NEST Physics Sample Paper – 2

Duration: 45 Minutes **Maximum Marks: 60**

Instructions

- This paper contains **20 Multiple Choice Questions (single correct answer)**, modelled on the Physics section of **NEST 2026**.
- Each correct answer carries **+3 marks**. There is a deduction of -1 **mark** for each incorrect answer; **no marks** are deducted for an unattempted question.
- Every question has exactly **four options**, of which only **one** is correct. Choose carefully.
- Personal calculators, log tables, mobile phones, and other electronic gadgets are strictly prohibited in the examination hall.
- A simple on-screen (virtual) calculator is provided in the computer-based test interface and may be used; blank sheets for rough work are supplied at the exam centre.

Q1. The coefficient of viscosity η appears in the force law $F = \eta A \dfrac{dv}{dx}$, where A is area and $\dfrac{dv}{dx}$ is the velocity gradient. The dimensional formula of η is

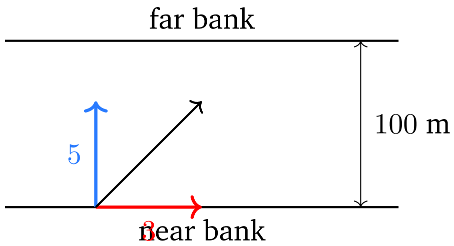
(A) $[MLT^{-1}]$

(B) $[ML^{-1}T^{-1}]$

(C) $[ML^{-1}T^{-2}]$

(D) $[ML^{-2}T^{-1}]$

Q2. A boat that can move at $5\ \mathrm{m\,s^{-1}}$ in still water heads straight across a river 100 m wide. The river flows at $3\ \mathrm{m\,s^{-1}}$ parallel to its banks, as shown. The time taken to reach the opposite bank is



(A) 25 s

(B) 33.3 s

(C) 20 s

(D) 12.5 s

Q3. A block of mass 10 kg rests on a rough horizontal floor for which the coefficient of static friction is $\mu_s = 0.4$. Take $g = 10\ \mathrm{m\,s^{-2}}$. The minimum horizontal force needed to just start the block moving is

(A) 40 N

(B) 100 N

(C) 4 N

(D) 25 N

Q4. A spring of force constant $k = 500\ \mathrm{N\,m^{-1}}$ is initially compressed by 2 cm. The work required to compress it *further* until the total compression is 6 cm is

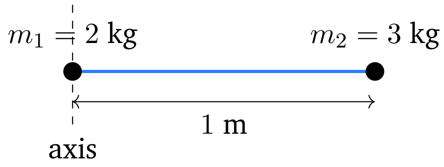
(A) 0.9 J

(B) 0.1 J

(C) 1.0 J

(D) 0.8 J

Q5. Two point masses, $m_1 = 2$ kg and $m_2 = 3$ kg, are fixed at the ends of a light rod of length 1 m. The system rotates about an axis perpendicular to the rod passing through the position of m_1, as shown. The moment of inertia about this axis is



(A) $2\ \text{kg m}^2$

(B) $5\ \text{kg m}^2$

(C) $3\ \text{kg m}^2$

(D) $1.2\ \text{kg m}^2$

Q6. A planet has mass $M = 6 \times 10^{24}$ kg and radius $R = 6 \times 10^6$ m. Take $G = 6.67 \times 10^{-11}\ \text{N m}^2\,\text{kg}^{-2}$. The escape velocity from the surface of the planet is approximately

(A) $8.0\ \text{km s}^{-1}$

(B) $11.2\ \text{km s}^{-1}$

(C) $22.4\ \text{km s}^{-1}$

(D) $5.6\ \text{km s}^{-1}$

Q7. A steel wire of length 2 m and cross-sectional area 1×10^{-6} m^2 carries a load of 100 N. The Young's modulus of steel is $2 \times 10^{11}\ \text{N m}^{-2}$. The elongation of the wire is

(A) 1.0 mm

(B) 0.5 mm

(C) 2.0 mm

(D) 0.1 mm

Q8. A Carnot engine operates between a source at $T_1 = 500$ K and a sink at $T_2 = 300$ K. The efficiency of the engine is

