FINAL NEET(UG)–2022 EXAMINATION

(Held On Sunday 17th JULY, 2022)

PHYSICS

TEST PAPER WITH ANSWER & SOLUTIONS

SECTION-A

1. Two hollow conducting spheres of radii R_1 and R_2 ($R_1 >> R_2$) have equal charges. The potential would be :

(1) more on smaller sphere

(2) equal on both the spheres

(3) dependent on the material property of the sphere

(4) more on bigger sphere

Ans. (1)

Sol. $V = \frac{1}{4\pi \in_0} \cdot \frac{Q}{R}$

$\frac{1}{4\pi \in_0} = \text{constant}$

$Q = \text{same (Given)}$

$\therefore V \propto \frac{1}{R}$

$\therefore$ Potential is more on smaller sphere.

2. The angular speed on a fly wheel moving with uniform angular acceleration changes from 1200 rpm to 3120 rpm in 16 seconds. The angular acceleration in rad/s^2 is :

(1) 4π

(2) 12π

(3) 104π

(4) 2π

Ans. (1)

Sol. $\omega = \omega_0 + \alpha t$

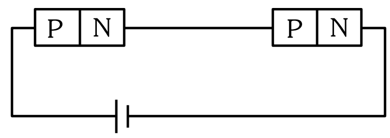
$\alpha = \frac{\omega - \omega_0}{t}$

$= \frac{(3120 - 1200)}{16\,s}\text{rpm}$

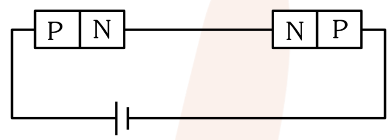
$= \frac{1920}{16} \times \frac{2\pi}{60} \text{rad/s}^2$

$= 4\pi \text{ rad/s}^2$

3.



(a)



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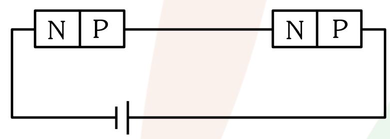


(c)

In the given circuits (a), (b) and (c), the potential drop across the two p-n junctions are equal in :

(1) Circuit (b) only

(2) Circuit (c) only

(3) Both circuits (a) and (c)

(4) Circuit (a) only

Ans. (3)

Sol. In (a) & (c) circuits, both the junctions are in same biasing conditions so offers equal resistances.
Since both are in series, therefore equal potential will drop across the junction.

4. Two objects of mass 10 kg and 20 kg respectively are connected to the two ends of a rigid rod of length 10 m with negligible mass. The distance of the center of mass of the system from the 10 kg mass is :

(1) $\frac{20}{3}$m

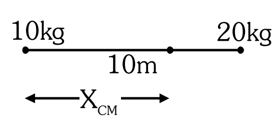
(2) 10 m

(3) 5 m

(4) $\frac{10}{3}$m

Ans. (1)

Sol.



$X_{CM} = \frac{20 \times 10}{20 + 10} = \frac{20}{3}$m

5. A biconvex lens has radii of curvature, 20 cm each. if the refractive index of the material of the lens is 1.5, the power of the lens is :-

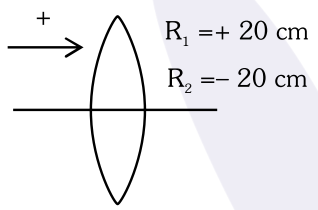
(1) +20 D (2) +5D
(3) infinity (4) +2D

Ans. (2)

Sol. $R_1 = R_2 = 20\text{ cm} = 0.2\text{ m}$

$$\mu = \frac{3}{2}$$

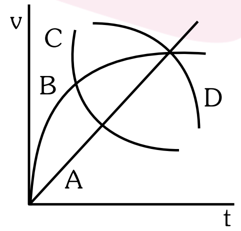
$$P = \frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$



$$P = \left(\frac{3}{2} - 1\right)\left(\frac{1}{0.2} + \frac{1}{0.2}\right)$$

$$P = \frac{1}{2}\left(\frac{2}{0.2}\right) = \frac{10}{2} = +5D$$

6. A spherical ball is dropped in a long column of a highly viscous liquid. The curve in the graph shown, which represents the speed of the ball (v) as a function of time (t) is :



(1) B (2) C
(3) D (4) A

Ans. (1)

Sol. Initially speed is zero, then increases & after some time it becomes constant.

