NEET 2022 — Physics Question Paper with Solutions

40 Physics questions as set in the paper · answers checked by RankUp

NEET 2022

1. Match List - I with List - II

List - I (Electromagnetic waves): (a) AM radio waves (b) Microwaves (c) Infrared radiations (d) X-rays

List - II (Wavelength): (i) 10^{-10} m (ii) 10^{2} m (iii) 10^{-2} m (iv) 10^{-4} m

Choose the correct answer from the options given below

(A) (a) - (iv), (b) - (iii), (c) - (ii), (d) - (i)
(B) (a) - (iii), (b) - (ii), (c) - (i), (d) - (iv)
(C) (a) - (iii), (b) - (iv), (c) - (ii), (d) - (i)
(D) (a) - (ii), (b) - (iii), (c) - (iv), (d) - (i)

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2. The angular speed of a fly wheel moving with uniform angular acceleration changes from 1200 rpm to 3120 rpm in 16 seconds. The angular acceleration in rad/s² is

(A) 2π
(B) 4π
(C) 12π
(D) 104π

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3. 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

(A) +2 D
(B) +20 D
(C) +5 D
(D) Infinity

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4. As the temperature increases, the electrical resistance

(A) Increases for both conductors and semiconductors
(B) Decreases for both conductors and semiconductors
(C) Increases for conductors but decreases for semiconductors
(D) Decreases for conductors but increases for semiconductors

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

(A) Magnetic flux
(B) Self inductance
(C) Magnetic permeability
(D) Electric permittivity

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

(A) Zero
(B) 30 Hz
(C) 60 Hz
(D) 120 Hz

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7. 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

(A) 1 : 1
(B) √2 : 1
(C) 1 : √2
(D) 1 : 2

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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 :

(A) v
(B) √2 v
(C) 2√2 v
(D) 3√2 v

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9. 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 :

(A) 10/3 m
(B) 20/3 m
(C) 10 m
(D) 5 m

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10. If a soap bubble expands, the pressure inside the bubble

(A) Decreases
(B) Increases
(C) Remains the same
(D) Is equal to the atmospheric pressure

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11. 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})

(A) 23000
(B) 20000
(C) 34500
(D) 23500

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

(A) 0°
(B) 45°
(C) 90°
(D) 180°

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

(A) 6.28×10^{-2} T
(B) 12.56×10^{-2} T
(C) 12.56×10^{-4} T
(D) 6.28×10^{-4} T

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14. Given below 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 charge 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 statements choose the most appropriate answer from the options given below.

(A) Both Statement I and Statement II are correct
(B) Both Statement I and Statement II are incorrect
(C) Statement I is correct and Statement II is incorrect
(D) Statement I is incorrect and Statement II is correct

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15. 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 disc about its diameter is

(A) 2 : 1
(B) √2 : 1
(C) 4 : 1
(D) 1 : √2

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16. The peak voltage of the ac source is equal to

(A) The value of voltage supplied to the circuit
(B) The rms value of the ac source
(C) √2 times the rms value of the ac source
(D) 1/√2 times the rms value of the ac source

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

(A) 36×10^7 J
(B) 36×10^4 J
(C) 36×10^5 J
(D) 1×10^5 J

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18. 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

(A) 6
(B) 8
(C) 9
(D) 12

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19. 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

(A) 2 weber
(B) 0.5 weber
(C) 1 weber
(D) Zero weber

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20. 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

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

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

(A) 1 : 2 : 3 : 4
(B) 1 : 4 : 9 : 16
(C) 1 : 3 : 5 : 7
(D) 1 : 1 : 1 : 1

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22. 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

(A) 0.05 N/kg
(B) 50 N/kg
(C) 20 N/kg
(D) 180 N/kg

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23. A light ray falls on a glass surface of refractive index √3, at an angle 60°. The angle between the refracted and reflected rays would be

(A) 30°
(B) 60°
(C) 90°
(D) 120°

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24. 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)

(A) $v = c$
(B) $v = \sqrt{(\mu_r/\varepsilon_r)}$
(C) $v = \sqrt{(\varepsilon_r/\mu_r)}$
(D) $v = c/\sqrt{(\varepsilon_r\mu_r)}$