(A) 60%

(B) 30%

(C) 20%

(D) 40%

Q9. The average translational kinetic energy of a single gas molecule at temperature $T = 300$ K is (Boltzmann constant $k_B = 1.38 \times 10^{-23}\ \mathrm{J\,K^{-1}}$)

(A) 4.14×10^{-21} J

(B) 6.21×10^{-21} J

(C) 2.07×10^{-21} J

(D) 1.24×10^{-20} J

Q10. A simple pendulum is required to have a time period of exactly 2 s (a "seconds pendulum"). Take $g = 10\ \mathrm{m\,s^{-2}}$ and $\pi^2 \approx 10$. The required length of the pendulum is

(A) 0.5 m

(B) 2.0 m

(C) 1.0 m

(D) 0.25 m

Q11. A tuning fork of unknown frequency produces 4 beats per second with a standard fork of frequency 256 Hz. When a little wax is loaded onto the unknown fork, the beat frequency *decreases*. The original frequency of the unknown fork is

(A) 252 Hz

(B) 248 Hz

(C) 264 Hz

(D) 260 Hz

Q12. Two point charges in vacuum experience a force F when separated by a distance r. If the separation is halved and the space between them is filled with a medium of dielectric constant $K = 2$, the new force becomes

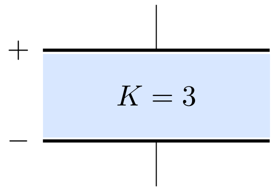
(A) $2F$

(B) $4F$

(C) $8F$

(D) $\frac{F}{2}$

Q13. A parallel-plate capacitor has capacitance $C_0 = 4\,\mu\text{F}$ in air. A dielectric slab of dielectric constant $K = 3$ is inserted so that it completely fills the gap between the plates, as shown. The new capacitance is



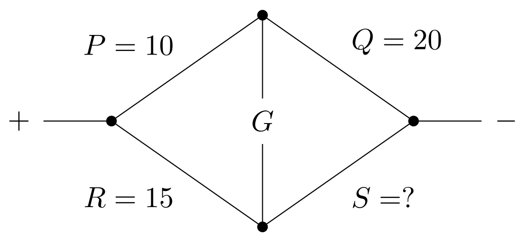
(A) $7\ \mu\text{F}$

(B) $12\ \mu\text{F}$

(C) $4/3\ \mu\text{F}$

(D) $1.33\ \mu\text{F}$

Q14. In the balanced Wheatstone bridge shown, the galvanometer G reads zero. The arms have resistances $P = 10\,\Omega$, $Q = 20\,\Omega$ and $R = 15\,\Omega$. The unknown resistance S is



(A) $7.5\ \Omega$

(B) $25\ \Omega$

(C) $30\ \Omega$

(D) $10\ \Omega$

Q15. A proton (mass $m = 1.6 \times 10^{-27}$ kg, charge $q = 1.6 \times 10^{-19}$ C) moves with speed $v = 2 \times 10^6\ \text{m s}^{-1}$ perpendicular to a uniform magnetic field $B = 0.5$ T. The radius of its circular path is

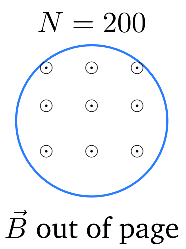
(A) 2 cm

(B) 4 cm

(C) 8 cm

(D) 1 cm

Q16. A circular coil of 200 turns is placed in a magnetic field directed perpendicular to its plane, as shown. The flux through each turn changes uniformly from 0.06 Wb to 0.02 Wb in 0.1 s. The magnitude of the induced emf in the coil is



(A) 0.4 V

(B) 8 V

(C) 40 V

(D) 80 V

Q17. An inductor of inductance $L = 0.5$ H is connected to an AC source of frequency $f = \frac{50}{\pi}$ Hz. The inductive reactance X_L is