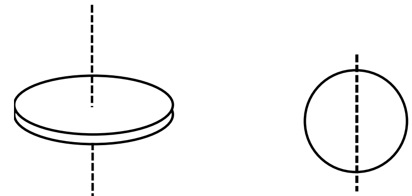
Acceleration (slope of v/t curve) of ball first decreases and after some time it becomes zero.

7. The ratio of the radius of gyration of a thin uniform disc about an axis passing through its centre and normal to its plane to the radius of gyration of the dis about its diameter is :

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

Ans. (1)

Sol.



$$I_1 = \frac{mR^2}{2} \qquad I_2 = \frac{mR^2}{4}$$

$$k = \sqrt{\frac{I}{m}}$$

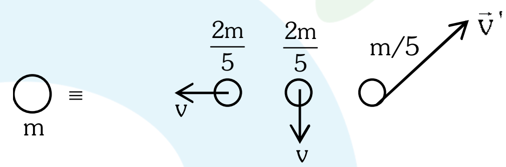
$$\Rightarrow \frac{k_1}{k_2} = \sqrt{\frac{I_1}{I_2}} = \sqrt{\frac{mR^2/2}{mR^2/4}} = \sqrt{2}:1$$

8. A shell of mass m is at rest initially. It explodes into three fragments having mass in the ratio 2 : 2 : 1. If the fragments having equal mass fly off along mutually perpendicular directions with speed v, the speed of the third (lighter) fragment is

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

Ans. (2)

Sol.



By conservation of momentum :

$$m(0) = \frac{2m}{5}(-v\hat{i}) + \frac{2m}{5}(-v\hat{j}) + \frac{m}{5}\vec{v}\,'$$

$$\Rightarrow \vec{v}\,' = 2v\hat{i} + 2v\hat{j}$$

$$\Rightarrow v' = \sqrt{(2v)^2 + (2v)^2}$$

$$= 2\sqrt{2}\ v$$

9. A long solenoid of radius 1 mm has 100 turns per mm. If 1A current flows in the solenoid, the magnetic field strength at the centre of the solenoid is

(1) 12.56×10^{-2} T
(2) 12.56×10^{-4} T
(3) 6.28×10^{-4} T
(4) 6.28×10^{-2} T

Ans. (1)

Sol. $B = \mu_0 ni = \mu_0 \frac{N}{\ell} i$

$$\therefore B = 4\pi \times 10^{-7} \times \frac{100}{10^{-3}} \times 1 = 12.56 \times 10^{-2}\ T$$

10. Let T_1 and T_2 be the energy of an electron in the first and second excited states of hydrogen atom, respectively. According to the Bohr's model of an atom, the ratio $T_1 : T_2$ is :

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

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

Ans. (3)

Sol. First excited state ⇒ n = 2

$$T_1 = -13.6\frac{z^2}{n^2} = -\frac{13.6}{4}\text{eV}$$

Second excited state ⇒ n = 3

$$T_2 = -13.6\frac{z^2}{n^2} = -\frac{13.6}{9}\text{eV}$$

$$T_1 : T_2 = \frac{1}{4} : \frac{1}{9} = 9 : 4$$

11. A light ray falls on a glass surface of refractive index $\sqrt{3}$, at an angle 60°. The angle between the refracted and reflected rays would be :

(1) 60°

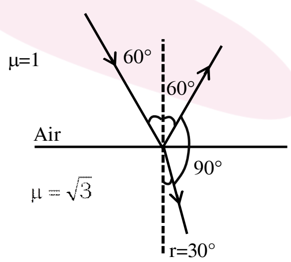
(2) 90°

(3) 120°

(4) 30°

Ans. (2)

Sol.



Method (i)

By Snell's law

$$1\sin 60° = \sqrt{3}\sin r$$

$$\frac{\sqrt{3}}{2} = \sqrt{3}\sin r$$

$$\sin r = \frac{1}{2}$$

r = 30°

Angle between refracted and reflected ray is 90°

Method (ii)

Because angle of incidence is Brewster's angle so that angle between reflected and refracted ray is 90°

$$\tan i_p = \mu = \sqrt{3}$$

$$\boxed{i_p = 60° = i}$$

12. If a soap bubble expands, the pressure inside the bubble :

(1) increases

(2) remains the same

(3) is equal to the atmospheric pressure

(4) decreases

Ans. (4)

Sol. $P = P_0 + \frac{4T}{R}$

⇒ R increases and P decreases

13. Plane angle and solid angle have :

(1) Dimensions but no units

(2) No units and no dimensions

(3) Both units and dimensions

(4) Units but no dimensions

Ans. (4)

Sol. Plane angle and solid angle are dimensionless but have units.

