Physics: Section – A (Q. No 1 to 35)

1. Given below are two statements:
Statement I: Atoms are electrically neutral as they contain equal number of positive and negative charges.
Statement II: Atoms of each element are stable and emit their characteristic spectrum.
In the light of the above statements, choose the most appropriate answer from the options given below:
(1) Both statement I and statement II are correct.
(2) Bothe statement I and statement II are incorrect.
(3) Statement I is correct but statement II is incorrect.
(4) Statement I is incorrect but statement I is correct.

Ans: (1)

Both statement I and statement II are correct.

Statement II is in NCERT book. (Summary of Atom chapter)

2. If $x = 5\sin\left(\pi t + \frac{\pi}{3}\right)m$ represents the motion of a particle executing simple harmonic motion, the amplitude and time period of motion, respectively, are
(1) 5cm, 2s (2) 5m, 2s (3) 5cm , 1s (4) 5m, 1s

Ans: (2)

$x = A\sin(\omega t + \varphi_0)$

$x = 5\sin(\pi t + \varphi_0)$

$A = 5m$

$T = \frac{2\pi}{\omega} = \frac{2\pi}{\pi} = 2s$

= 5m, 2s

3. A bob is whirled in a horizontal plane by means of a string with an initial speed of ω rpm. The tension in the string is T. If speed becomes 2ω while keeping the same radius, the tension in the string becomes:
(1) T (2) 4T (3) $\frac{T}{4}$ (4) $\sqrt{2}T$

Ans: (2)

$T = m\omega^2 R$

$T \propto \omega^2$

$\frac{T^{|}}{T} = \left(\frac{\omega^{|}}{\omega}\right)^2 = \left(\frac{2\omega}{\omega}\right)^2 = 4$

$T^{|} = 4T$

4. In an ideal transformer, the turns ratio is $\frac{N_p}{N_S}=\frac{1}{2}$. The ratio $V_S : V_P$ is equal to (the symbols carry their usual meaning).

(1) 1 : 2 (2) 2 : 1 (3) 1: 1 (4) 1 : 4

Ans: (2)

$\frac{V_S}{V_P}=\frac{N_S}{N_P}=\frac{2}{1}$

5. A logic circuit provides the output Y as per the following truth table:

A	B	Y
0	0	1
0	1	0
1	0	1
1	1	0

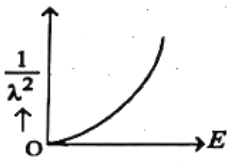
The expression for the output Y is:

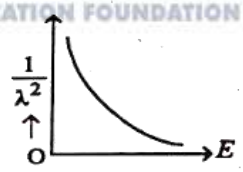
(1) $A.B+\overline{A}$ (2) $A.\overline{B}+\overline{A}$ (3) $\overline{B}$ (4) B

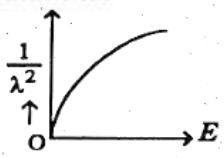
Ans: (3)

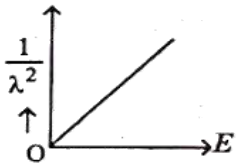
Y = $\bar{B}$

6. The graph which shows the variation of $\left(\frac{1}{\lambda^2}\right)$ and its kinetic energy, E is (where λ is de Broglie wavelength of a free particle)

(1) 

(2) 

(3) 

(4) 

Ans: (4)

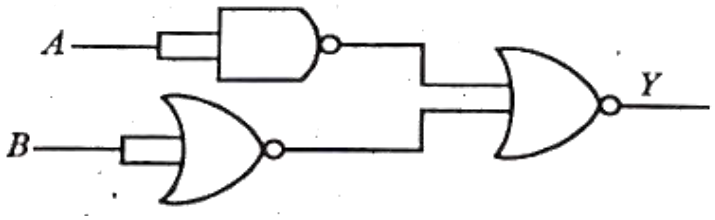
$K.E=\frac{1}{2}mv^2$

$K.E=\frac{p^2}{2m}$

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

$K.E\ \alpha\ \frac{1}{\lambda^2}$

7. The output (Y) of the given logic gate is similar to the output of an/a:

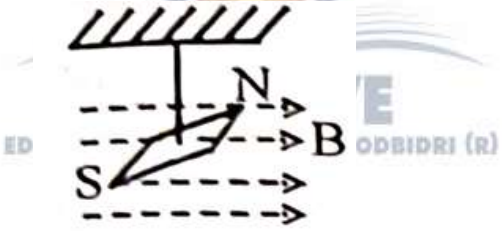


(1) NAND gate (2) NOR gate (3) OR gate (4) AND gate

Ans: (4)

$= \overline{(\bar{A} + \bar{A}) + (\bar{B} \cdot \bar{B})}$
$= \overline{(\bar{A} + \bar{A})} \cdot \overline{\bar{B} \cdot \bar{B}}$
$= (\bar{\bar{A}} \cdot \bar{\bar{A}}) \cdot (\bar{\bar{B}} + \bar{\bar{B}})$
$= (A \cdot A) \cdot (B + B)$
$= A \cdot B$

