NEST Physics Sample Paper – 6

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 resistance of a conductor is found from $R = \dfrac{V}{I}$. In a measurement the voltage is $V = (10.0 \pm 0.2)$ V and the current is $I = (2.00 \pm 0.01)$ A. The percentage error in the computed value of R is

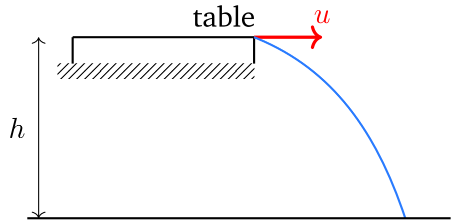
(A) 1.5%

(B) 2.5%

(C) 0.5%

(D) 4.0%

Q2. A ball rolls off the edge of a horizontal table of height $h = 5$ m with a horizontal speed $u = 6\ \mathrm{m\,s^{-1}}$ (take $g = 10\ \mathrm{m\,s^{-2}}$, neglect air resistance). The time to reach the floor and the horizontal distance from the foot of the table are



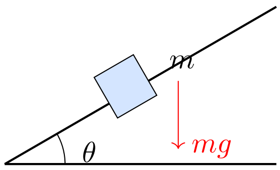
(A) 1 s and 6 m

(B) 2 s and 12 m

(C) 0.5 s and 3 m

(D) 1 s and 3 m

Q3. A block just begins to slide down a rough inclined plane when the angle of inclination is raised to $30°$. The coefficient of static friction between the block and the incline is



(A) $\frac{1}{2}$

(B) $\sqrt{3}$

(C) $\frac{1}{\sqrt{3}}$

(D) $\frac{\sqrt{3}}{2}$

Q4. A bullet of mass 20 g moving with a speed of 100 m s^{-1} strikes a fixed wooden block and penetrates a depth of 10 cm before coming to rest. Assuming the resisting force is constant, its magnitude is

(A) 200 N

(B) 500 N

(C) 2000 N

(D) 1000 N

Q5. A flywheel in the form of a uniform solid disc of mass 20 kg and radius 0.5 m rotates about its central axis at an angular speed of 10 rad s^{-1}. The rotational kinetic energy stored in the flywheel is

(A) 125 J

(B) 250 J

(C) 500 J

(D) 62.5 J

Q6. The acceleration due to gravity at the surface of the Earth is $g = 9.8$ m s^{-2} and the radius of the Earth is $R = 6400$ km. Assuming the Earth to be a uniform sphere, the acceleration due to gravity at a depth of 3200 km below the surface is

(A) 7.35 m s^{-2}

(B) 4.9 m s^{-2}

(C) 2.45 m s^{-2}

(D) 9.8 m s^{-2}

Q7. A soap bubble of radius 1 cm is blown in air. The surface tension of the soap solution is 0.03 N m^{-1}. The excess pressure inside the bubble (over the outside atmospheric pressure) is

(A) 3 Pa

(B) 6 Pa

(C) 12 Pa

(D) 24 Pa

Q8. For one mole of an ideal diatomic gas (rigid molecules), the molar specific heat at constant volume is $C_V = \frac{5}{2}R$. Using $C_P - C_V = R$, the ratio of specific heats $\gamma = \frac{C_P}{C_V}$ is

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

(B) $\frac{3}{2}$

(C) $\frac{4}{3}$

(D) $\frac{7}{5}$

Q9. The root-mean-square speed of the molecules of an ideal gas at an absolute temperature T is v. If the absolute temperature is doubled to $2T$ (the gas remaining the same), the new root-mean-square speed becomes

(A) $4v$

(B) $2v$

(C) $\frac{v}{2}$

(D) $\sqrt{2}\,v$

Q10. A solid cylinder of uniform cross-sectional area A and total mass m floats vertically in a liquid of density ρ. It is pushed down slightly and released, executing simple harmonic motion. The time period of the oscillation is

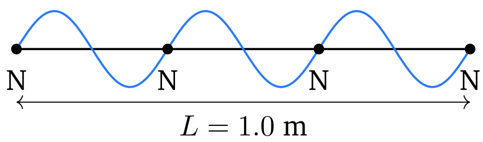
(A) $2\pi\sqrt{\frac{\rho A g}{m}}$

(B) $2\pi\sqrt{\frac{m}{\rho A g}}$

(C) $2\pi\sqrt{\frac{m}{\rho g}}$

(D) $2\pi\sqrt{\frac{A}{m\rho g}}$

Q11. A sonometer wire of length 1.0 m is fixed at both ends and vibrates in its third harmonic (three loops), as shown. The wave speed on the wire is $120\ \text{m s}^{-1}$. The frequency of vibration and the distance between two adjacent nodes are



