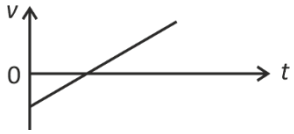
= 1 × 400 = 400

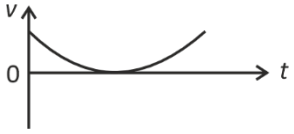
5. The following plots show variation of velocity (v) with time (t) of a ball thrown vertically upward, and falling back. Which of the following plots is/are correct?

A. 

B. 

C. 

D. 

E. 

(1) C only
(2) A and E only
(3) D only
(4) B only

Answer (1)

Sol. During the whole journey, acceleration due to gravity is vertically downward.

Therefore, slope of velocity vs time curve should be negative throughout the journey.

$\therefore$ Statement (C) is correct

6. In a vernier calliper, 20 VSD coincide with 16 MSD (each division of length 1 mm). The least count of the vernier callipers is:

(1) 0.01 cm
(2) 0.1 cm
(3) 0.02 cm
(4) 0.2 cm

Answer (3)

Sol. Least count of vernier callipers

$$\text{L.C.} = 1\ \text{MSD} - 1\ \text{VSD} \quad \ldots(i)$$

$$20\ \text{VSD} = 16\ \text{MSD}$$

$$1\ \text{VSD} = \frac{16}{20}\ \text{MSD}$$

From (i)

$$\text{L.C.} = 1\ \text{MSD} - \frac{16}{20}\ \text{MSD}$$

$$\text{L.C.} = \frac{4}{20}\text{MSD}$$

$$\text{L.C.} = \frac{1}{5}\text{mm} = 0.2\ \text{mm}$$

$$\text{L.C.} = 0.02\ \text{cm}$$

7. An ac circuit contains a resistance of 1 kΩ, a capacitor of 0.1 μF and an inductor of 1 mH connected in series. The resonance frequency of the circuit is approximately:

(1) 10.1 kHz

(2) 20.7 kHz

(3) 15.9 kHz

(4) 13.5 kHz

Answer (3)

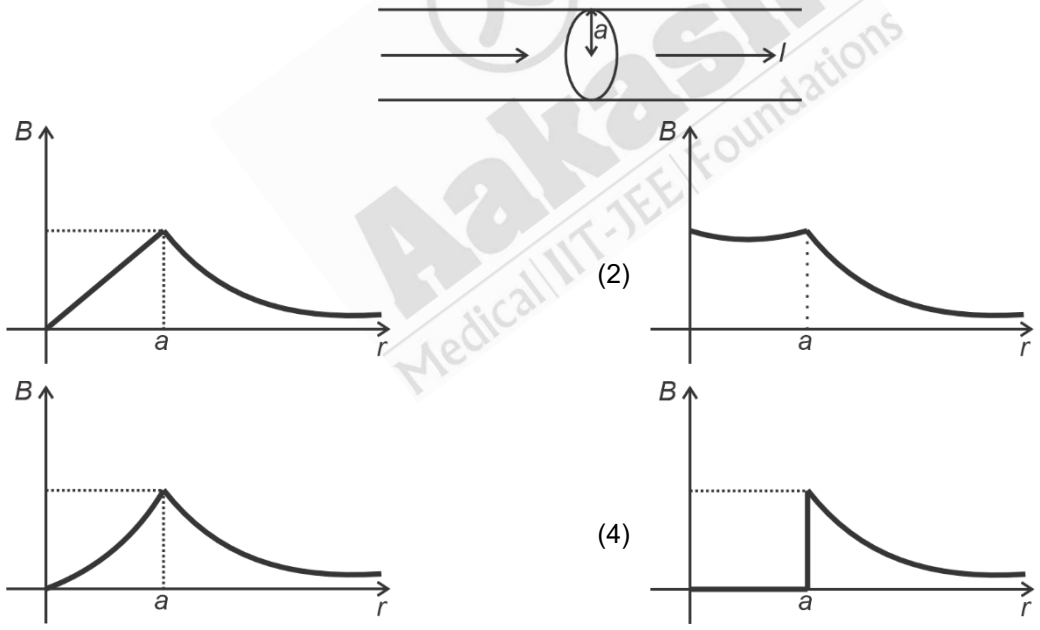
Sol. Resonance frequency

$$f_0 = \frac{1}{2\pi\sqrt{LC}}$$

$$= \frac{1}{2\pi\sqrt{1\times10^{-7}\times10^{-3}}}$$

= 15.9 kHz

8. The figure given below shows a long straight solid wire of circular cross-section of radius '*a*' carrying steady current *I*. The current *I* is uniformly distributed across its cross-section. The plot which correctly represents the variation of magnetic field (*B*) with distance (*r*) from the axis of the conductor in the region is :



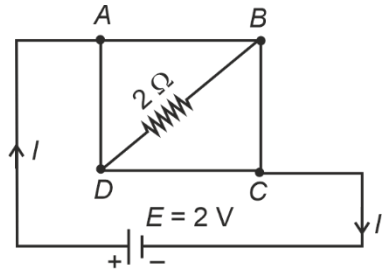
Answer (1)

Sol. For a long straight solid wire carrying steady current, which is uniformly distributed across its cross-section, the variation of magnetic field (*B*) with distance (*r*) from axis will be

$$B = \frac{\mu_0 I r}{2\pi a^2} \Rightarrow B \propto r, \quad \text{for } r < a$$

$$B = \frac{\mu_0 I}{2\pi r} \Rightarrow B \propto \frac{1}{r}, \quad \text{for } r > a$$

9. A uniform metallic wire having resistance 4 Ω is bent to form a square loop (*ABCD*) (see figure). A resistance of 2 Ω is connected between points *B* and *D* and a battery of 2 V is connected across points *A* and *C* as shown in the figure. Now the value of current (*I*) is :



(1) 2 A
(2) 4 A
(3) 8 A
(4) 4.5 A

Answer (1)

Sol.