8. In a uniform magnetic field of 0.049 T, a magnetic needle performs 20 complete oscillations in 5 seconds as shown. The moment of inertia of the needle is 9.8×10^{-6} kg m^2. If the magnitude of magnetic moment of needle is x $\times 10^{-5}$ Am^2; then the value of 'x' is:



(1) 5 π^2 (2) 128 π^2 (3) 50 π^2 (4) 1280 π^2

Ans: (4)

$B = 0.049\ T$
$I = 9.8 \times 10^{-6}\ kg/m^2$

$T = 2\pi\sqrt{\frac{I}{MB}}$

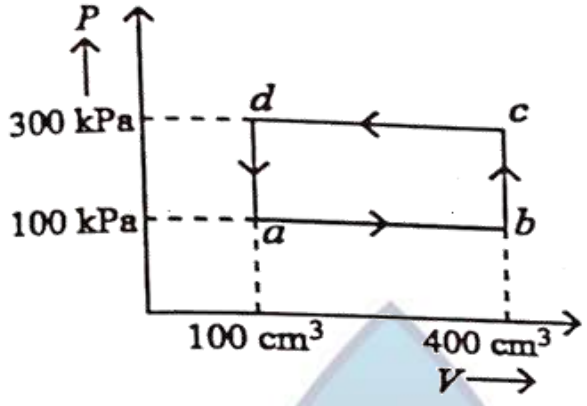
$T = \frac{5}{20} = \frac{1}{4}s$

$\frac{1}{4} = 2\pi\sqrt{\frac{9.8 \times 10^{-6}}{M \times 0.049}}$

$M = 1280\pi^2 \times 10^{-5}$

$x = 1280\pi^2$

9. A thermodynamics system is taken through the cycle abcda. The work done by the gas along the path bc is:

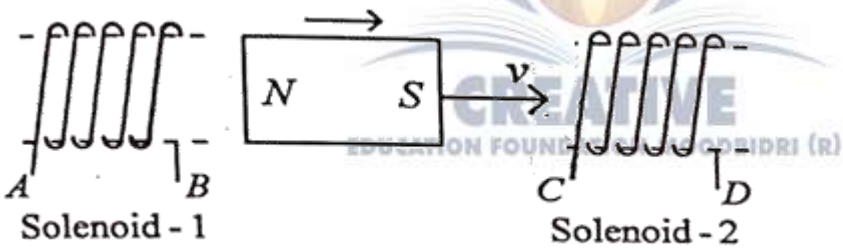


(1) Zero (2) 30 J (3) – 90 J (4) – 60 J

Ans: (1)

Work done = Zero (Isochoric process)

10. .



In the above diagram, a strong bar magnet is moving towards solenoid-2 from solenoid-1. The direction of induced current in solenoid-1 and that in solenoid-2, respectively are through the directions:

(1) AB and DC (2) BA and CD (3) AB and CD (4) BA and DC

Ans: (1)

AB and DC

11. An unpolarised light beam strikes a glass surface at Brewster's angle. Then
(1) The reflected light will partially polarised.
(2) The refracted light will be completely polarised.
(3) Both the reflected and refracted light will be completely polarised.
(4) The reflected light will be completely polarised but the refracted light will be partially polarised.

Ans: (4)

An unpolarized light beam is incident on a surface at an angle of incidence equal to Brewster's angle, then the reflected beam is polarized completely and the refracted beam polarized partially.

12. A wire of length 'l' and resistance 100 Ω is divided into 10 equal parts. The first 5 parts are connected in series while the next 5 parts are connected in parallel. The two combinations are again connected in series. The resistance of this final combination is:
(1) 26 Ω (2) 52 Ω (3) 55 Ω (4) 60 Ω

Ans: (2)

R = 100 Ω

Divided into 10 equal parts

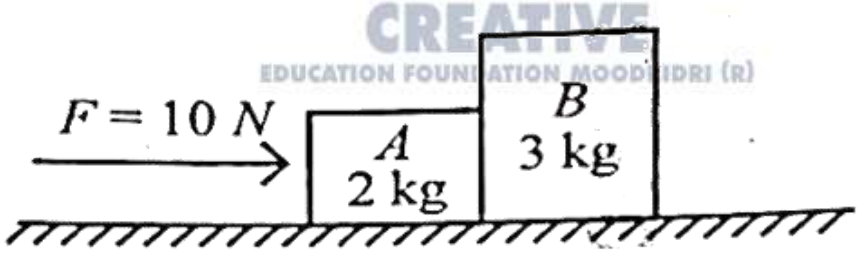
$R^1 = \frac{100}{10} = 10\Omega$

First 5 resistors are in series = 50 Ω.