14. When light propagates through a material medium of relative permittivity ϵ_r and relative permeability μ_r, the velocity of light, v is given by : (c-velocity of light in vacuum)

(1) $v = \sqrt{\frac{\mu_r}{\epsilon_r}}$ (2) $v = \sqrt{\frac{\epsilon_r}{\mu_r}}$

(3) $v = \frac{c}{\sqrt{\epsilon_r \mu_r}}$ (4) v = c

Ans. (3)

Sol. $n = \sqrt{\epsilon_r u_r}$

$$n = \frac{c}{v} \Rightarrow v = \frac{c}{n}$$

$$v = \left(\frac{c}{\sqrt{\epsilon_r \mu_r}}\right)$$

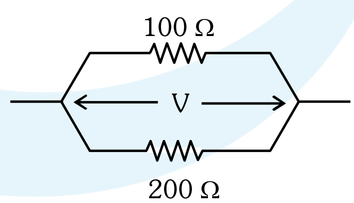
15. Two resistors of resistance, 100 Ω and 200 Ω are connected in parallel in an electrical circuit. The ratio of the thermal energy developed in 100 Ω to that in 200 Ω in a given time is :

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

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

Ans. (1)

Sol.



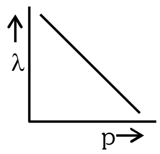
As both resistors are in parallel combination so potential drop (V) across both are same.

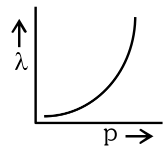
$$P = \frac{V^2}{R} \Rightarrow P \propto \frac{1}{R}$$

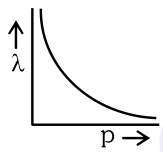
$$\frac{P_1}{P_2} = \frac{R_2}{R_1} = \frac{200}{100} = \frac{2}{1}$$

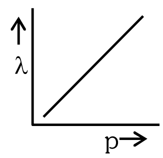
= 2 : 1

16. The graph which shows the variation of the de Broglie wavelength (λ) of a particle and its associated momentum (p) is :

(1) 

(2) 

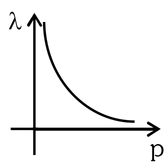
(3) 

(4) 

Ans. **(3)**

Sol. $\lambda = \frac{h}{p}$

Graph will be hyperbolic

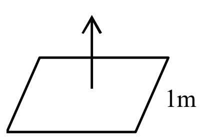


17. A square loop of side 1 m and resistance 1 Ω is placed in a magnetic field of 0.5 T. If the plane of loop is perpendicular to the direction of magnetic field, the magnetic flux through the loop is :

(1) 0.5 weber
(2) 1 weber
(3) Zero weber
(4) 2 weber

Ans. **(1)**

Sol. B= 0.5 T



Angle between $\vec{B}$ & $\vec{A}$ is zero

ϕ = B.A. cos 0

= 0.5 $\times$(1) $\times$ 1

= 0.5 Wb

18. The dimensions $[MLT^{-2}A^{-2}]$ belong to the :

(1) self inductance
(2) magnetic permeability
(3) electric permittivity
(4) magnetic flux

Ans. **(2)**

Sol. $[MLT^{-2}A^{-2}]$ = Magnetic permeability

19. When two monochromatic lights of frequency, υ and $\frac{\upsilon}{2}$ are incident on a photoelectric metal, their stopping potential becomes $\frac{V_s}{2}$ and V_s respectively. The threshold frequency for this metal is:

(1) 3υ (2) $\frac{2}{3}\upsilon$

(3) $\frac{3}{2}\upsilon$ (4) 2υ

Ans. **Bonus**

Sol. Using the equation

$eV = h\upsilon - \phi$

or $eV = h\upsilon - h\upsilon_{Th}$

$\frac{eV_s}{2} = \frac{h\upsilon}{2} - h\upsilon_{Th}$ ...(1)

$eV_s = h\upsilon - h\upsilon_{Th}$ ...(2)