→ Each side will have resistance of 1 Ω

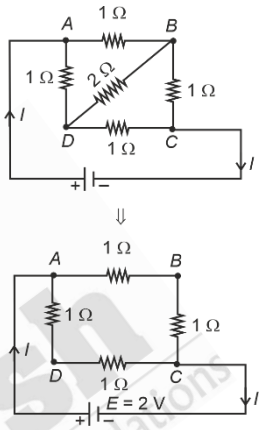
→ It is balanced wheat stone bridge

→ No current in the resistance of 2 Ω

→ $[R_{effective}]_{AC} = 1\ \Omega$

→ $I = \frac{E}{R_{eff.}} = \frac{2}{1}$

→ $I = 2$ A



10. An unknown nucleus has a nuclear density of 2.29×10^{17} kg/m^3 and mass of 19.926×10^{-27} kg. Its mass number *A* is approximately:

(Take $R_0 = 1.2 \times 10^{-15}$ m, $4\pi = 12.56$)

(1) 12
(2) 19
(3) 20
(4) 16

Answer (1)

Sol. Given

$\rho = 2.29 \times 10^{17}$ kg/m^3, mass $m = 19.926 \times 10^{-27}$ kg

$R_0 = 1.2 \times 10^{-15}$ m and $R = R_0 A^{\frac{1}{3}}$

Now use volume = $\frac{\text{Mass}}{\text{Density}}$

$\Rightarrow \frac{4}{3}\pi R^3 = \frac{M}{\rho}$

$\Rightarrow \frac{4}{3}\pi\left[R_0 (A)^{1/3}\right]^3 = \frac{M}{\rho}$

$\Rightarrow \frac{4}{3}\pi R_0^3 A = \frac{M}{\rho}$

$\Rightarrow A = \frac{M}{\rho} \times \frac{3}{4\pi \times R_0^3} = \frac{19.926 \times 10^{-27} \times 3}{2.29 \times 10^{17} \times 12.56 \times \left(1.2 \times 10^{-15}\right)^3} \approx 12$

11. A rectangular wire loop of sides 8 cm and 3 cm with a small cut, is moving out of a region of uniform magnetic field of magnitude 0.3 T directed normal to the plane of the loop. The emf developed across the cut, if the velocity of the loop is 2 cm s^{-1}, in a direction normal to the shorter side of the loop, will be :

(1) 1.8×10^{-4} volt (2) 1.2×10^{-4} volt

(3) 1.3×10^{-4} volt (4) 4.8×10^{-4} volt

Answer (1)

Sol. Induced emf across the shorter side

$E_{induced} = Bvl \quad [\because \vec{B} \perp \vec{V} \perp \vec{l}]$

$= 0.3 \times 2 \times 10^{-2} \times 3 \times 10^{-2}$

$= 1.8 \times 10^{-4}$ V

$= 1.8 \times 10^{-4}$ volt

12. A galvanometer of resistance 100 Ω gives full scale deflection for a current of 1 mA. It is converted into an ammeter of range 0 –10 A. The shunt required is:

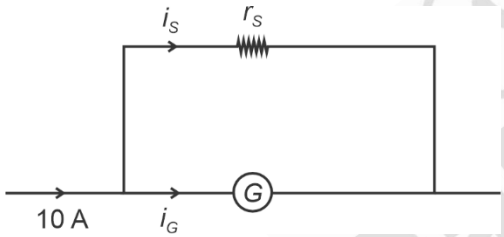
(1) 0.01 Ω (2) 0.10 Ω

(3) 0.001 Ω (4) 1.0 Ω

Answer (1)

Sol. $i_G = 1$ mA $= 0.001$ A

$i_S = 10 - i_G \simeq 10$ A



Both shunt resistance and galvanometer are in parallel connection

$\therefore \quad i_S r_S = i_G R_G$

$\Rightarrow \quad 10 \times r_s = 0.001 \times 100$

$\Rightarrow \quad r_s = 0.01\ \Omega$

13. In Young's double slit experiment, using monochromatic light of wavelength λ, the intensity of light at a point on the screen where the path difference is λ, is K units. The intensity of light at a point where the path difference is $\frac{\lambda}{3}$ will be

(1) $\frac{K}{4}$ (2) K

(3) $\frac{K}{2}$ (4) $2K$

Answer (1)

Sol. $I = I_0 \cos^2 \frac{\Delta\phi}{2}$ [$I_0 \rightarrow$ maximum intensity]