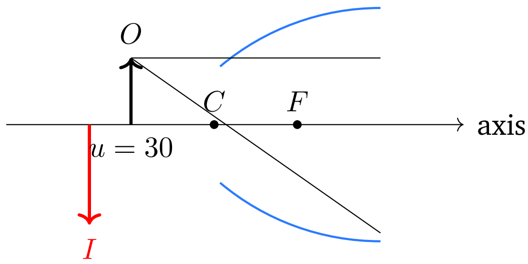
(A) 50 Ω

(B) 25 Ω

(C) 100 Ω

(D) $\frac{1}{50}$ Ω

Q18. An object is placed 30 cm in front of a concave mirror of focal length 20 cm. Using the mirror formula, the image distance and magnification are



(A) $v = -12$ cm, $m = -0.4$

(B) $v = -30$ cm, $m = -1$

(C) $v = -60$ cm, $m = -2$

(D) $v = +60$ cm, $m = +2$

Q19. In a Young's double-slit experiment, the slit separation is $d = 0.5$ mm and the screen is $D = 1.5$ m away. Light of wavelength $\lambda = 500$ nm is used. The distance of the third bright fringe from the central maximum is

(A) 1.5 mm

(B) 3.0 mm

(C) 6.0 mm

(D) 4.5 mm

Q20. In the Bohr model of the hydrogen atom, the energy of the nth orbit is $E_n = -\frac{13.6}{n^2}$ eV. The energy of the photon emitted when the electron makes a transition from $n = 3$ to $n = 2$ is

(A) 3.40 eV

(B) 1.89 eV

(C) 1.51 eV

(D) 10.2 eV

Detailed Solutions

Q1.

Solution

Concept — Dimensions of viscosity: From $F = \eta A \dfrac{dv}{dx}$, solve for η and substitute the dimensions of each quantity.

Step 1 — Rearrange: $\eta = \dfrac{F}{A\,(dv/dx)}$. The velocity gradient $\dfrac{dv}{dx}$ has dimensions $\dfrac{[LT^{-1}]}{[L]} = [T^{-1}]$.

Step 2 — Combine: $[\eta] = \dfrac{[MLT^{-2}]}{[L^2]\,[T^{-1}]} = [MLT^{-2}]\,[L^{-2}]\,[T] = [ML^{-1}T^{-1}]$.

Why other options are wrong:

- (A) $[MLT^{-1}]$ omits dividing by area.
- (C) $[ML^{-1}T^{-2}]$ is the dimension of pressure or stress, not viscosity.
- (D) $[ML^{-2}T^{-1}]$ over-divides by an extra length.

Final Answer: $[\eta] = [ML^{-1}T^{-1}] \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q1

Q2.

Solution

Concept — River–boat crossing: When the boat heads straight across, only the component of velocity perpendicular to the banks carries it across. The current is parallel to the banks and does not affect the crossing time.

Step 1 — Crossing velocity: The boat points directly across, so the across-stream speed is the full still-water speed $5\ \text{m s}^{-1}$. The $3\ \text{m s}^{-1}$ current only drifts it downstream.

Step 2 — Time: $t = \dfrac{\text{width}}{v_\perp} = \dfrac{100}{5} = 20\ \text{s}$.

Why other options are wrong:

- (A) 25 s uses the resultant speed $\sqrt{5^2 - 3^2} = 4\ \text{m s}^{-1}$, which would apply only if the boat aimed upstream to land straight across.
- (B) 33.3 s uses the current speed $3\ \text{m s}^{-1}$.
- (D) 12.5 s uses the resultant $\sqrt{5^2 + 3^2} \approx 5.83...$ incorrectly doubled.

Final Answer: $t = 20$ s $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q2

Q3.

Solution

Concept — Limiting static friction: A block on a horizontal floor just starts to move when the applied horizontal force equals the maximum static friction $f_s = \mu_s N$, with $N = mg$ here.

Step 1 — Normal force: $N = mg = 10 \times 10 = 100$ N.

Step 2 — Minimum force: $F_{\text{min}} = \mu_s N = 0.4 \times 100 = 40$ N.

Why other options are wrong:

- (B) 100 N is the normal force (weight), not the friction.
- (C) 4 N uses $\mu_s \times m$ and forgets g.
- (D) 25 N divides weight by 4 instead of multiplying by 0.4.