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

(A) More on bigger sphere
(B) More on smaller sphere
(C) Equal on both the spheres
(D) Dependent on the material property of the sphere

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

(A) 10^4 A/m²
(B) 10^6 A/m²
(C) 10^{-5} A/m²
(D) 10^5 A/m²

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27. Plane angle and solid angle have

(A) Units but no dimensions
(B) Dimensions but no units
(C) No units and no dimensions
(D) Both units and dimensions

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

(A) 1 : 4
(B) 4 : 1
(C) 4 : 9
(D) 9 : 4

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29. Match List - I with List - II

List - I: (a) Gravitational constant (G) (b) Gravitational potential energy (c) Gravitational potential (d) Gravitational intensity

List - II: (i) $[L^2T^{-2}]$ (ii) $[M^{-1}L^3T^{-2}]$ (iii) $[LT^{-2}]$ (iv) $[ML^2T^{-2}]$

Choose the correct answer from the options given below

(A) (a)-(ii), (b)-(i), (c)-(iv), (d)-(iii)
(B) (a)-(ii), (b)-(iv), (c)-(i), (d)-(iii)
(C) (a)-(ii), (b)-(iv), (c)-(iii), (d)-(i)
(D) (a)-(iv), (b)-(ii), (c)-(i), (d)-(iii)

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30. 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 :

(A) 11
(B) 9
(C) 10
(D) 8

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31. 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

(A) 138×10^1
(B) 1382
(C) 1382.5
(D) 14×10^2

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32. 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

(A) Zero
(B) $5\sqrt{3}$ ms^{-1}
(C) 5 ms^{-1}
(D) 10 ms^{-1}

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33. 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

(A) Uniform and remains constant for both the regions.
(B) A linearly increasing function of distance upto the boundary of the wire and then linearly decreasing for the outside region.
(C) 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.
(D) A linearly decreasing function of distance upto the boundary of the wire and then a linearly increasing one of the outside region.

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34. A series LCR circuit with inductance 10 H, capacitance 10 μF, resistance 50 Ω is connected to an ac source of voltage, V = 200sin(100t) volt. If the resonant frequency of the LCR circuit is ν_0 and the frequency of the ac source is ν, then

(A) $\nu_0 = \nu = 50$ Hz
(B) $\nu_0 = \nu = 50/\pi$ Hz
(C) $\nu_0 = 50/\pi$ Hz, $\nu = 50$ Hz
(D) $\nu = 100$ Hz, $\nu_0 = 100/\pi$ Hz

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35. 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:

(A) Both (A) and (R) are true and (R) is the correct explanation of (A)
(B) Both (A) and (R) are true and (R) is not the correct explanation of (A)
(C) (A) is true but (R) is false
(D) (A) is false but (R) is true

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36. 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

(A) 0.25 A
(B) 1.5 A
(C) 1 A
(D) 2 A

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

(A) 5.6×10^6 m^3
(B) 5.6×10^3 m^3
(C) 5.6×10^{-3} m^3
(D) 5.6 m^3

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38. 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

(A) $\sin^{-1}(0.500)$
(B) $\sin^{-1}(0.750)$
(C) $\tan^{-1}(0.500)$
(D) $\tan^{-1}(0.750)$

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39. 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

(A) 1 : 1
(B) 4 : 5
(C) 5 : 4
(D) 25 : 16

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40. In the given nuclear reaction, the element X is

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

(A) $^{23}_{11}Na$
(B) $^{23}_{10}Ne$
(C) $^{22}_{10}Ne$
(D) $^{22}_{12}Mg$

Answer key and explanations

1. Answer: (D) (a) - (ii), (b) - (iii), (c) - (iv), (d) - (i)

Wavelength decreases from radio waves to X-rays: AM radio $\sim 10^2$ m, microwaves $\sim 10^{-2}$ m (cm range), infrared $\sim 10^{-4}$ m (sub-mm to μm), X-rays $\sim 10^{-10}$ m (Å). So (a)-(ii), (b)-(iii), (c)-(iv), (d)-(i).