$I = I_0 \cos^2 \frac{K\Delta x}{2}$

$$K = I_0 \cos^2\left(\frac{2\pi}{\lambda} \times \frac{\lambda}{2}\right)$$

$K = I_0$

$$K_1 = I_0 \cos^2\left(\frac{2\pi}{\lambda} \times \frac{\lambda}{3 \times 2}\right) = I_0 \cos^2\left(\frac{\pi}{3}\right)$$

$$K_1 = \frac{I_0}{4}$$

$$\frac{K}{K_1} = 4 \Rightarrow K_1 = \frac{K}{4}$$

14. The magnitude and direction of the acceleration produced in a body of mass 5 kg when two mutually perpendicular forces 8 N and 6 N act on it, are respectively:

(1) 2 m s^{-2}; $\tan^{-1}$ (3/4) with 6 N force

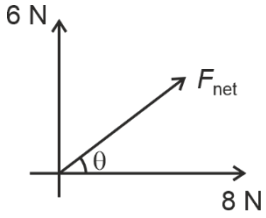
(2) 2 m s^{-2}; $\tan^{-1}$ (4/3) with 8 N force

(3) 2 m s^{-2}; $\tan^{-1}$ (3/4) with 8 N force

(4) 20 m s^{-2}; $\tan^{-1}$ (4/3) with 8 N force

Answer (3)

Sol.



$$F_{net} = \sqrt{6^2 + 8^2}$$

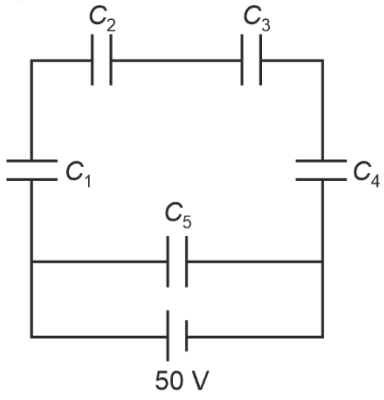
$$a = \frac{F_{net}}{m} = \frac{10}{5} = 2 \text{ m/s}^2$$

$$\tan\theta = \frac{6}{8}$$

$$\theta = \tan^{-1}\left(\frac{3}{4}\right) \text{ from 8 N}$$

15. Five capacitors of capacitances

$C_1 = C_2 = C_3 = C_4 = 10\ \mu F$ and $C_5 = 2.5\ \mu F$ are connected as shown, along with a battery of 50 V.



The equivalent capacitance and the charges on each capacitor respectively are:

(1) 5 μF, 125 μC on all capacitors

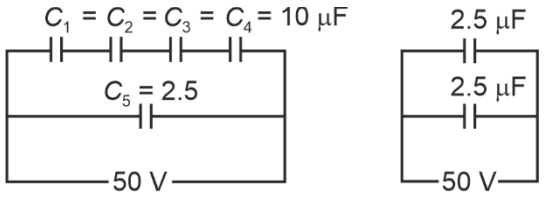
(2) 5 μF, 250 μC on all capacitors

(3) 4 μF, 250 μC on C_1 to C_4 and 125 μC on C_5

(4) 5 μF, 125 μC on C_1 to C_4 and 25 μC on C_5

Answer (1)

Sol.

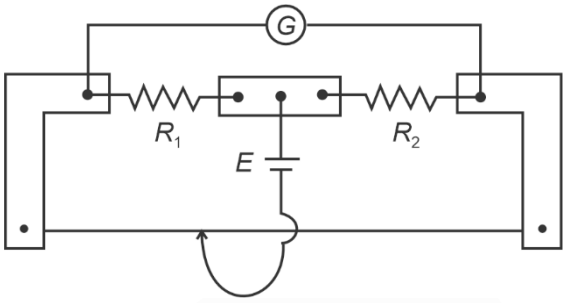


$C_{eq} = 2.5 + 2.5 = 5\ \mu F$`

$q_1 = q_2 = q_3 = q_4 = 2.5 \times 50 = 125\ \mu C$

$q_5 = 2.5 \times 50 = 125\ \mu C$

16. In a metre bridge experiment (see figure), the positions of the cell, *E*, and galvanometer, *G*, are interchanged. We shall observe in the galvanometer:



(1) Only the right-sided deflection

(2) Only the left-sided deflection

(3) There will be no deflection irrespective of the position of the jockey

(4) Both right-sided and left-sided deflection and at balance point, no deflection

Answer (4)

Sol.

- Position of null point will not change when galvanometer (*G*) and the cell (*E*) are interchanged.
- There will be no deflection in galvanometer only at balance point.

In an unbalanced meter bridge, if *E* and *G* are interchanged mutually, then the deflection in galvanometer may be towards left-side or right-side.

17. The power of a crane, which lifts a mass of 1000 kg to a height of 20 m in 10 s is: ($g = 9.8\ m/s^2$)

(1) 19.6 W

(2) 39.2 W

(3) 39.2 kW

(4) 19.6 kW

Answer (4)

Sol. $\text{Power} = \frac{\text{Work}}{\text{Time}}$

$= \frac{mgh}{t}$

$= \frac{10^3 \times 9.8 \times 20}{10}$

= 19.6 kW

18. Match List I with List II:

	List I		List II
A.	Young's Modulus	I.	$\frac{\Delta d}{\Delta L}\left(\frac{L}{d}\right)$
B.	Compressibility	II.	$\frac{FL}{A(\Delta L)}$
C.	Bulk Modulus	III.	$-\frac{1}{\Delta P}\left(\frac{\Delta V}{V}\right)$
D.	Poisson's Ratio	IV.	$-P\left(\frac{V}{\Delta V}\right)$

Choose the **correct** answer from the options given below:

(1) A-I, B-IV, C-III, D-II
(2) A-IV, B-I, C-II, D-III
(3) A-III, B-II, C-I, D-IV
(4) A-II, B-III, C-IV, D-I

Answer (4)

Sol. A. Young's Modulus $= \frac{\text{Stress}}{\text{Strain}} = \frac{FL}{A\Delta L}$

B. Compressibility $= \frac{1}{\text{Bulk modulus}} = -\frac{1}{\Delta P}\left(\frac{\Delta V}{V}\right)$

C. Bulk Modulus $= -P\left(\frac{V}{\Delta V}\right)$

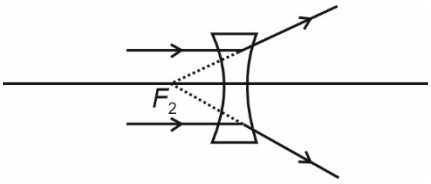
D. Poisson's Ratio $= \frac{\text{Lateral strain}}{\text{Longitudinal strain}} = \frac{\Delta d}{\Delta L}\left(\frac{L}{d}\right)$

19. In a concave lens, a ray of light emanating from the object parallel to the principal axis of the lens after refraction:

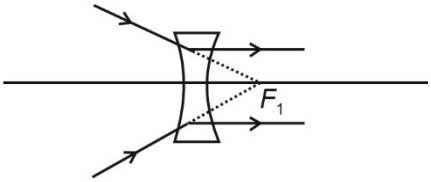
(1) emerges parallel to the principal axis.
(2) appears to diverge from the first principal focus.
(3) passes through 2F, which is the radius of curvature of the lens.
(4) passes through the second principal focus.

Answer (2*)

Sol.



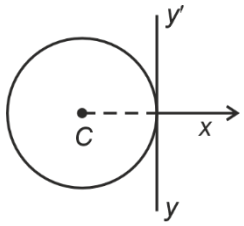
F_2 is the second principal focus $\Rightarrow$ It is the virtual image position for object at infinity.



F_1 is the first principal focus $\Rightarrow$ It is the virtual object position for which image is formed at infinity.

The best appropriate answer is option (2), although it should be second principal focus.

20. A thin wire of length '*L*' and linear mass density '*m*' is bent into a circular ring (in *x*-*y* plane) with centre '*C*' as shown in figure. The moment of inertia of the ring about an axis *yy*′ will be :



(1) $\frac{3mL^3}{8\pi^2}$ (2) $\frac{3mL^3}{8\pi}$

(3) $\frac{3mL^2}{8\pi^2}$ (4) $\frac{3mL^2}{8\pi}$

Answer (1)

Sol. Mass of thin wire = (Linear mass density) × (Length)

$\Rightarrow \quad M = mL$

$L = 2\pi r$, where r = radius of circular ring = $\frac{L}{2\pi}$

Using parallel axis theorem,

$$I_{yy'} = I_{CM} + Mr^2 = \frac{Mr^2}{2} + Mr^2 = \frac{3}{2}Mr^2$$

$$\Rightarrow \quad I_{yy'} = \frac{3}{2} \times (mL) \times \left(\frac{L}{2\pi}\right)^2 = \frac{3mL^3}{8\pi^2}$$

21. Each side of a metallic cube of mass 5.580 kg is measured to the 9.0 cm. Keeping the significant figures in view, the density of the material of the cube can be best expressed as $X \times 10^3$ kg m^{-3} where the value of X is:

(1) 7.654 (2) 7.7

(3) 7.65 (4) 7.6

Answer (2)

Sol. Density = $= \frac{\text{Mass}}{\text{Volume}}$

$$= \frac{5.580 \text{ kg}}{(9.0 \text{ cm})^3}$$

$$= \frac{5.580}{729} \times 10^6 \frac{\text{kg}}{\text{m}^3}$$

$$= 0.007654321 \times 10^6 \frac{\text{kg}}{\text{m}^3}$$

$$= 7.654 \times 10^3 \frac{\text{kg}}{\text{m}^3}$$

$$= 7.7 \times 10^3 \frac{\text{kg}}{\text{m}^3}$$

Hence, on comparing

$X = 7.7$

22. For a travelling harmonic wave

$y(x, t) = 2.0 \cos 2\pi(10t - 0.0080x + 0.35)$, where x and y are in cm and t in s. The phase difference between oscillatory motion of two points separated by a distance of 0.5 m is:

(1) $8\ \pi$ rad
(2) $0.08\ \pi$ rad
(3) $0.008\ \pi$ rad
(4) $0.8\ \pi$ rad

Answer (4)

Sol. $y(x, t) = 2.0 \cos 2\pi(10t - 0.008x + 0.35)$

Total phase

$\phi = 20\pi - 2\pi \times 8 \times 10^{-3}x + 2\pi \times 0.35$

$\Delta\phi = k\Delta x$

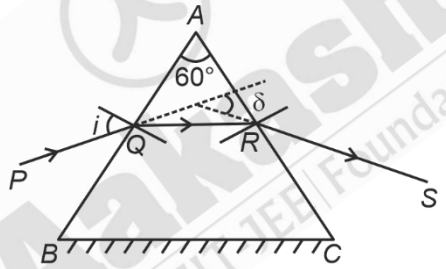
$\Delta\phi = 2\pi \times 8 \times 10^{-3}\ \Delta x$