Final Answer: $F_{\text{min}} = 40$ N $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q3

Q4.

Solution

Concept — Spring potential energy: The energy stored in a spring compressed by x is $U = \frac{1}{2}kx^2$. The work to go from x_1 to x_2 equals the change in stored energy.

Step 1 — Energies (convert cm to m): $x_1 = 0.02$ m, $x_2 = 0.06$ m.

$$U_1 = \tfrac{1}{2}(500)(0.02)^2 = \tfrac{1}{2}(500)(4 \times 10^{-4}) = 0.1 \text{ J},$$

$$U_2 = \tfrac{1}{2}(500)(0.06)^2 = \tfrac{1}{2}(500)(36 \times 10^{-4}) = 0.9 \text{ J}.$$

Step 2 — Work done: $W = U_2 - U_1 = 0.9 - 0.1 = 0.8$ J.

Why other options are wrong:

- (A) 0.9 J is the total energy at 6 cm, ignoring the initial 2 cm already stored.
- (B) 0.1 J is only the initial stored energy U_1.
- (C) 1.0 J adds the two energies instead of subtracting.

Final Answer: $W = 0.8$ J $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q4

Q5.

Solution

Concept — Moment of inertia of point masses: For point masses, $I = \sum m_i r_i^2$, where r_i is the perpendicular distance of each mass from the axis. The rod is light, so it contributes nothing.

Step 1 — Distances from the axis (through m_1): $r_1 = 0$ (axis passes through m_1), $r_2 = 1$ m.

Step 2 — Compute:

$$I = m_1 r_1^2 + m_2 r_2^2 = 2(0)^2 + 3(1)^2 = 0 + 3 = 3\ \text{kg m}^2.$$

Why other options are wrong:

- (A) 2 kg m^2 uses m_1 at 1 m by mistake.
- (B) 5 kg m^2 adds both masses as if both were at 1 m.
- (D) 1.2 kg m^2 is the value about the centre of mass, not about m_1.

Final Answer: $I = 3$ kg m^2 $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q5

Q6.

Solution

Concept — Escape velocity: The minimum speed to escape a planet's gravity from its surface is $v_e = \sqrt{\dfrac{2GM}{R}}$.

Step 1 — Substitute:

$$v_e = \sqrt{\frac{2(6.67 \times 10^{-11})(6 \times 10^{24})}{6 \times 10^6}}.$$

Step 2 — Simplify the fraction: Numerator $= 2(6.67 \times 10^{-11})(6 \times 10^{24}) = 8.00 \times 10^{14}$. Divide by 6×10^6: $\dfrac{8.00 \times 10^{14}}{6 \times 10^6} \approx 1.33 \times 10^8$.

Step 3 — Square root: $v_e = \sqrt{1.33 \times 10^8} \approx 1.12 \times 10^4\ \text{m s}^{-1} = 11.2\ \text{km s}^{-1}$.

Why other options are wrong:

- (A) $8.0\ \mathrm{km\,s^{-1}}$ is the circular orbital speed $\sqrt{GM/R}$, missing the factor 2.
- (C) $22.4\ \mathrm{km\,s^{-1}}$ doubles the answer instead of taking $\sqrt{2}$.
- (D) $5.6\ \mathrm{km\,s^{-1}}$ halves the correct value.

Final Answer: $v_e \approx 11.2\ \mathrm{km\,s^{-1}} \Rightarrow \boxed{\mathrm{B}}$

Answer: (B) Go Back to Q6

Q7.

Solution

Concept — Young's modulus: $Y = \dfrac{\text{stress}}{\text{strain}} = \dfrac{F/A}{\Delta L/L}$, so the elongation is $\Delta L = \dfrac{FL}{AY}$.

Step 1 — Substitute:

$$\Delta L = \frac{(100)(2)}{(1\times10^{-6})(2\times10^{11})} = \frac{200}{2\times10^{5}}.$$

Step 2 — Compute: $\Delta L = \dfrac{200}{2\times10^{5}} = 1\times10^{-3}\ \mathrm{m} = 1.0\ \mathrm{mm}$.