Next 5 resistors are in parallel = 2 Ω

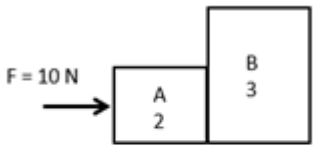
The resistance of final combination = 50 + 2 = 52 Ω

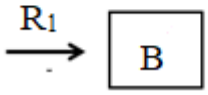
13. A horizontal force 10 N is applied to a block A as shown in figure. The mass of blocks A and B are 2 kg and 3kg, respectively. The blocks slide over a frictionless surface. The force exerted by block A on block B is:



(1) Zero (2) 4 N (3) 6 N (4) 10 N

Ans: (3)





$F_{net} = M_{total} \times a$

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

Normal reaction on 3 kg

$R_1 = M \times a = 3 \times 2 = 6\ N$

14. Two bodies A and B of sae mass undergo completely inelastic one dimensionless collision. The body A moves with velocity v_1 while body B is at rest before collision. The velocity of the system after collision is v_2. The ratio v_1: v_2 is:
(1) 1 : 2 (2) 2 : 1 (3) 4 : 1 (4) 1 : 4

Ans: (2)

According to conservation of linear momentum

$$mv_1 = 2mv_2$$

$$v_2 = \frac{v_1}{2}$$

$$\frac{v_1}{v_2} = 2$$

15. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R.
Assertion A: The potential (V) at any axial point, at 2 m distance (r) from the centre of the dipole of dipole moment vector $\vec{P}$ of magnitude, 4×10^{-6} C m, is $\pm 9 \times 10^3$V. (take $\frac{1}{4\pi \in_0} = 9 \times 10^9$ SI units)
Reason R: $V = \pm \frac{2P}{4\pi \in_0 r^2}$, where r is the distance of any axial point, situated at 2 m from the centre of the dipole,
In the light of the above statements, choose the correct answer from the options given below:
(1) Both A and R are rue and R is the correct explanation of A.
(2) Both A and R are true and R is not correct explanation of A.
(3) A is true but R is false.
(4) A is false but R is true.

Ans: (3)

Assertion is true

Reason is incorrect

16. Match list I with List II

List I (Spectral Lines of Hydrogen for transition from)	List II (Wavelengths (nm))
A. n_2 = 3 to n_1 = 2	I. 410.2
B. n_2 = 4 to n_1 = 2	II. 434.1
C. n_2 = 5 to n_1 = 2	III. 656.3
D. n_2 = 6 to n_1 = 2	IV. 486.1

Choose the correct answer from the options given below:

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

Ans: (2)

$\frac{1}{\lambda} = RZ^2\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right) \qquad R = 1.07 \times 10^7 m^{-1}$

for (A) $\frac{1}{\lambda} = 1.07 \times 10^7 \left(\frac{1}{4} - \frac{1}{9}\right) = 656.3nm$

For (B) $\frac{1}{\lambda} = 1.07 \times 10^7 \left(\frac{1}{4} - \frac{1}{16}\right) = 486.1nm$

For (C) $\frac{1}{\lambda} = 1.07 \times 10^7 \left(\frac{1}{4} - \frac{1}{25}\right) = 434.1nm$

For (D) $\frac{1}{\lambda} = 1.07 \times 10^7 \left(\frac{1}{4} - \frac{1}{36}\right) = 410.2nm$

17. In a vernier callipers, (N + 1) divisions of vernier scale coincide with N divisions of main scale. If 1 MSD represents 0.1 mm, the vernier constant (in cm) is:

(1) $\frac{1}{10N}$ (2) $\frac{1}{100(N+1)}$ (3) 100 N (4) 10 (N + 1)

Ans: (2)

$(N+1)VSD = N(MSD)$

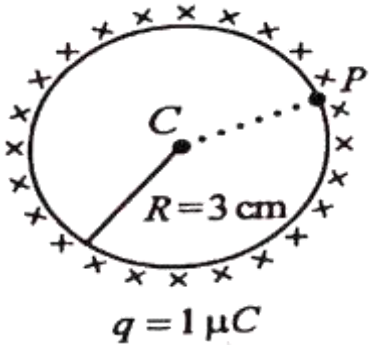
$VSD = \frac{N}{N+1}(MSD)$

$Vernier\ constant = 1\ MSD - 1\text{VSD}$

$(1 - \frac{N}{N+1})\ MSD = (\frac{1}{N+1})0.1mm = \frac{1}{100(N+1)}cm$

18. A thin spherical shell is charged by some source. The potential difference between the two points C and P (in V) shown in figure is:

(Take $\frac{1}{4\pi \in_0} = 9\times10^9\ SI$ units)