$= 2\pi \times 8 \times 10^{-3} \times \left(\frac{100}{2}\right)$

$= 8\pi \times 10^{-1}$

$= 0.8\pi$

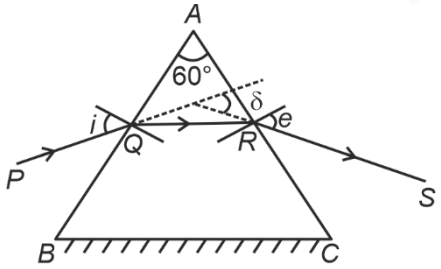
23. A ray of monochromatic light is passing through an equilateral prism (ABC) as shown in the figure. The refracted ray (QR) is parallel to its base (BC) and the angle of incidence (i) is 50°. Then the angle of deviation (δ) is:



(1) 40°
(2) 45°
(3) 55°
(4) 35°

Answer (1)

Sol.



$i = e$

Equation of prism

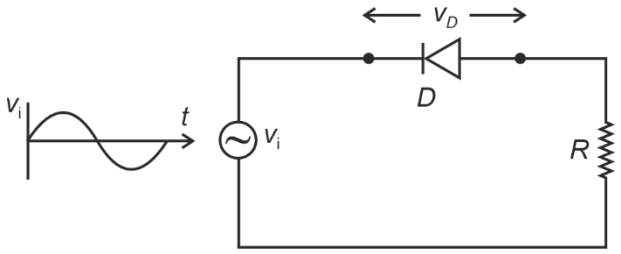
$i + e = A + \delta$

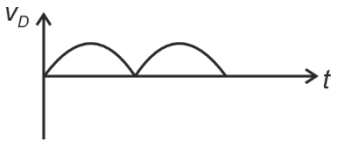
$2i - A = \delta$

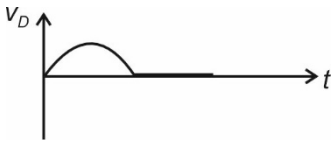
$2(50) - 60 = \delta$

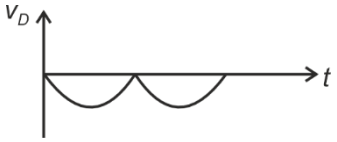
$\delta = 40°$

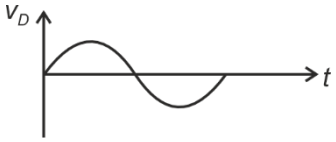
24. In the circuit shown below, the voltage appearing across the diode *D* will be of the form:



(1) 

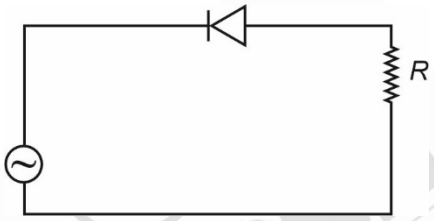
(2) 

(3) 

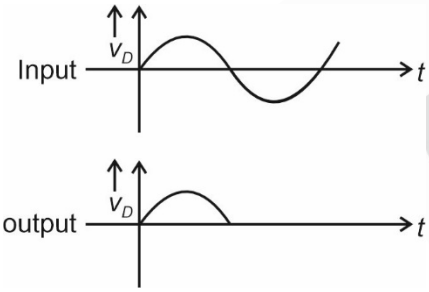
(4) 

Answer (2)

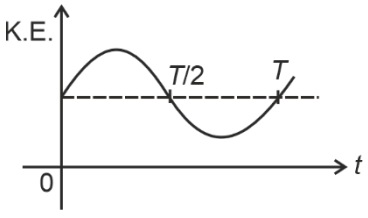
Sol. Voltage drop will be across the diode, when it will be in reverse bias 1

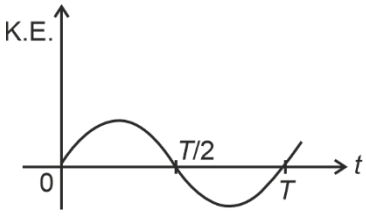


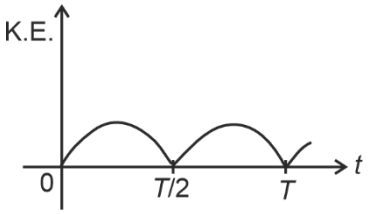
In positive half cycle it will be in reverse biased

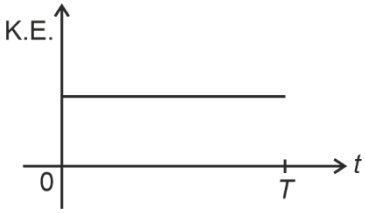


25. For a simple pendulum, having time period *T*, the variation of kinetic energy (K.E.) with time (*t*) is represented by:

(1) 

(2) 

(3) 

(4) 

Answer (3)

Sol. Kinetic energy, $K = \frac{1}{2}mv^2$

$= \frac{1}{2}mA^2\omega^2\cos^2(\omega t + \phi)$

$\therefore K \propto \cos^2(\omega t + \phi)$

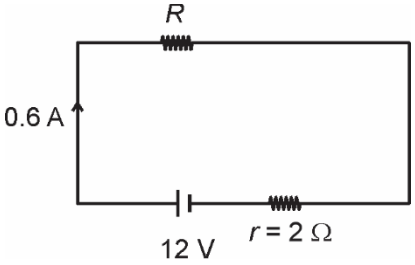
26. A resistor is connected to a battery of 12 V emf and internal resistance 2 Ω. If the current in the circuit is 0.6 A, the terminal voltage of the battery is:

(1) 10 V (2) 10.8 V

(3) 12 V (4) 1.2 V

Answer (2)

Sol. Circuit can be draw as,



$\Rightarrow$ Terminal voltage of battery $V = E - ir$

$= 12 - 0.6 \times 2$

$= 10.8$ V

27. The amount of work done to raise a mass 'm' from the surface of the Earth to a height equal to the radius of the Earth 'R' will be

(1) $2mgR$ (2) mgR

(3) $mg\frac{R}{4}$ (4) $mg\frac{R}{2}$

Answer (4)

Sol. W.D. $= U_2 - U_1$

$$= -\frac{GMm}{R+R} - \left(\frac{-GMm}{R}\right)$$

$$= -\frac{GMm}{2R} + \frac{GMm}{R}$$

$$= \frac{GMm}{2R} = \frac{mgR}{2}$$

28. An electric heater supplies heat to a system at a rate of 100 W. If the system performs work at a rate of 75 J/s, then the rate at which internal energy increases will be:

(1) 125 W (2) 100 W

(3) 25 W (4) 75 W

Answer (3)

Sol. Using 1st law of thermodynamics for electric heater,

$Q = \Delta U + W$

$\Rightarrow \quad \frac{dQ}{dt} = \frac{d(\Delta U)}{dt} + \frac{dW}{dt}$

$\Rightarrow \quad 100 \text{ W} = \frac{d(\Delta U)}{dt} + 75 \text{ W}$

$\therefore \quad \frac{d(\Delta U)}{dt} = 25 \text{ W}$

29. A room heater is rated 400 W, 220 V. If the supply voltage drops to 200 V, what will be the power consumed (approximately)?

(1) 121 W (2) 331 W

(3) 200 W (4) 400 W

Answer (2)

Sol. Rated power of heater

$$P_0 = \frac{V_0^2}{R} \quad \ldots(i)$$

Consumed power

$$P_c = \frac{V^2}{R} \quad \ldots(ii) \quad [V \rightarrow \text{applied voltage}]$$

From (i) and (ii)

$$\frac{P_c}{P_0} = \frac{V^2}{V_0^2}$$

$$P_c = \left[\frac{V}{V_0}\right]^2 P_0$$

$$P_c = \left[\frac{200}{220}\right]^2 \times 400$$

P_c = 331 W

30. When a ruler falls vertically, 5 different persons catch it with different reaction times.

(g = 9.8 m s^{-2})

A. Person A has reaction time of 0.20 s.

B. Person B has reaction time of 0.22 s.

C. Person C has reaction time of 0.18 s.

D. Person D has reaction time of 0.19 s.

E. Person E has reaction time of 0.21 s.

What is the **correct** order of the distance travelled by the ruler for each person?

(1) C > D > A > B > E

(2) C > D > A > E > B

(3) B > E > A > C > D

(4) B > E > A > D > C

Answer (4)

Sol.

$\rightarrow$ There will be large distance for large reaction time

$\rightarrow$ Descending order of reaction time

$\Rightarrow$ $t_B > t_E > t_A > t_D > t_C$

$\rightarrow$ Descending order of distance covered

$\Rightarrow$ $S_B > S_E > S_A > S_D > S_C$

31. Consider two uncharged capacitors of equal capacitance 200 pF. One of them is charged by a 100 V supply and disconnected. Now this capacitor is connected to the uncharged capacitor. The amount of electrostatic energy lost in the process is:

(1) 1.0×10^{-6} J
(2) 0.5×10^{-6} J
(3) 0.5 J
(4) 1.0 J

Answer (2)

Sol. Energy loss $= \frac{1}{2}\frac{C_1C_2}{C_1+C_2}V^2$

$= \frac{1}{2}\left(\frac{200\times 200}{400}\right)\times 10^{-12}(100)^2$

$= \frac{1}{2}\times 10^6 \times 10^{-12}$

$= 0.5 \times 10^{-6}$ J

32. Savitha, a XI standard student, while conducting an experiment to determine the effective length of a simple pendulum L, notes down the data of time taken to complete 30 oscillations as 60 s and hence calculates the length of the simple pendulum as :

(Take $\pi^2 = 9.8$, and $g = 9.8$ m/s^2)

(1) 2 m
(2) 0.75 m
(3) 1.5 m
(4) 1 m

Answer (4)

Sol. Time taken for 30 oscillations = 60 s

Time period of simple pendulum = Time taken for 1 oscillation

$\Rightarrow T = \frac{60}{30} = 2$ s

$T = 2\pi\sqrt{\frac{l}{g}} \quad \Rightarrow \quad l = \frac{gT^2}{4\pi^2} = \frac{9.8\times 2\times 2}{4\times 9.8} = 1$ m

33. The peak value of an alternating current is 5 A and frequency is 60 Hz. How long will the current, starting from zero, take to reach the peak value ?