Why other options are wrong:

- (B) 0.5 mm uses $L = 1$ m instead of 2 m.
- (C) 2.0 mm doubles the load or the length erroneously.
- (D) 0.1 mm is a decade error in the area.

Final Answer: $\Delta L = 1.0\ \mathrm{mm} \Rightarrow \boxed{\mathrm{A}}$

Answer: (A) Go Back to Q7

Q8.

Solution

Concept — Carnot efficiency: A Carnot engine between source T_1 and sink T_2 (in kelvin) has efficiency $\eta = 1 - \dfrac{T_2}{T_1}$.

Step 1 — Substitute: $\eta = 1 - \dfrac{300}{500} = 1 - 0.6 = 0.4$.

Step 2 — Express as percent: $\eta = 40\%$.

Why other options are wrong:

- (A) 60% is T_2/T_1 itself, not $1 - T_2/T_1$.
- (B) 30% uses a wrong temperature ratio.
- (C) 20% uses $(T_1 - T_2)/(T_1 + T_2)$ by mistake.

Final Answer: $\eta = 40\% \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q8

Q9.

Solution

Concept — Equipartition of energy: The average translational kinetic energy of a single molecule is $\langle KE \rangle = \frac{3}{2}k_BT$ (three translational degrees of freedom).

Step 1 — Substitute: $\langle KE \rangle = \frac{3}{2}(1.38 \times 10^{-23})(300)$.

Step 2 — Compute: $\frac{3}{2} \times 300 = 450$, so $\langle KE \rangle = 450 \times 1.38 \times 10^{-23} = 621 \times 10^{-23} = 6.21 \times 10^{-21}$ J.

Why other options are wrong:

- (A) 4.14×10^{-21} J uses k_BT only (forgets the $3/2$).
- (C) 2.07×10^{-21} J uses $\frac{1}{2}k_BT$ (one degree of freedom).
- (D) 1.24×10^{-20} J uses $3k_BT$ (doubles the correct coefficient).

Final Answer: $\langle KE \rangle = 6.21 \times 10^{-21}$ J $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q9

Q10.

Solution

Concept — Simple pendulum: The period is $T = 2\pi\sqrt{\frac{L}{g}}$, so the required length is $L = \frac{gT^2}{4\pi^2}$.

Step 1 — Substitute ($T = 2$ s, $g = 10$, $\pi^2 \approx 10$):

$$L = \frac{(10)(2)^2}{4(10)} = \frac{(10)(4)}{40} = \frac{40}{40} = 1.0 \text{ m}.$$

Why other options are wrong:

- (A) 0.5 m comes from using $T = 2\pi\sqrt{L/g}$ with a dropped factor.
- (B) 2.0 m mistakenly uses $L = gT^2/(2\pi^2)$.
- (D) 0.25 m uses $T = 1$ s instead of 2 s.

Final Answer: $L = 1.0 \text{ m} \Rightarrow \boxed{\text{C}}$

Answer: (C) **Go Back to Q10**

Q11.

Solution

Concept — Beats and the wax test: The beat frequency equals $|f_{\text{unknown}} - f_{\text{standard}}|$, so the unknown is either $256+4$ or $256-4$. Loading wax *lowers* the unknown fork's frequency; observing the change resolves the ambiguity.

Step 1 — Two candidates: $f = 256 \pm 4 = 260$ Hz or 252 Hz.

Step 2 — Apply the wax test: Wax increases mass and *decreases* the unknown frequency. The beat count is observed to *decrease*, meaning the unknown frequency moved *closer* to 256 Hz. Starting above (260 Hz), lowering it toward 256 reduces the beats. Starting below (252 Hz), lowering it further increases the beats. Hence the original frequency is 260 Hz.

Why other options are wrong:

- (A) 252 Hz: waxing would *increase* the beats, contradicting the observation.
- (B) 248 Hz gives 8 beats, not 4.
- (C) 264 Hz gives 8 beats, not 4.

Final Answer: $f = 260 \text{ Hz} \Rightarrow \boxed{\text{D}}$

Answer: (D) **Go Back to Q11**

Q12.