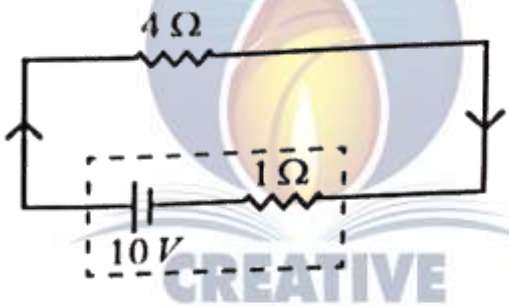


(1) 3×10^5 (2) 1×10^5 (3) 0.5×10^5 (4) Zero

Ans: (4)

potential at C and P is same for spherical shell so potential difference between C and P is Zero

19. The terminal voltage of the battery, whose emf is 10V and internal resistance $1\,\Omega$, when connected through an external resistance of $4\,\Omega$ as shown in the figure is:



(1) 4 V (2) 6 V (3) 8 V (4) 10 V

Ans: (3)

$V = \in - ir$

$i = \dfrac{\in}{r+R} = \dfrac{10}{5} = 2A$

$V = 10 - 2 \times 1 = 8V$

20. If c is the velocity of light in free space, the correct statements about photon among the following are:

A. The energy of a photon is E = hv.
B. The velocity of a photon is c.
C. The momentum of a photon , $p = \dfrac{hv}{c}$.
D. In a photon-electron collision, both total energy and total momentum are conserved.
E. Photon possesses positive charge.

Choose the correct answer from the options given below:

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

Ans: (2)

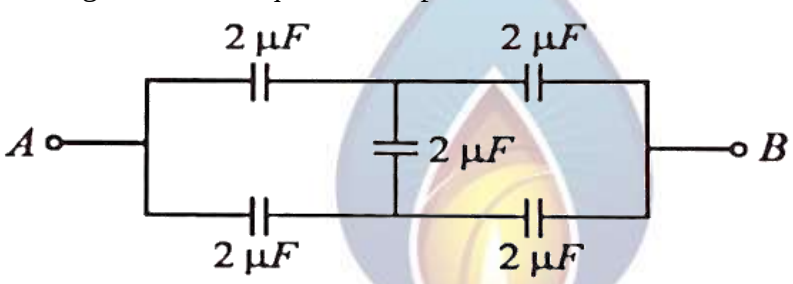
A,B,C and D only

21. A particle moving with uniform speed in a circular path maintains:
(1) Constant velocity.
(2) Constant acceleration.
(3) Constant velocity but varying acceleration.
(4) Varying velocity and varying acceleration.

Ans: (4)

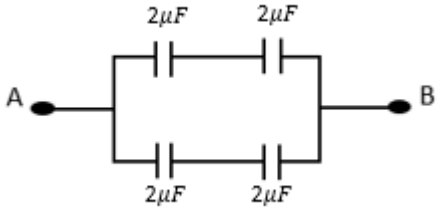
Varying velocity and varying acceleration

22. In the following circuit, the equivalent capacitance between terminal A and terminal B is:

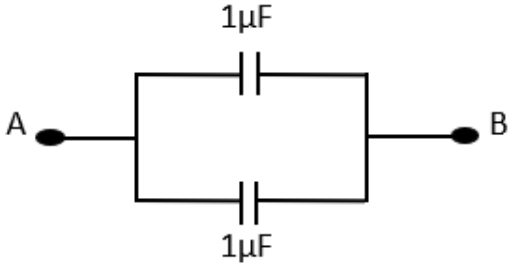


(1) 2 μF (2) 1 μF (3) 0.5 μF (4) 4 μF

Ans: (1)



It acts like Wheatstone bridge network
In series $\frac{1}{C_s} = \frac{1}{C_1} + \frac{1}{C_2} = \frac{1}{2} + \frac{1}{2} = 1\ \mu F$



In Parallel $C_P = C_1 + C_2 = 1 + 1 = 2\mu F$

23. A thin flat circular disc of radius 4.5 cm is placed gently over the surface of water. If surface tension of water is 0.07 Nm^{-1}, then the excess force required to take it away, from the surface is:
(1) 19.8 mN (2) 198 N (3) 1.98 mN (4) 99 N

Ans: (1)

R=4.5cm = $4.5\times 10^{-2}m$, $T = 0.07\ Nm^{-1}$.
$F = surface\ tension \times circumference\ of\ disc$
$= 0.07 \times 2\pi R = 0.07 \times 2 \times 3.14 \times 4.5 \times 10^{-2} = 19.8mN$

24. The maximum elongation of a steel wire of 1 m length if the elastic limit of steel and its Young's modulus, respectively, are 8×10^8 N m^{-2} and 2×10^{11} Nm^{-2}, is
(1) 4 mm (2) 0.4 mm (3) 40 mm (4) 8 mm

Ans: (1)

$l = 1m\ \Delta l = ?$
$Y = 8 \times 10^8\ Nm^{-2}$
$\Delta l = \frac{stress \times l}{Y}$
$= \frac{8 \times 10^8 \times 1}{2 \times 10^{11}} = 4mm$