Data Incorrect

20. In half wave rectification, if the input frequency is 60 Hz, then the output frequency would be :

(1) 30 Hz (2) 60 Hz
(3) 120 Hz (4) Zero

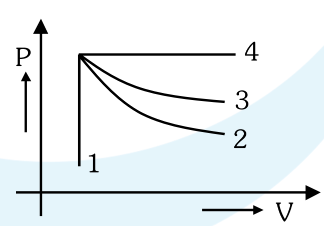
Ans. **(2)**

Sol. In half wave rectification

$f_{in} = f_{out}$

$\Rightarrow f_{out} = 60$ Hz

21. An ideal gas undergoes four different processes from the same initial state as shown in the figure below . Those processes are adiabatic, isothermal, isobaric and isochoric. The curve which represents the adiabatic process among 1,2,3 and 4 is :



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

Ans. **(1)**

Sol. 1 : Isochoric

2 : Adiabatic

3 : Isothermal

4 : Isobaric

22. Match List – I with List –II

	List –I (Electromagnetic waves)		List-II (Wavelength)
(a)	AM radio waves	(i)	10^{-10} m
(b)	Microwaves	(ii)	10^{2} m
(c)	Infrared radiations	(iii)	10^{-2} m
(d)	X-rays	(iv)	10^{-4} m

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

(1) (a) – (iii), (b) – (ii), (c) – (i), (d) – (iv)
(2) (a) – (iii), (b) – (iv), (c) – (ii), (d) – (i)
(3) (a) – (ii), (b) – (iii), (c) – (iv), (d) – (i)
(4) (a) – (iv), (b) – (iii), (c) – (ii), (d) – (i)

Ans. (3)

Sol. (a) Radio wave (ii) $\approx 10^{2}$ m (ii)

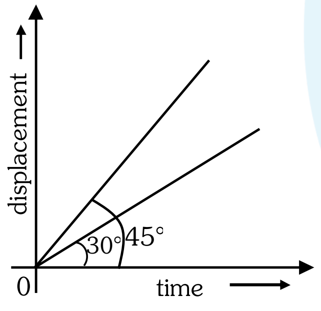
(b) Microwave $\approx$ (iii) 10^{-2} m (iii)

(c) Infrared radiations $\approx$ (iv)10^{-4} m (iv)

(d) X- ray (i) $\approx$ Å = 10^{-10} m (i)

(a) – (ii), (b) – (iii), (c) – (iv), (d) – (i)

23. The displacement-time graphs of two moving particles make angles of 30° and 45° with the x-axis as shown in the figure. The ratio of their respective velocity is :



(1) 1 : 1　　(2) 1 : 2

(3) 1 : $\sqrt{3}$　　(4) $\sqrt{3}$: 1

Ans. (3)

Sol. Velocity is slope of x–t graph

$$V = \frac{dx}{dt} = \tan\theta$$

$$\frac{V_1}{V_2} = \frac{\tan\theta_1}{\tan\theta_2} = \frac{\tan 30^\circ}{\tan 45^\circ} = \frac{1}{\sqrt{3}}$$

24. In a Young's double slit experiment, a student observes 8 fringes in a certain segment of screen when a monochromatic light of 600 nm wavelength is used. If the wavelength of light is changed to 400 nm, then the number of fringes he would observe in the same region of the screen is :

(1) 8　　(2) 9

(3) 12　　(4) 6

Ans. (3)

Sol. $y = (n\lambda)\left(\frac{D}{d}\right)$

$n_1\lambda_1 = n_2\lambda_2$

(8) (600 nm) = n_2(400)

$n_2 = 12$

25. The peak voltage of the ac source is equal to:

(1) the rms value of the ac source
(2) $\sqrt{2}$ times the rms value of the ac source
(3) $1/\sqrt{2}$ time the rms value of the ac source
(4) the value of voltage supplied to the circuit.

Ans. (2)

Sol. Peak voltage is $\sqrt{2}$ times rms voltages in ac.

26. If the initial tension on a stretched string is doubled, then the ratio of the initial and final speeds of a transverse wave along the string is:

(1) $\sqrt{2} : 1$　　(2) $1 : \sqrt{2}$

(3) 1:2　　(4) 1:1

Ans. (2)

Sol. $v \propto \sqrt{\text{Tension}}$

$$\frac{v_i}{v_f} = \sqrt{\frac{T_i}{T_f}}$$

$$\frac{v_i}{v_f} = \sqrt{\frac{T}{2T}}$$

$$\frac{v_i}{v_f} = \sqrt{\frac{1}{2}} = \frac{1}{\sqrt{2}}$$

27. Given blow are two statements:

Statement I :

Biot-Savart's law gives us the expression for the magnetic field strength of an infinitesimal current element(Idl) of a current carrying conductor only.