2. Answer: (B) 4π

$\Delta\omega = (3120 - 1200)$ rev/min $= 1920$ rev/min $= 1920 \times 2\pi/60$ rad/s $= 64\pi$ rad/s. $\alpha = \Delta\omega/t = 64\pi/16 = 4\pi$ rad/s^2. Forgetting the conversion from rpm to rad/s gives a wrong multiple of π.

3. Answer: (C) +5 D

Lens maker's formula: $1/f = (\mu - 1)(1/R_1 - 1/R_2) = 0.5 \times (1/0.20 + 1/0.20)$ m$^{-1} = 0.5 \times 10 = 5$ m^{-1}. So f = 20 cm and P = +5 D. +20 D comes from confusing focal length in cm with power.

4. Answer: (C) Increases for conductors but decreases for semiconductors

In metals, more frequent collisions of electrons with vibrating ions at higher temperature reduce relaxation time, so resistance rises. In semiconductors, many more charge carriers are generated thermally, which outweighs the collision effect, so resistance falls (negative temperature coefficient).

5. Answer: (C) Magnetic permeability

From $F = \mu_0 I_1 I_2 l/(2\pi d)$, $\mu_0 = F/(I^2) \times$ (length/length) has dimensions $[MLT^{-2}]/[A^2] = [MLT^{-2}A^{-2}]$. Magnetic flux is $[ML^2T^{-2}A^{-1}]$, self inductance $[ML^2T^{-2}A^{-2}]$ and permittivity $[M^{-1}L^{-3}T^4A^2]$.

6. Answer: (C) 60 Hz

A half-wave rectifier passes one half-cycle of each input cycle, so the output repeats once per input cycle: 60 Hz. 120 Hz is the output frequency of a full-wave rectifier.

7. Answer: (C) 1 : √2

$v = \sqrt{(T/\mu)}$, so $v \propto \sqrt{T}$. With T doubled, $v_2 = \sqrt{2}\, v_1$, and $v_1 : v_2 = 1 : \sqrt{2}$. $\sqrt{2} : 1$ is the inverse (final to initial).

8. Answer: (C) 2√2 v

Masses are 2m/5, 2m/5 and m/5. The two equal fragments have perpendicular momenta (2m/5)v each, with resultant $(2m/5)v\sqrt{2}$. Momentum conservation gives $(m/5)v_3 = 2\sqrt{2}\, mv/5$, so $v_3 = 2\sqrt{2}\, v$. √2 v ignores the smaller mass of the third fragment.

9. Answer: (B) 20/3 m

Taking the 10 kg mass at the origin: $x_{cm} = (10 \times 0 + 20 \times 10)/(10 + 20) = 200/30 = 20/3$ m. The centre of mass lies nearer the heavier mass; 10/3 m is its distance from the 20 kg mass.

10. Answer: (A) Decreases

Pressure inside a soap bubble is $P_0 + 4T/r$. As the bubble expands, r increases, so the excess pressure $4T/r$ and hence the inside pressure decrease, while always staying above atmospheric pressure.

11. Answer: (C) 34500

At constant speed, motor force = mg + friction = $2000 \times 10 + 3000 = 23000$ N. Power = $Fv = 23000 \times 1.5 = 34500$ W. 23000 is the force in newtons, not the power.

12. Answer: (C) 90°

No work is done in moving a charge along an equipotential surface, so the field has no component along it. Electric field lines are therefore always perpendicular (90°) to equipotential surfaces.

13. Answer: (B) 12.56×10^{-2} T

n = 100 turns/mm = 10^5 turns/m. $B = \mu_0 nI = 4\pi \times 10^{-7} \times 10^5 \times 1 = 4\pi \times 10^{-2} = 12.56 \times 10^{-2}$ T. The radius of the solenoid does not matter for a long solenoid; using 100 turns per cm would give the 10^{-4} answer.

14. Answer: (C) Statement I is correct and Statement II is incorrect

Biot–Savart's law gives dB due to a current element I dl, so Statement I is correct. It is analogous to Coulomb's law, but the source I dl is a vector and the charge q is a scalar; Statement II swaps these, so it is incorrect.