25. $^{290}_{82}X \xrightarrow{\alpha} Y \xrightarrow{e^+} Z \xrightarrow{\beta^-} P \xrightarrow{e^-} Q$. In the nuclear emission stated above, the mass number and atomic number of the product Q respectively, are:
(1) 280, 81 (2) 286, 80 (3) 288, 82 (4) 286, 81

Ans: (4)

$^{290}_{82}X \xrightarrow{\alpha} Y^{286}_{80} \xrightarrow{e^+} Z^{286}_{80} \xrightarrow{\beta^-} P^{286}_{81} \xrightarrow{e^-} Q^{286}_{81}$

$\therefore 286, 81$

26. At any instant of time t, the displacement of any particle is given by 2t – 1 (SI unit) under the influence of force of 5N. The value of instantaneous power is(in SI unit):
(1) 10 (2) 5 (3) 7 (4) 6

Ans: (1)

s=2t-1

$\Rightarrow$v = $\frac{ds}{dt}$=2

F=5N
P = $\overrightarrow{F}.\vec{v}$
= 5(2)
= 10W

27. The quantities which have the same dimensions as those of solid angle are:
(1) Strain and angle (2) Strass and angle
(3) Strain and arc (4) Angular speed and stress

Ans: (1)

Strain and Angle

28. The moment of inertia of a thin rod about an axis passing through its mid point and perpendicular to the rod is 2400 g cm^2. The length of the 400 g rod is nearly:
(1) 8.5 cm (2) 17.5 cm (3) 20.7 cm (4) 72.0 cm

Ans: (1)

$I=\frac{Ml^2}{12}$

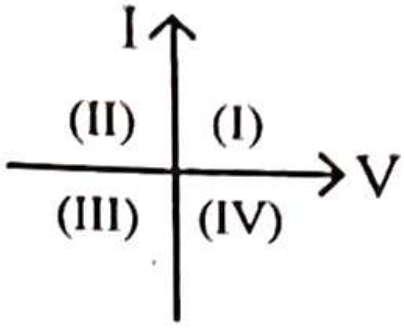
$2400\times10^{-3}\times10^{-4}=\frac{Ml^2}{12}$

$l^2=\frac{12\times2400\times10-7}{400\times10^{-3}}$

$=72\times10^{-4}$

$L = 8.5cm$

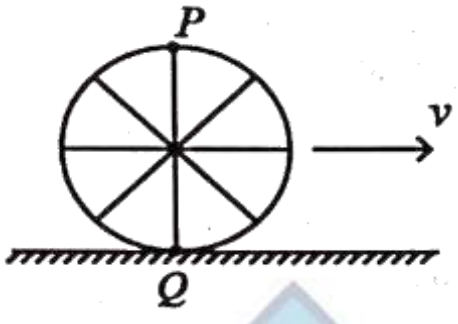
29. Consider the following statements A and B and identify the correct answer.



A. For a solar cell, the I-V characteristic lies in the IV quadrant of the given graph.
B. In a reverse biased pn junction diode, the current measured in (μA), is due to majority charge carriers.
(1) A is correct but B is incorrect.
(2) A is incorrect but B is correct.
(3) both A and B are correct
(4) both A and B are incorrect.

Ans: (1)

30. A wheel of a bullock cart is rolling on a level road as shown in the figure below. If its linear speed is v in the direction shown, which one of the following options is correct (P and Q are any highest and lowest points on the wheel, respectively)?



(1) Point P moves slower than point Q.
(2) Point P moves faster than point Q.
(3) Both the points P and Q move with equal speed.
(4) Point P has zero speed.

Ans: (2)

$v_P = 2v, v_Q = 0$

31. A tightly would 100 turns coil of radius 10 cm carriers a current of 7A. The magnitude of the magnetic field at the centre of the coil is (take permeability of free spaces as $4\pi \times 10^{-7}$ SI units):
(1) 44 mT (2) 4.4 T (3) 4.4 mT (4) 44 T

Ans: (3)

$B = \frac{n\mu_0 i}{2r} = \frac{100\times4\pi\times10^{-7}\times7}{2\times10\times10^{-2}}$ = 0.00439

B = 4.4 mT

32. If the monochromatic source in Young's double slit experiment is replaced by white light, then
(1) Interference pattern will disappear.
(2) There will be a central dark fringe surrounded by a few coloured fringes.
(3) There will be a central bright white fringe surrounded by a few coloured fringes.
(4) All bright fringes will be of equal width.

Ans: (3)

There will be central bright white fringes surrounded by a few colored fringes.