(1) $\frac{1}{240}$s
(2) $\frac{1}{30}$s
(3) $\frac{1}{120}$s
(4) $\frac{1}{60}$s

Answer (1)

Sol. Alternating current,

$i = i_{peak}\sin(\omega t)$

where $\omega = 2\pi f = 2\pi \times 60 = 120\pi$ rad/s

$\Rightarrow \quad i = 5\sin(120\pi t)$

$\Rightarrow \quad 5 = 5\sin(120\pi t)$

$\Rightarrow \quad \sin(120\pi t) = 1 = \sin\left(\frac{\pi}{2}\right)$

$\therefore \quad 120\pi t = \frac{\pi}{2}$

$\Rightarrow \quad t = \frac{1}{240}$s

34. In interference and diffraction, the light energy is redistributed. If it reduces in one region, producing a dark fringe, it increases in another region, producing a bright fringe.

A. As there is no gain or loss of energy, these phenomena are consistent with the principle of conservation of energy.

B. Diffraction and interference are characteristics exhibited only by light waves.

Choose the **correct** answer from the options given below:

(1) A is true, but B is false

(2) A is true and B is also true

(3) A is false, but B is true

(4) Both A and B are false

Answer (1)

Sol. In interference and diffraction there is no loss of energy, the energy gets redistributed.

Interference and diffraction both are exhibited in light as well as sound waves.

35. A box of mass 15 kg is kept on the floor of a stationary trolley. The coefficient of static friction between the box and the trolley is 0.12. Keeping the box in stationary state over the trolley, the maximum acceleration with which the trolley can be moved horizontally in m s^{-2} is:

(g = 10 m/s^2)

(1) 1.5

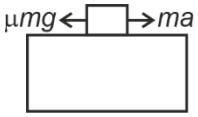
(2) 1.8

(3) 2.1

(4) 1.2

Answer (4)

Sol.



$a = \mu g = 0.12 \times 10 = 1.2$ m/s^2

36. The sum of kinetic energy and potential energy of a simple pendulum bob is 0.02 joule. The speed of the simple pendulum bob at equilibrium position is approximately:

(Consider mass of the bob = 20 g)

(1) 1.41 m/s

(2) 14.1 m/s

(3) 0.2 m/s

(4) 2.0 m/s

Answer (1)

Sol. At equilibrium position

Total energy = K.E

$$\frac{1}{2}mv^2 = 0.02$$

$$\frac{1}{2} \times 20 \times v^2 \times 10^{-3} = 2 \times 10^{-2}$$

$$v = \sqrt{2}$$

v = 1.41 m/s

37. Four statements are given (A is mass number):

A. The volume of a nucleus is proportional to $A^{1/3}$.

B. The volume of a nucleus is proportional to A.

C. The difference in mass of an atom and its nucleus is called the mass defect.

D. The difference in mass of a nucleus and its constituents is called the mass defect.

Choose the **correct** answer from the options given below:

(1) B and D are true, but A and C are false

(2) A and D are true, but B and C are false

(3) A and C are true, but B and D are false

(4) B and C are true, but A and D are false

Answer (1)

Sol. As we know,

Size of nucleus, $r = r_0(A)^{\frac{1}{3}}$

$\Rightarrow \quad r^3 = r_0^3 \cdot A$

$\Rightarrow \quad V \propto A \quad \left(\because V = \frac{4}{3}\pi r^3\right)$

So, option A $\rightarrow$ wrong and B $\rightarrow$ correct

while the difference between the actual mass of nucleus and its constituents is called the mass defect.

$\therefore$ option C $\rightarrow$ wrong and D $\rightarrow$ correct

38. The angular speed of a flywheel is increased from 600 rpm to 1200 rpm in 10 s. The number of revolutions completed by the flywheel during this time is :

(1) 600

(2) 900

(3) 300

(4) 150

Answer (4)

Sol. $\alpha = \frac{\omega_2 - \omega_1}{\Delta t} = \left(\frac{1200 - 600}{10}\right)\frac{2\pi}{60} = 2\pi \text{ rad/s}^2$

$\Rightarrow$ Use equation of motion, $\omega_2^2 = \omega_1^2 + 2\alpha\theta$

$\Rightarrow \quad \omega_2 = 1200 \times \frac{2\pi}{60} = 40\pi$

$\omega_1 = 600 \times \frac{2\pi}{60} = 20\pi$

$(40\pi)^2 = (20\pi)^2 + 2 \times 2\pi\theta$

$\Rightarrow \quad 1200\pi^2 = 4\pi\theta$

$\Rightarrow \quad \theta = 300\pi$ radian

$\Rightarrow$ Number of revolution $= \frac{\theta}{2\pi} = 150$

39. A submarine is designed to withstand an absolute pressure of 100 atm. How deep can it go below the water surface?

(Consider the density of water = 1000 kg m^{-3},
1 atm = 1 × 10^5 Pa and gravitational acceleration g = 10 m/s^2)

(1) 9900 m (2) 99 m

(3) 9000 m (4) 990 m

Answer (4)

Sol. $P = P_0 + \rho gh$

$\Rightarrow 100 \times 10^5 = 10^5 + 10^3 \times 10 \times h$

$\Rightarrow 10^7 = 10^5 + 10^4 h$

$\Rightarrow 10^3 = 10 + h$

$\Rightarrow h = 1000 - 10 = 990$ m

40. Match List I with List II:

	List-I (Electromagnetic wave)		**List-II (Production)**
A.	Microwave	I.	Electrons in atoms emit light when they move from a higher energy level to a lower energy level
B.	Visible light	II.	Radioactive decay of nucleus
C.	Gamma rays	III.	Vibration of atoms and molecules
D.	Infra-red rays	IV.	Klystron valve or magnetron valve

Choose the **correct** answer from the options given below:

(1) A–III, B–I, C–II, D–IV

(2) A–III, B–IV, C–I, D–II

(3) A–IV, B–III, C–II, D–I

(4) A–IV, B–I, C–II, D–III

Answer (4)

Sol.