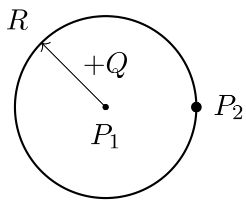
(A) 60 Hz and $\frac{1}{2}$ m

(B) 120 Hz and $\frac{1}{3}$ m

(C) 180 Hz and $\frac{1}{3}$ m

(D) 180 Hz and $\frac{1}{6}$ m

Q12. A hollow conducting sphere of radius $R = 0.1$ m carries a total charge $Q = 2 \times 10^{-9}$ C distributed uniformly on its surface. Take $\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9$ $\mathrm{N\,m^2\,C^{-2}}$. The magnitudes of the electric field at a point P_1 at the centre and at a point P_2 on the surface are, respectively,



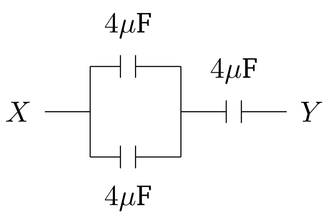
(A) $1800\ \mathrm{N\,C^{-1}}$ and $1800\ \mathrm{N\,C^{-1}}$

(B) $1800\ \mathrm{N\,C^{-1}}$ and 0

(C) $900\ \mathrm{N\,C^{-1}}$ and $1800\ \mathrm{N\,C^{-1}}$

(D) 0 and $1800\ \mathrm{N\,C^{-1}}$

Q13. In the network shown, two $4\,\mu$F capacitors are connected in parallel, and this combination is joined in series with a $4\,\mu$F capacitor across the terminals X and Y. The equivalent capacitance between X and Y is



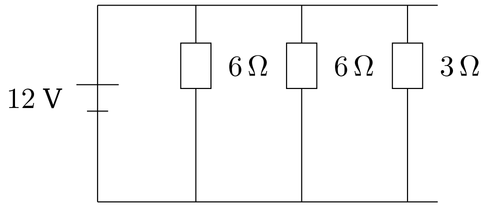
(A) $\frac{8}{3}\,\mu$F

(B) $12\,\mu$F

(C) $4\,\mu$F

(D) $\frac{4}{3}\,\mu$F

Q14. An ideal battery of emf 12 V is connected across a parallel combination of three resistors of $6\,\Omega$, $6\,\Omega$ and $3\,\Omega$, as shown. The total current drawn from the battery is



(A) 6 A

(B) 8 A

(C) 4 A

(D) 12 A

Q15. A proton of mass 1.6×10^{-27} kg and charge 1.6×10^{-19} C moves in a uniform magnetic field of magnitude 0.5 T perpendicular to its velocity. The period of its circular motion (cyclotron period) is closest to

(A) 6.3×10^{-8} s

(B) 2.0×10^{-7} s

(C) 1.3×10^{-7} s

(D) 4.0×10^{-7} s

Q16. A steady current of 4 A flows through an inductor of inductance 0.5 H. The energy stored in the magnetic field of the inductor is

(A) 2 J

(B) 4 J

(C) 8 J

(D) 1 J

Q17. An ideal step-up transformer has 100 turns in its primary coil and 1000 turns in its secondary coil. If the primary is connected to a 220 V AC supply, the output (secondary) voltage is

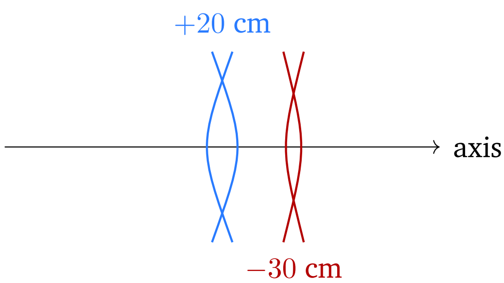
(A) 2200 V

(B) 22 V

(C) 220 V

(D) 1100 V

Q18. Two thin lenses are placed in contact coaxially: a convex lens of focal length $+20$ cm and a concave lens of focal length -30 cm, as shown. The focal length of the combination is



(A) $+50$ cm

(B) -60 cm

(C) $+60$ cm

(D) $+12$ cm

Q19. In a Young's double-slit experiment with light of wavelength $\lambda = 600$ nm, a thin transparent sheet of refractive index $\mu = 1.5$ and thickness $t = 6\,\mu$m is introduced in the path of one of the beams. The fringe pattern shifts by a number of fringes equal to

(A) 15

(B) 10

(C) 7.5

(D) 5

Q20. A single ideal semiconductor diode is connected in series with a load resistor and a sinusoidal AC source, forming a half-wave rectifier. During one full cycle of the input AC, the diode conducts and current flows through the load during

(A) the full cycle $(360°)$

(B) one half of the cycle $(180°)$

(C) one quarter of the cycle $(90°)$

(D) none of the cycle

Detailed Solutions

Q1.