33. Match List – I with List – II

List – I (Material)	List – II (Susceptibility (χ))
A. Diamagnetic	I. $\chi = 0$
B. Ferromagnetic	II. $0 > \chi \geq -1$

C. Paramagnetic III. $\chi >> 1$

D. Non-magnetic IV. $0 < \chi < \epsilon$ (s small positive number)

Choose the correct answer from the options given below:

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

Ans: (1)

Diamagnetic → $0 > \chi > -1$

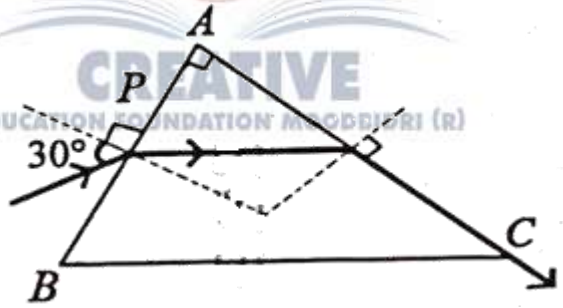
Ferromagnetic → $\chi >> 1$

Paramagnetic → $0 < \chi < \varepsilon$

Non-magnetic → $\chi = 0$

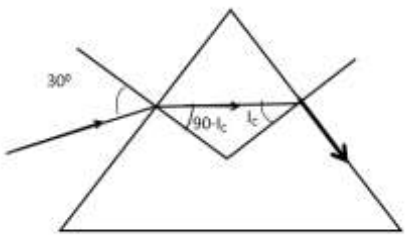
A – II, B – III, C – IV, D - I

34. A light ray enters through a right angled prism at point P with the angle of incidence 30^0 as shown in figure. It travels through the prism parallel to its base BC and emerges along the face AC. The refractive index of the prism is:



(1) $\frac{\sqrt{5}}{4}$ (2) $\frac{\sqrt{5}}{2}$ (3) $\frac{\sqrt{3}}{4}$ (4) $\frac{\sqrt{3}}{2}$

Ans: (2)



$n_1 \sin 30 = n\, a\sin(90 - I_c)$

(1) $\left(\frac{1}{2}\right) = n\,cos(I_C)$

$$\frac{1}{2} = n\sqrt{1-\frac{1}{n^2}}$$

$$\frac{1}{2} = \sqrt{n^2-1}$$

$$n^2 - 1 = \frac{1}{4}$$

$$n^2 = \frac{1}{4} + 1$$

$$n^2 = \frac{5}{4}$$

$$n = \frac{\sqrt{5}}{2}$$

35. The mass of a planet is $\frac{1}{10}^{th}$ that of the earth and its diameter is half that of the earth. The acceleration due to gravity on that planet is:
(1) 19.6 ms^{-2} (2) 9.8 ms^{-2} (3) 4.9 ms^{-2} (4) 3.92 ms^{-2}

Ans: (4)

$$M_p = \frac{M_E}{10}$$

$$dp = \frac{1}{2}dE \quad \Rightarrow R_P = \frac{1}{2}R_E$$

$$g_E = \frac{GM_E}{R_E^2} \quad ---(1)$$

$$g_p = \frac{GM_p}{R_p^2} = \frac{G\left(\frac{M_E}{10}\right)}{\left(\frac{R_E}{2}\right)^2} = \frac{4}{10}\left(\frac{GM_E}{R_E^2}\right) = 3.92 \text{ m/s}^2$$

Physics: Section-B (Q. No. 36 to 50)

36. The minimum energy required to launch a satellite of mass m from the surface of earth of mass M and radius R in a circular orbit at an altitude of 2R from the surface of the earth is:
(1) $\frac{5GmM}{6R}$ (2) $\frac{2GmM}{3R}$ (3) $\frac{GmM}{2R}$ (4) $\frac{GmM}{3R}$

Ans: (1)

Energy required = $E_f - E_i$

$= \frac{-GMm}{2(R+h)} - (\frac{-GMm}{R})$

$= \frac{5GMm}{6R}$

37. A metallic bar of Young's modulus, $0.5\times10^{11}\,Nm^{-2}$ and coefficient of linear thermal expansion $10^{-5}\,°C^{-1}$, length 1 m and area of cross-section $10^{-3}m^2$ is heated from $0°C$ to $100°C$ without expansion or bending. The compressive force developed in it is:

(1) $5\times10^3\,N$ (2) $50\times10^3\,N$ (3) $100\times10^3\,N$ (4) $2\times10^3\,N$

Ans: (2)

Thermal stress $\left(\frac{F}{A}\right) = Y\alpha\Delta\theta$

$F = YA\alpha\Delta\theta$

$= (0.5\times10^{11})(10^{-3})(10^{-5})(100) = 0.5\times10^5$

$F = 50\times10^3$N

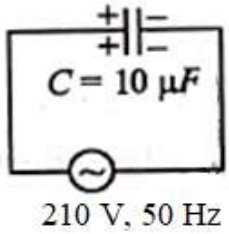
38. A small telescope has an objective of focal length 140 cm and an eye piece of focal length 5.0 cm. the magnifying power of telescope for viewing a distant object is:

(1) 34 (2) 28 (3)17 (4) 32

Ans: (2)