15. Answer: (B) √2 : 1

$I(\text{normal axis}) = MR^2/2$ so $k_1 = R/\sqrt{2}$; $I(\text{diameter}) = MR^2/4$ so $k_2 = R/2$. $k_1/k_2 = (R/\sqrt{2})/(R/2) = 2/\sqrt{2} = \sqrt{2}$, i.e. √2 : 1. 2 : 1 is the ratio of the moments of inertia, not the radii of gyration.

16. Answer: (C) √2 times the rms value of the ac source

For a sinusoidal source $V_{rms} = V_0/\sqrt{2}$, so $V_0 = \sqrt{2}\, V_{rms}$. $1/\sqrt{2}$ times rms reverses the relation.

17. Answer: (A) 36×10^7 J

$E = P \times t = 100 \times 10^3 \text{ W} \times 3600 \text{ s} = 3.6 \times 10^8 \text{ J} = 36 \times 10^7$ J. 1×10^5 J is just the power value in watts, ignoring the time.

18. Answer: (D) 12

Fringe width $\beta = \lambda D/d$, so for a fixed region the number of fringes $n \propto 1/\lambda$: $n_1\lambda_1 = n_2\lambda_2$ gives $n_2 = 8 \times 600/400 = 12$. Fewer fringes would mean a longer wavelength.

19. Answer: (B) 0.5 weber

With the plane perpendicular to B, the area vector is parallel to B, so $\Phi = BA \cos 0° = 0.5 \times 1^2 = 0.5$ Wb. Zero flux would apply if the plane were parallel to the field; the resistance is irrelevant.

20. Answer: (B) 2 : 1

In parallel both have the same voltage, so heat $H = V^2t/R \propto 1/R$. $H_{100} : H_{200} = 200 : 100 = 2 : 1$. 1 : 2 would apply for series connection ($H \propto R$).

21. Answer: (C) 1 : 3 : 5 : 7

Distance in the nth second from rest: $s_n = (g/2)(2n - 1)$, giving 1 : 3 : 5 : 7 for n = 1 to 4. 1 : 4 : 9 : 16 is the ratio of total distances after 1, 2, 3, 4 s.

22. Answer: (B) 50 N/kg

Field intensity = F/m = 3.0 N / 0.060 kg = 50 N/kg. Using the mass in grams without conversion gives 0.05.

23. Answer: (C) 90°

Snell's law: $\sin r = \sin 60°/\sqrt{3} = (\sqrt{3}/2)/\sqrt{3} = 1/2$, so r = 30°. The reflected ray makes 60° with the normal; the angle between reflected and refracted rays = 180° − 60° − 30° = 90° (this is Brewster incidence, $\tan 60° = \sqrt{3}$).

24. Answer: (D) $v = c/\sqrt{(\varepsilon_r \mu_r)}$

$v = 1/\sqrt{(\mu\varepsilon)} = 1/\sqrt{(\mu_0\mu_r\varepsilon_0\varepsilon_r)} = c/\sqrt{(\varepsilon_r\mu_r)}$, since $c = 1/\sqrt{(\mu_0\varepsilon_0)}$. The ratio forms of μ_r and ε_r are dimensionless and cannot be a speed.

25. Answer: (B) More on smaller sphere

The potential of an isolated charged sphere is $V = kQ/R$. With equal Q, the sphere of smaller radius has the larger potential. Potential depends only on charge and radius, not on the material.

26. Answer: (D) 10^5 A/m²

Area $A = \pi r^2 = \pi \times 10^{-4}/\pi = 10^{-4}$ m². Resistivity $\rho = RA/L = 10 \times 10^{-4}/10 = 10^{-4}$ Ω m. Current density $J = E/\rho = 10/10^{-4} = 10^5$ A/m².

27. Answer: (A) Units but no dimensions

Plane angle (radian) and solid angle (steradian) are ratios of lengths or areas, so they are dimensionless, yet they have named units rad and sr. A quantity cannot have dimensions without units.

28. Answer: (D) 9 : 4

First excited state is n = 2 and second excited state is n = 3. Energy $\propto 1/n^2$, so $T_1 : T_2 = (1/4) : (1/9) = 9 : 4$. 4 : 1 wrongly takes n = 1 and n = 2.