Solution

Concept — Coulomb's law in a medium: $F = \dfrac{1}{4\pi\varepsilon_0 K}\dfrac{q_1q_2}{r^2}$. The force scales as $\dfrac{1}{Kr^2}$ for fixed charges.

Step 1 — Effect of halving separation: Replacing r by $r/2$ multiplies the force by $\dfrac{1}{(1/2)^2} = 4$.

Step 2 — Effect of the medium: Filling with $K = 2$ divides the force by 2.

Step 3 — Combine: $F_{\text{new}} = F \times 4 \times \dfrac{1}{2} = 2F$.

Why other options are wrong:

- (B) $4F$ accounts for the distance change but forgets the dielectric.
- (C) $8F$ multiplies by K instead of dividing.
- (D) $\frac{F}{2}$ accounts for the dielectric but ignores the distance change.

Final Answer: $F_{\text{new}} = 2F \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q12

Q13.

Solution

Concept — Dielectric in a parallel-plate capacitor: Filling the gap completely with a dielectric of constant K multiplies the capacitance: $C = KC_0$.

Step 1 — Substitute: $C = KC_0 = 3 \times 4\,\mu\text{F} = 12\,\mu\text{F}$.

Why other options are wrong:

- (A) $7\ \mu$F adds K to C_0 $(3 + 4)$ instead of multiplying.
- (C) $4/3\ \mu$F divides by K instead of multiplying.
- (D) $1.33\ \mu$F is the same erroneous C_0/K as (C).

Final Answer: $C = 12\,\mu\text{F} \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q13

Q14.

Solution

Concept — Balanced Wheatstone bridge: When the galvanometer reads zero, the bridge is balanced and $\frac{P}{Q} = \frac{R}{S}$.

Step 1 — Balance condition: $\frac{P}{Q} = \frac{R}{S} \Rightarrow S = \frac{Q\,R}{P}$.

Step 2 — Substitute: $S = \frac{20 \times 15}{10} = \frac{300}{10} = 30\,\Omega$.

Why other options are wrong:

- (A) $7.5\ \Omega$ uses $S = \frac{PR}{Q}$ (ratio inverted).
- (B) $25\ \Omega$ comes from adding instead of the product/quotient.
- (D) $10\ \Omega$ simply copies P.

Final Answer: $S = 30\,\Omega \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q14

Q15.

Solution

Concept — Charged particle in a magnetic field: A particle moving perpendicular to $\vec{B}$ follows a circle of radius $r = \frac{mv}{qB}$.

Step 1 — Substitute:

$$r = \frac{(1.6 \times 10^{-27})(2 \times 10^{6})}{(1.6 \times 10^{-19})(0.5)}.$$

Step 2 — Compute: Numerator $= 3.2 \times 10^{-21}$; denominator $= 0.8 \times 10^{-19} = 8 \times 10^{-20}$. So $r = \frac{3.2 \times 10^{-21}}{8 \times 10^{-20}} = 0.04$ m $= 4$ cm.

Why other options are wrong:

- (A) 2 cm uses $B = 1$ T.
- (C) 8 cm uses $B = 0.25$ T or doubles v.
- (D) 1 cm is a decade slip in the arithmetic.

Final Answer: $r = 4$ cm $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q15

Q16.

Solution

Concept — Faraday's law: The induced emf in an N-turn coil is $\varepsilon = N\left|\frac{\Delta\Phi}{\Delta t}\right|$, where Φ is the flux through one turn.

Step 1 — Rate of change of flux: $\frac{\Delta\Phi}{\Delta t} = \frac{0.06-0.02}{0.1} = \frac{0.04}{0.1} = 0.4\ \text{Wb}\,\text{s}^{-1}$.

Step 2 — Multiply by turns: $\varepsilon = N\left|\frac{\Delta\Phi}{\Delta t}\right| = 200 \times 0.4 = 80$ V.

Why other options are wrong:

- (A) 0.4 V forgets to multiply by $N = 200$.
- (B) 8 V uses $N = 20$.
- (C) 40 V halves the answer (uses $N = 100$).

Final Answer: $\varepsilon = 80$ V $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q16

Q17.