	List-I (Electromagnetic wave)	**List-II (Production)**
(A-IV)	Microwave	Klystron valve or magnetron valve
(B-I)	Visible light	Electrons in atoms emit light when they move from a higher energy level to a lower energy level
(C-II)	Gamma rays	Radioactive decay of nucleus
(D-III)	Infra-red rays	Vibration of atoms and molecules

41. Which of the following statements are correct?

A. Inside a conductor, the electrostatic field is zero.

B. Electric field at the surface of a charged conductor does not depend on its surface charge density.

C. The interior of a charged conductor can have no excess charge in the static situation.

D. At the surface of a charged conductor, the electrostatic field must be normal to the surface at every point.

E. The electrostatic potential is zero everywhere inside a charged conductor.

Choose the **correct** answer from the options given below:

(1) C, D and E only
(2) A, B and D only
(3) A, C and D only
(4) A, C and E only

Answer (3)

Sol.

A. Electrostatic field is zero inside a conductor.

B. Electric field at the surface of a charged conductor = $\frac{\sigma}{\varepsilon_0}\hat{n}$, depends on surface charge density (σ).

C. The interior of a charged conductor cannot have any excess charge in the static situation.

D. At the surface of a charged conductor, the electrostatic field $\perp$ surface.

E. The electrostatic potential is constant and can be non-zero everywhere inside a charged conductor.

42. For a metal of work function 6.6 eV, which of the following wavelengths of incident radiation does ***not*** give rise to the photoelectric effect?

(Take Planck's constant as 6.6×10^{-34} J s)

(1) 200 nm
(2) 150 nm
(3) 100 nm
(4) 50 nm

Answer (1)

Sol. For incident radiation having wavelength (λ), photoelectric effect doesn't occur when $\frac{hc}{\lambda}$ < work-function

$$\Rightarrow \lambda > \frac{hc}{W_0}$$

$$\Rightarrow \lambda > \frac{6.6\times10^{-34}\times3\times10^{8}}{6.6\times1.6\times10^{-19}}$$

$$\Rightarrow \lambda > \frac{3\times10^{-7}}{1.6}$$

$$\Rightarrow \lambda > \frac{300}{1.6}\text{nm}$$

$$\Rightarrow \lambda = 187.5 \text{ nm}$$

$\therefore$ Option (1) 200 nm is correct.

43. In the first excited state of hydrogen atom, the energy of its electron is –3.4 eV. The radial distance of the electron from the hydrogen nucleus in this case is approximately:

(Take 1 eV = 1.6×10^{-19} J, e = 1.6×10^{-19} C and $\frac{1}{4\pi\varepsilon_0} = 9\times10^{9}$ N m^2/C^2)

(1) 2.1×10^{-8} m
(2) 2.1×10^{-11} m
(3) 2.1×10^{-9} m
(4) 2.1×10^{-10} m

Answer (4)

Sol. $\frac{KQ^2}{2r} = 3.4 \text{ eV}$

$\frac{9\times10^9\times(1.6\times10^{-19})^2}{2\times3.4\times1.6\times10^{-19}} = r$

$2.1176\times10^{-10} = r$

$r = 2.1\times10^{-10}$ m

44. Two statements are given below:

A. When the forward bias voltage across a p-n junction diode increases above a certain threshold voltage, the diode current increases significantly.

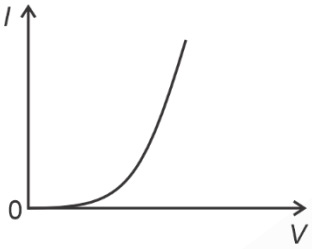
B. This current is called reverse saturation current.

Choose the **correct** answer from the options given below:

(1) Both Statements A and B are false
(2) Statement A is true, but Statement B is false
(3) Both Statements A and B are true
(4) Statement A is false, but Statement B is true

Answer (2)

Sol.



$V - I$ characteristics of a forward-biased junction diode

When forward bias voltage increases beyond threshold voltage, diode current increases significantly. This is not reverse saturation current.

45. A flask contains argon and chlorine in the ratio of 2 : 1 by mass. The temperature of the mixture is 27°C. The ratio of root mean square speed of the molecules of the two gases $\left(\frac{V_{rms}^{Ar}}{V_{rms}^{Cl}}\right)$ is:

(Atomic mass of argon = 40.0 u and molecular mass of chlorine = 70.0 u)

(1) $\frac{\sqrt{7}}{2}$
(2) $\frac{7}{2}$
(3) $\frac{7}{4}$
(4) $\frac{2}{\sqrt{7}}$

Answer (1)

Sol. $v_{rms} = \sqrt{\frac{3RT}{M}}$

For same temperature, $v_{rms} \propto \frac{1}{\sqrt{M}}$

$\frac{V_{rms}^{Ar}}{V_{rms}^{Cl}} = \sqrt{\frac{M_{Cl}}{M_{Ar}}} = \sqrt{\frac{70}{40}} = \frac{\sqrt{7}}{2}$