29. Answer: (B) (a)-(ii), (b)-(iv), (c)-(i), (d)-(iii)

$G = Fr^2/m^2$ gives $[M^{-1}L^3T^{-2}]$; potential energy is energy, $[ML^2T^{-2}]$; potential is energy per unit mass, $[L^2T^{-2}]$; intensity is force per unit mass, $[LT^{-2}]$. So (a)-(ii), (b)-(iv), (c)-(i), (d)-(iii).

30. Answer: (A) 11

$T \propto \sqrt{L}$, so T_long : T_short = $\sqrt{121} : \sqrt{100} = 11 : 10$. They are again in phase when n_short × 10 = n_long × 11 (in the same time unit); the smallest whole numbers are n_short = 11 and n_long = 10. So the shorter pendulum makes 11 vibrations; 10 is the count for the longer one.

31. Answer: (D) 14×10^2

$55.3 \times 25 = 1382.5$ m². In multiplication the result keeps the least number of significant figures among the factors; 25 has two, so the area is $1.4 \times 10^3 = 14 \times 10^2$ m². 138×10^1 keeps three figures, which is one too many.

32. Answer: (B) $5\sqrt{3}$ ms^{-1}

At the highest point only the horizontal component remains. With 60° measured from the vertical, the horizontal component is $10 \sin 60° = 5\sqrt{3}$ m s^{-1}. 5 m s^{-1} wrongly measures the angle from the horizontal.

33. Answer: (C) 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.

Inside (r < R), the enclosed current is $I r^2/R^2$, so $B = \mu_0 Ir/(2\pi R^2)$, increasing linearly with r. Outside (r > R), all current is enclosed and $B = \mu_0 I/(2\pi r)$, falling as 1/r, not linearly.

34. Answer: (B) $\nu_0 = \nu = 50/\pi$ Hz

$\omega_0 = 1/\sqrt{(LC)} = 1/\sqrt{(10 \times 10 \times 10^{-6})} = 1/\sqrt{(10^{-4})} = 100$ rad/s, so $\nu_0 = 100/(2\pi) = 50/\pi$ Hz. The source has $\omega = 100$ rad/s, so $\nu = 50/\pi$ Hz too. Taking $\omega = 100$ directly as 100 Hz is the trap.

35. Answer: (C) (A) is true but (R) is false

When a coil spring is stretched, the wire is twisted rather than elongated, so its extension is governed by the shear (rigidity) modulus; the assertion is true. Steel has a higher elastic modulus and tensile strength than copper, so the reason is false.

36. Answer: (C) 1 A

Rotation about a horizontal diameter changes the flux of the vertical field component. ε_max = NBAω = $1000 \times 2 \times 10^{-5} \times \pi(10)^2 \times 2 = 0.02 \times 314.16 \times 2 = 12.566$ V. I_max = 12.566/12.56 ≈ 1 A.

37. Answer: (D) 5.6 m³

With no intermolecular forces the water behaves as an ideal gas. Moles = 4500 g / 18 g mol^{-1} = 250 mol; at STP V = 250 × 22.4 L = 5600 L = 5.6 m³. 5.6×10^3 forgets to convert litres to m³.

38. Answer: (B) sin^{-1} (0.750)

Medium A, where light is slower, is denser. sin C = n_B/n_A = v_A/v_B = 1.5/2.0 = 0.75, so C = sin^{-1}(0.750). Critical angle is defined through sine, not tangent.

39. Answer: (C) 5 : 4

Nuclear radius $R = R_0 A^{(1/3)}$: $R_1 : R_2 = 125^{(1/3)} : 64^{(1/3)} = 5 : 4$. 25 : 16 is the ratio of their surface areas, and 4 : 5 is the reversed order.

40. Answer: (C) $^{22}_{10}$Ne

In β^+ decay a proton becomes a neutron, emitting a positron and a neutrino: mass number stays 22 and atomic number falls from 11 to 10. So X is $^{22}_{10}$Ne. $^{22}_{12}$Mg would be the product of β^- decay.

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