Statement II :

Biot-Savart's law is analogous to Coulomb's inverse square law of change q, with the former being related to the field produced by a scalar source, Idl while the latter being produced by a vector source, q.

In light of above statement choose the most **appropriate** answer from the options given below:

(1) Both statement I and Statement II are incorrect

(2) Statement I is correct and Statement II is incorrect

(3) Statement I is incorrect and Statement II is correct

(4) Both statement I and Statement II are correct

Ans. (2)

Sol. $d\vec{B} = \dfrac{\mu_0\left(Id\vec{\ell}\times\vec{r}\right)}{4\pi r^3}$

As per Biot Savart law, the expression for magnetic field depends on current carrying element $Id\vec{\ell}$, which is a vector quantity, therefore, statement-I is correct and statement-II is wrong.

28. As the temperature increase, the electrical resistance :

(1) decreases for both conductors and semiconductors

(2) increases for conductors but decreases for semiconductors

(3) decreases for conductors but increase for semiconductors

(4) increases for both conductors and semiconductors.

Ans. (2)

Sol. For conductors α is (+)ve

For semiconductors & Insulators α is (–)ve

29. The energy that will be ideally radiated by a 100 kW transmitter in 1 hour is :

(1) 36×10^4 J

(2) 36×10^5 J

(3) 1×10^5 J

(4) 36×10^7 J

Ans. (4)

Sol. $E = P \times t = 100 \times 10^3 \times 3600$

$= 36 \times 10^7$ J

30. A body of mass 60 g experiences a gravitational force of 3.0 N, when placed at a particular point. The magnitude of the gravitational field intensity at that point is:

(1) 50 N/kg (2) 20 N/kg

(3) 180 N/kg (4) 0.05 N/kg

Ans. (1)

Sol. $I_g = \dfrac{F}{m}$

$= \dfrac{3}{60\times10^{-3}} = 50$ N/kg

31. In the given nuclear reaction, the element X is:

${}^{22}_{11}Na \to X + e^+ + \nu$

(1) ${}^{23}_{10}Ne$ (2) ${}^{22}_{10}Ne$

(3) ${}^{22}_{12}Mg$ (4) ${}^{23}_{11}Na$

Ans. (2)

Sol. ${}^{22}_{11}Na \longrightarrow X + e^+ + \nu$

This is β^+ – decay

${}^{22}_{11}Na \longrightarrow {}^{22}_{10}Ne + e^+ + \nu$

32. The angle between the electric lines of force and the equipotential surface is:

(1) 45° (2) 90°

(3) 180° (4) 0°

Ans. (2)

Sol. Electric field is always perpendicular to EPS.

33. A copper wire of length 10 m and radius $\left(10^{-2}/\pi\right)$m has electrical resistance of 10 Ω. The current density in the wire for an electric field strength of 10 (V/m) is:

(1) 10^6 A/m^2 (2) 10^{-5} A/m^2

(3) 10^5 A/m^2 (4) 10^4 A/m^2

Ans. (3)

Sol. Radius of wire $= \dfrac{10^{-2}}{\sqrt{\pi}}$

Cross sectional area $A = \pi r^2 = 10^{-4}$ m^2

$j = \dfrac{i}{A} = \left(\dfrac{V}{R}\right).\dfrac{1}{A} = \dfrac{E\ell}{RA}$ $R = \dfrac{\rho\ell}{A}$

$j = \dfrac{10\times10}{10\times10^{-4}} = 10^5 A/m^2$

or

$J = \sigma E \Rightarrow \dfrac{E}{\rho} = \dfrac{E\ell}{RA} = \dfrac{10\times10\times\pi}{10\times10^{-4}\times\pi}$

$\Rightarrow 10^5$ A/m^2

34. The ratio of the distances travelled by a freely falling body in the 1st, 2nd, 3rd and 4th second :

(1) 1 : 4 : 9 : 16 (2) 1 : 3 : 5 : 7

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

Ans. **(2)**

Sol. $S_{nth} = u + \frac{a}{2}(2n-1)$

$= 0 + \frac{a}{2}(2n-1)$

$S_{nth} \propto (2n-1)$

$\Rightarrow S_{1st}, S_{2nd}, S_{3rd}, S_{4th}$

= [2(1) – 1] : [2(2) – 1] : [2(3) – 1] : [2(4) – 1]