Magnifying power = $\frac{f_0}{f_e} = \frac{140}{5} = 28$

39. A $10\mu F$ capacitor is connected to a 210 V, 50 Hz source as shown in figure. The peak current in the circuit is nearly $(\pi = 3.14)$:



(1) 0.58 A (2) 0.93 A (3) 1.20A (4) 0.35A

Ans: (2)

$V_{rms} = 210$

$V_0 = 210\sqrt{2}\ volts$

$i_0 = \frac{V_0}{X_C} = V_0\omega C$

$= (210\sqrt{2})(2\pi)(50)(10 \times 10^{-6})$

$= 0.93A$

40. If the mass of the bob in a simple pendulum is increased to thrice its original mass and its length is made half its original length, then the new time period of oscillation is $\frac{x}{2}$ times its original time period. Then the value of x is:

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

Ans: (2)

$T_0 = 2\pi\sqrt{\frac{l}{g}}$

$T_1 = 2\pi\sqrt{\frac{l}{2g}}$

$= \frac{T_0}{\sqrt{2}}$

$T_1 = \left(\frac{\sqrt{2}}{2}\right)T_0$

$\therefore X = \sqrt{2}$

41. The property which is not of an electromagnetic wave travelling in free space is that:

(1) They are transverse in nature

(2) The energy density in electric field is equal to energy density in magnetic field.

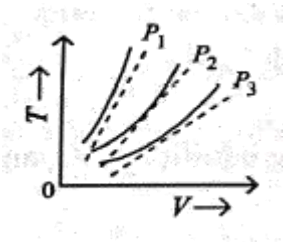
(3) They travel with a speed equal to $\frac{1}{\sqrt{\mu_0 \in_0}}$.

(4) They originate from charges moving with uniform speed.

Ans: (4)

EM Waves are produced by accelerating charges.

42. The following graph represents the T-V curves of an ideal gas (where T is the temperature and V the volume) at three pressures P_1, P_2 and P_3 compared with those of Charles's law represented as dotted lines.



Then the correct relation is:

(1) $P_3 > P_2 > P_1$ (2) $P_1 > P_3 > P_2$ (3) $P_2 > P_1 > P_3$ (4) $P_1 > P_2 > P_3$

Ans: (4)

Charles Law

$T \propto V$

$\theta_1 < \theta_2 < \theta_3$

$\tan\theta_1 < \tan\theta_2 < \tan\theta_3$

$P_1 > P_2 > P_3$

43. A force defined by $F = \alpha t^2 + \beta t$ acts on a particle at a given time t. the factor which is dimensionless, if α and β are constants, is:

(1) $\beta t/\alpha$ (2) $\alpha t/\beta$ (3) $\alpha\beta t$ (4) $\alpha\beta/t$

Ans: (2)

$F = \alpha t^2 + \beta t$

$[M^1L^1T^{-2}] = [\alpha]\,[T^2]$

$[\alpha] = \frac{M^1L^1T^{-3}}{T^2}$

$[\alpha] = M^1L^1T^{-4}$

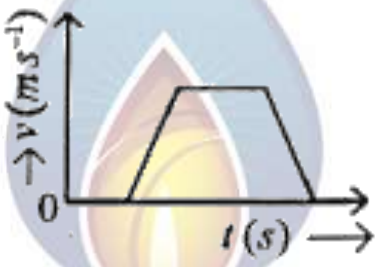
Similarly,

$[\beta] = M^1L^1T^{-3}$

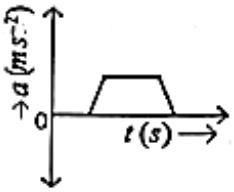
By option checking,

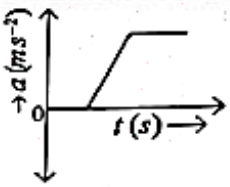
$\frac{\alpha t}{\beta}$ is dimensionless

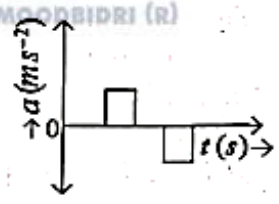
44. The velocity (v) – time (t) plot of the motion of a body is shown below:

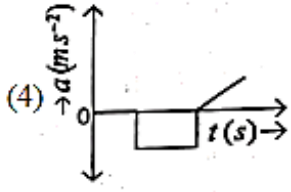


The acceleration (a) – time (t) graph that best suits this motion is :

(1) 

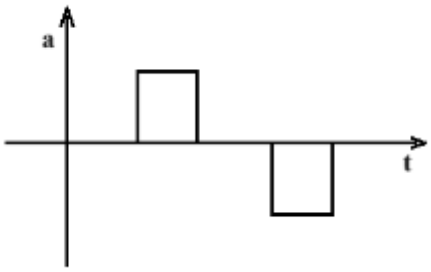
(2) 

(3) 

(4) 

Ans: (3)

Slope of v – t graph gives acceleration.