Solution

Concept — Inductive reactance: The reactance of an inductor is $X_L = \omega L = 2\pi f L$.

Step 1 — Substitute ($f = \frac{50}{\pi}$ Hz, $L = 0.5$ H):

$$X_L = 2\pi\left(\frac{50}{\pi}\right)(0.5) = 2 \times 50 \times 0.5.$$

Step 2 — Compute: The π cancels: $X_L = 2 \times 50 \times 0.5 = 50\,\Omega$.

Why other options are wrong:

- (B) $25\ \Omega$ drops the factor of 2 in $2\pi f$.
- (C) $100\ \Omega$ forgets the factor $L = 0.5$.
- (D) $\frac{1}{50}\ \Omega$ uses the capacitive formula $1/(\omega L)$ by mistake.

Final Answer: $X_L = 50\,\Omega \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q17

Q18.

Solution

Concept — Mirror formula: $\frac{1}{v}+\frac{1}{u}=\frac{1}{f}$ with the sign convention (distances in front of a concave mirror are negative); magnification $m=-\frac{v}{u}$.

Step 1 — Apply formula: $u=-30$ cm, $f=-20$ cm (concave).

$$\frac{1}{v}=\frac{1}{f}-\frac{1}{u}=\frac{1}{-20}-\frac{1}{-30}=-\frac{1}{20}+\frac{1}{30}=\frac{-3+2}{60}=-\frac{1}{60}.$$

So $v=-60$ cm (real image, in front of the mirror).

Step 2 — Magnification: $m=-\frac{v}{u}=-\frac{-60}{-30}=-2$. The image is real, inverted and magnified two-fold.

Why other options are wrong:

- (A) $v=-12$ cm comes from a sign error (adding the reciprocals).
- (B) $v=-30$ cm, $m=-1$ would need the object at C ($u=2f=40$ cm), not 30 cm.
- (D) $v=+60$ cm (positive) would be a virtual image, impossible for an object beyond F in a concave mirror.

Final Answer: $v=-60$ cm, $m=-2 \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q18

Q19.

Solution

Concept — Position of bright fringes: The nth bright fringe lies at $y_n=\frac{n\lambda D}{d}$ from the central maximum.

Step 1 — Substitute ($n=3$, SI units): $\lambda=500\times10^{-9}$ m, $D=1.5$ m, $d=0.5\times10^{-3}$ m.

$$y_3=\frac{3(500\times10^{-9})(1.5)}{0.5\times10^{-3}}=\frac{3(7.5\times10^{-7})}{5\times10^{-4}}.$$

Step 2 — Compute: $y_3=\frac{2.25\times10^{-6}}{5\times10^{-4}}=4.5\times10^{-3}$ m $=4.5$ mm.

Why other options are wrong:

- (A) 1.5 mm is the fringe width β (the $n=1$ position).

- (B) 3.0 mm is the position of the 2nd bright fringe.
- (C) 6.0 mm is the 4th bright fringe.

Final Answer: $y_3 = 4.5$ mm $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q19

Q20.

Solution

Concept — Bohr transitions: The photon energy emitted in a transition from n_i to n_f is $\Delta E = E_{n_i} - E_{n_f}$, with $E_n = -\dfrac{13.6}{n^2}$ eV.

Step 1 — Energy levels: $E_3 = -\dfrac{13.6}{9} = -1.51$ eV, $E_2 = -\dfrac{13.6}{4} = -3.40$ eV.

Step 2 — Photon energy: $\Delta E = E_3 - E_2 = (-1.51) - (-3.40) = 1.89$ eV.

Why other options are wrong:

- (A) 3.40 eV is the magnitude of E_2 alone.
- (C) 1.51 eV is the magnitude of E_3 alone.
- (D) 10.2 eV is the $n = 2 \to 1$ transition energy, not $3 \to 2$.

Final Answer: $\Delta E = 1.89$ eV $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q20

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	B	2	C	3	A	4	D	5	C
6	B	7	A	8	D	9	B	10	C
11	D	12	A	13	B	14	C	15	B
16	D	17	A	18	C	19	D	20	B