= 1 : 3 : 5 : 7

35. An electric lift with a maximum load of 2000 kg (lift + passengers) is moving up with a constant speed of 1.5 ms^{-1}. The frictional force opposing the motion is 3000 N. The minimum power delivered by the motor to the lift in watts is: (g = 10 ms^{-2})

(1) 20000 (2) 34500

(3) 23500 (4) 23000

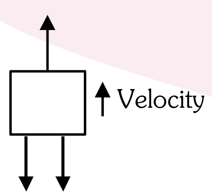
Ans. **(2)**

Sol. Constant velocity $\Rightarrow$ a = 0

$\Rightarrow$ T = W + f

= 20000 + 3000

= 23000 N



$\Rightarrow$ Power = Tv

= 23000 × 1.5

= 34500 watts

SECTION-B

36. The volume occupied by the molecules contained in 4.5 kg water at STP, if the intermolecular forces vanish away is:

(1) $5.6 \times 10^3\ m^3$

(2) $5.6 \times 10^{-3}\ m^3$

(3) $5.6\ m^3$

(4) $5.6 \times 10^6\ m^3$

Ans. **(3)**

Sol. V = (no. of moles) (22.4 litre)

$= \frac{\text{mass}}{\text{molar mass}}(22.4 \times 10^{-3} m^3)$

$= \frac{4.5 \times 10^3}{18} \times 22.4 \times 10^{-3} m^3$

= $5.6\ m^3$

37. The area of a rectangular field (in m^2) of length 55.3 m and breadth 25 m after rounding off the value for correct significant digits is :

(1) 1382 (2) 1382.5

(3) 14×10^2 (4) 138×10^1

Ans. **(3)**

Sol. Area = Length × Breadth

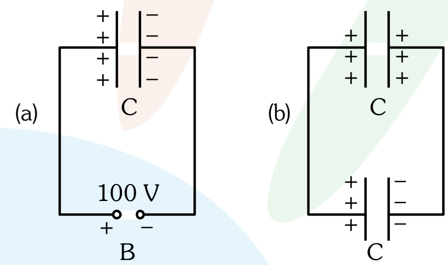
= 55.3 × 25

= 1382.5

= 14×10^2

Resultant should have 2 significant figures.

38. A capacitor of capacitance C = 900 pF is charged fully by 100 V battery B as shown in figure (a). Then it is disconnected from the battery and connected to another uncharged capacitor of capacitance C = 900 pF as shown in figure (b). The electrostatic energy stored by the system (b) is:

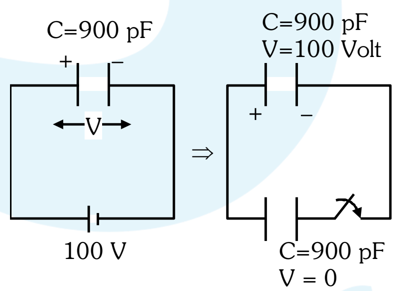


(1) 3.25×10^{-6} J (2) 2.25×10^{-6} J

(3) 1.5×10^{-6} J (4) 4.5×10^{-6} J

Ans. **(2)**

Sol.



Common potential

$$V_C = \frac{C_1V_1 + C_2V_2}{C_1 + C_2}$$

$$= \frac{C \times 100 + C \times 0}{C + C}$$

= 50 Volt

Electrostatic energy stored

$$= 2 \times \frac{1}{2}CV^2 = CV^2$$

= $900 \times 10^{-12} \times 50 \times 50$

= 225×10^{-8} J

= 2.25×10^{-6} J

39. Match **List - I** with **List - II** :

	List - I		List – II
(a)	Gravitational constant (G)	(i)	$[L^2T^{-2}]$
(b)	Gravitational potential energy	(ii)	$[M^{-1}L^3T^{-2}]$
(c)	Gravitational potential	(iii)	$[LT^{-2}]$
(d)	Gravitational intensity	(iv)	$[ML^2T^{-2}]$

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

(1) (a)–(ii), (b)–(iv), (c)–(i), (d)– (iii)

(2) (a)–(ii), (b)–(iv), (c)–(iii), (d)– (i)

(3) (a)–(iv), (b)–(ii), (c)–(i), (d)– (iii)

(4) (a)–(ii), (b)–(i), (c)–(iv), (d)– (iii)