45. Two heaters A and B have power rating of 1 kW and 2 kW, respectively. Those two are first connected in series and then in parallel to a fixed power source. The ratio of power outputs for these two cases is:

(1) 1: 1 (2) 2:9 (3) 1:2 (4) 2:3

Ans: (2)

For Series combination,

$\frac{1}{P_{eq}} = \frac{1}{P_1} + \frac{1}{P_2}$

$\frac{1}{P_{eq}} = \frac{1}{1} + \frac{1}{2}$

$\frac{1}{P_{eq}} = \frac{2+1}{2}$

$(P_{eq})_s = \frac{2}{3}$ kW

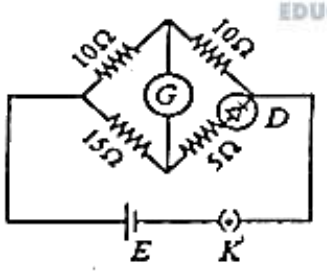
For Parallel combination,

$P_{eq} = P_1 + P_2 = 1 + 2 = 3$ kW

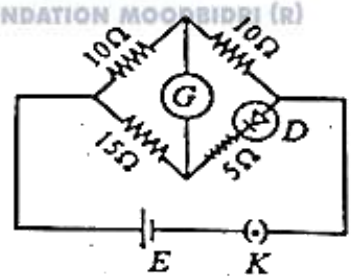
$\frac{(P_{eq})_s}{(P_{eq})_p} = \frac{2}{3} \times \frac{1}{3} = \frac{2}{9}$

46. Choose the correct circuit which can achieve the bridge balance

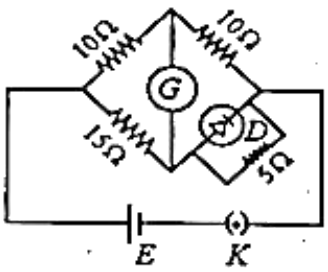
(1)



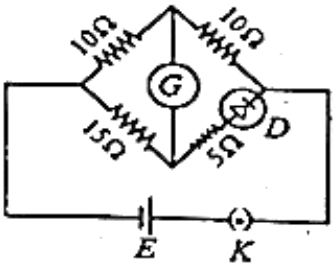
(2)



(3)



(4)



Ans: (1)

Only first circuit can achieve balance. Since diode is forward biased and the current passes through four resistors.

47. A sheet is placed on horizontal surface in front of a strong magnetic pole. A force is needed to:
A. Hold the sheet there if it is magnetic.
B. Hold the sheet there if it is non-magnetic.
C. Move the sheet away from the pole with uniform velocity if it is conducting.
D. Move the sheet away from the pole with uniform velocity if it is both, non-conducting and non-polar.
Choose the correct statement(s) from the options given below:
(1) B and D only (2) A and C only (3) A, C and D only (4) C only

Ans: (2)

Force is required to oppose the attraction between magnetic sheet and magnet. Force is also required if it is conducting and moved due to eddy currents.

48. If the plates of a parallel plate capacitor connected to a battery are moved close to each other, then
A. The charge stored in it, increases.
B. The energy stored in it, decreases.
C. Its capacitance increases.
D. The ratio of charge to its potential remains the same.
E. The product of charge and voltage increases.
Choose the most appropriate answer from the options given below:
(1) A, B and E only (2) A, C and E only
(3) B, D and E only (4) A, B and C only

Ans: (2)

$C = \frac{\varepsilon_0 A}{d}$

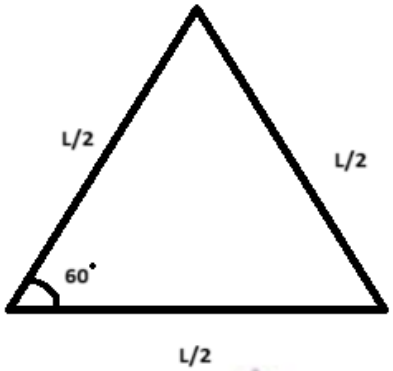
When `d' decreases, `C' increases, `Q' increases, energy increases but potential remains constant.

49. An iron bar of length L has magnetic moment M. it is bent at the middle of its length such that the two arms make an angle 60° with each other. The magnetic moment of this new magnet is :
(1) M (2) $\frac{M}{2}$ (3) 2 M (4) $\frac{M}{\sqrt{3}}$

Ans: (2)

$M = q_m \times L$

$M' = q_m \times \frac{L}{2} = \frac{M}{2}$



50. A parallel plate capacitor is charged by connecting it to a battery through a resistor. If I is the current in the circuit, then in the gap between the plates:
(1) There is no current.
(2) Displacement current of magnitude equal to I flows in the same direction as I.
(3) Displacement current of magnitude equal to I flows in a direction opposite to that of I.
(4) Displacement current of magnitude greater than I flows but can be in any direction.

Ans: (2)

Applying junction rule at the left plate of the capacitor.

$$I_1 = I_2$$

$$I_c = I_d$$

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