Ans. **(1)**

Sol. Gravitational constant = $[M^{-1}L^3T^{-2}]$

Gravitational potential energy = $[ML^2T^{-2}]$

Gravitational potential = $[L^2T^{-2}]$

Gravitational intensity = $[LT^{-2}]$

40. Two pendulums of length 121 cm and 100 cm start vibrating in phase. At some instant, the two are at their mean position in the same phase. The minimum number of vibrations of the shorter pendulum after which the two are again in phase at the mean position is :

(1) 9 (2) 10

(3) 8 (4) 11

Ans. **(4)**

Sol. $(n)T_\ell = (n + 1)T_s$

$$(n)2\pi\sqrt{\frac{1.21}{g}} = (n+1)2\pi\sqrt{\frac{1}{g}}$$

$(n)(1.1) = (n + 1)$

$0.1(n) = 1$

$n = 10$

No. of oscillation of smaller one

$= n + 1$

$= 10 + 1$

$= 11$

41. Given below are two statements: One is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A):

The stretching of a spring is determined by the shear modulus of the material of the spring.

Reason (R):

A coil spring of copper has more tensile strength than a steel spring of same dimensions.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both (A) and (R) are true and (R) is not the correct explanation of (A)

(2) (A) is true but (R) is false

(3) (A) is false but (R) is true

(4) Both (A) and (R) are true and (R) is the correct explanation of (A)

Ans. **(2)**

Sol. In stretching of a spring shape charges therefore shear modulus is used.

$$Y_{copper} < Y_{steel}$$

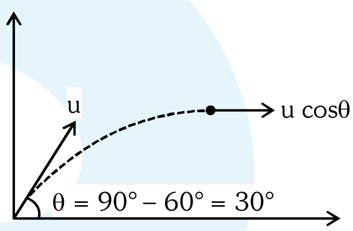
42. A ball is projected with a velocity, 10 ms^{-1}, at an angle of 60° with the vertical direction. Its speed at the highest point of its trajectory will be:

(1) $5\sqrt{3}ms^{-1}$ (2) 5 ms^{-1}

(3) 10 ms^{-1} (4) Zero

Ans. **(1)**

Sol. At highest point only horizontal component of velocity remains $\Rightarrow u_x = u\cos\theta$



$u_x = u\cos\theta = 10\cos30°$

$= 5\sqrt{3}ms^{-1}$

43. Two transparent media A and B are separated by a plane boundary. The speed of light in those media are 1.5×10^8 m/s and 2.0×10^8 m/s, respectively. The critical angle for a ray of light for these two media is:

(1) $\sin^{-1}(0.750)$ (2) $\tan^{-1}(0.500)$

(3) $\tan^{-1}(0.750)$ (4) $\sin^{-1}(0.500)$

Ans. **(1)**

Sol. $\mu = \frac{C}{u} \Rightarrow u \propto \frac{1}{\mu}$

Critical angle

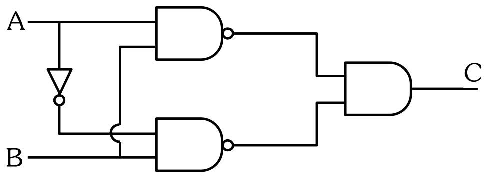
$$\sin i_c = \frac{\mu_R}{\mu_D} = \frac{u_D}{u_R} = \frac{1.5}{2} = \frac{3}{4}$$

$$i_c = \sin^{-1}\left(\frac{3}{4}\right)$$

$$\sin i_c = \frac{\mu_R}{\mu_D} = \frac{u_D}{u_R}$$

$$i_c = \sin^{-1}\left(\frac{3}{4}\right)$$

44.



The truth table for the given logic circuit is :

(1)

A	B	C
0	0	1
0	1	0
1	0	0
1	1	1

(2)

A	B	C
0	0	1
0	1	0
1	0	1
1	1	0

(3)

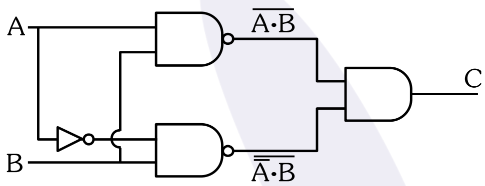
A	B	C
0	0	0
0	1	1
1	0	0
1	1	1

(4)

A	B	C
0	0	0
0	1	1
1	0	1
1	1	0

Ans. (2)

Sol.



$C = \overline{A \cdot B} . \overline{\bar{A} \cdot B}$

using De-Morgan Theorem

$C = \overline{A \cdot B + \bar{A} \cdot B}$

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

Therefore

A	B	C
0	0	1
0	1	0
1	0	1
1	1	0

45. A series LCR circuit with inductance 10 H, capacitance 10 μF, resistance 50 Ω is connected to an ac source of voltage, V = 200 sin (100 t) volt. If the resonant frequency of the LCR circuit is ν_o and the frequency of the ac source is ν, then

(1) $\nu_o = \nu = \frac{50}{\pi}$ Hz

(2) $\nu_o = \frac{50}{\pi}$ Hz, $\nu = 50$ Hz

(3) $\nu = 100$ Hz ; $\nu_o = \frac{100}{\pi}$ Hz

(4) $\nu_o = \nu = 50$ Hz

Ans. (1)

Sol. $\omega = 100$

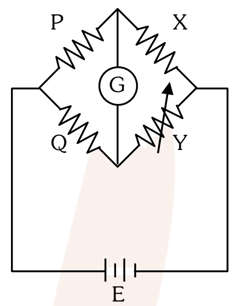
$$\nu = \frac{\omega}{2\pi} = \frac{100}{2\pi} = \frac{50}{\pi} \text{ Hz}$$

Resonance frequency

$$\nu_0 = \frac{1}{2\pi\sqrt{LC}} = \frac{1}{2\pi}\sqrt{\frac{1}{10 \times 10 \times 10^{-6}}}$$

$$= \frac{50}{\pi} \text{Hz}$$

46. A wheatstone bridge is used to determine the value of unknown resistance X by adjusting the variable resistance Y as shown in the figure. For the most precise measurement of X, the resistances P and Q :



(1) should be approximately equal and are small

(2) should be very large and unequal

(3) do not play any significant role

(4) should be approximately equal to 2X

Ans. (1)

Sol. Resistance of P & Q should be approx. equal as it decreases error in experiment.

47. From Ampere's circuital law for a long straight wire of circular cross-section carrying a steady current, the variation of magnetic field in the inside and outside region of the wire is:

(1) a linearly increasing function of distance upto the boundary of the wire and then linearly decreasing for the outside region.

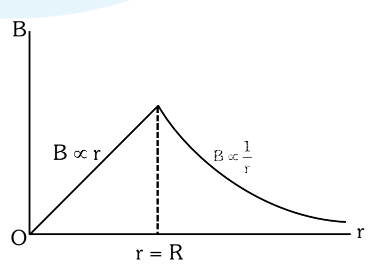
(2) a linearly increasing function of distance r upto the boundary of the wire and then decreasing one with 1/r dependence for the outside region.

(3) a linearly decreasing function of distance upto the boundary of the wire and then a linearly increasing one for the outside region.

(4) uniform and remains constant for both the regions.

Ans. (2)

Sol.



48. A big circular coil of 1000 turns and average radius 10 m is rotating about its horizontal diameter at 2 rad s^{-1}. If the vertical component of earth's magnetic field at that place is 2×10^{-5} T and electrical resistance of the coil is 12.56 Ω, then the maximum induced current in the coil will be :

(1) 1.5 A
(2) 1 A
(3) 2 A
(4) 0.25 A

Ans. **(2)**

Sol. $i_{max} = \frac{E_{max}}{R} = \frac{NBA\omega}{R}$

$$i_{max} = \frac{1000 \times 2 \times 10^{-5} \times \pi(10^2) \times 2}{12.56}$$

$i_{max} = 1A$

49. Two point charges –q and +q are placed at a distance of L, as shown in the figure.

The magnitude of electric field intensity at a distance R (R >>L) varies as :

(1) $\frac{1}{R^3}$
(2) $\frac{1}{R^4}$
(3) $\frac{1}{R^6}$
(4) $\frac{1}{R^2}$

Ans. **(1)**

Sol. It is electric dipole at large distance electric field intensity

$$E = \frac{KP}{R^3}\sqrt{1 + 3\cos^2\theta}$$

$$\therefore E \propto \frac{1}{R^3}$$

50. A nucleus of mass number 189 splits into two nuclei having mass number 125 and 64. The ratio of radius of two daughter nuclei respectively is:

(1) 4 : 5
(2) 5 : 4
(3) 25 : 16
(4) 1 : 1

Ans. **(2)**

Sol. Nuclear Radius :

$R = R_0(A)^{1/3}$

$$\frac{R(125)}{R(64)} = \frac{R_0(125)^{1/3}}{R_0(64)^{1/3}} = \frac{5}{4}$$