Solution

Concept — Propagation of errors in a quotient: For $R = \frac{V}{I}$, the fractional errors add: $\frac{\Delta R}{R} = \frac{\Delta V}{V} + \frac{\Delta I}{I}$.

Step 1 — Individual fractional errors: $\frac{\Delta V}{V} = \frac{0.2}{10.0} = 0.02$ and $\frac{\Delta I}{I} = \frac{0.01}{2.00} = 0.005$.

Step 2 — Add and convert to percentage: $\frac{\Delta R}{R} = 0.02 + 0.005 = 0.025 = 2.5\%$.

Why other options are wrong:

- (A) 1.5% subtracts the errors instead of adding.
- (C) 0.5% keeps only the current error.
- (D) 4.0% doubles the voltage error contribution.

Final Answer: Percentage error in R is $2.5\% \Rightarrow \boxed{B}$

Answer: (B) Go Back to Q1

Q2.

Solution

Concept — Horizontal projectile: The vertical and horizontal motions are independent. Vertical: $h = \frac{1}{2}gt^2$. Horizontal: $x = u\,t$ at constant speed.

Step 1 — Time to land: $h = \frac{1}{2}gt^2 \Rightarrow 5 = \frac{1}{2}(10)t^2 \Rightarrow t^2 = 1 \Rightarrow t = 1$ s.

Step 2 — Horizontal range: $x = u\,t = 6 \times 1 = 6$ m.

Why other options are wrong:

- (B) 2 s, 12 m uses $h = \frac{1}{2}gt^2$ with a missing factor (e.g. $h = gt^2/4$).
- (C) 0.5 s, 3 m takes $h = gt^2$ (drops the $\frac{1}{2}$).
- (D) 1 s, 3 m has the right time but halves the range.

Final Answer: $t = 1$ s and $x = 6$ m $\Rightarrow \boxed{A}$

Answer: (A) Go Back to Q2

Q3.

Solution

Concept — Angle of repose: The block begins to slide when the angle of inclination equals the angle of repose θ, for which $\mu_s = \tan\theta$.

Step 1 — Apply the condition: At the verge of sliding, $mg\sin\theta = \mu_s\, mg\cos\theta$, hence $\mu_s = \tan\theta$.

Step 2 — Substitute $\theta = 30°$: $\mu_s = \tan 30° = \dfrac{1}{\sqrt{3}} \approx 0.577$.

Why other options are wrong:

- (A) $\frac{1}{2}$ is $\sin 30°$, not $\tan 30°$.
- (B) $\sqrt{3}$ is $\tan 60°$ (uses the wrong angle).
- (D) $\frac{\sqrt{3}}{2}$ is $\cos 30°$, not the tangent.

Final Answer: $\mu_s = \tan 30° = \dfrac{1}{\sqrt{3}} \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q3

Q4.

Solution

Concept — Work–energy theorem: The work done by the resisting force equals the loss of kinetic energy: $F\,d = \frac{1}{2}mv^2$.

Step 1 — Convert units: $m = 20$ g $= 0.02$ kg, $d = 10$ cm $= 0.1$ m, $v = 100\ \text{m s}^{-1}$.

Step 2 — Kinetic energy: $\frac{1}{2}mv^2 = \frac{1}{2}(0.02)(100)^2 = \frac{1}{2}(0.02)(10000) = 100$ J.

Step 3 — Resisting force: $F = \dfrac{\frac{1}{2}mv^2}{d} = \dfrac{100}{0.1} = 1000$ N.

Why other options are wrong:

- (A) 200 N uses mv (momentum) divided by d incorrectly.
- (B) 500 N halves the kinetic energy a second time.
- (C) 2000 N forgets the factor $\frac{1}{2}$ in the kinetic energy.

Final Answer: $F = 1000$ N $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q4

Q5.

Solution

Concept — Rotational kinetic energy: $KE_{\text{rot}} = \frac{1}{2}I\omega^2$. For a uniform solid disc about its central axis, $I = \frac{1}{2}MR^2$.

Step 1 — Moment of inertia: $I = \frac{1}{2}(20)(0.5)^2 = \frac{1}{2}(20)(0.25) = 2.5\ \text{kg m}^2$.

Step 2 — Rotational KE: $KE = \frac{1}{2}I\omega^2 = \frac{1}{2}(2.5)(10)^2 = \frac{1}{2}(2.5)(100) = 125$ J.

Why other options are wrong:

- (B) 250 J uses $I = MR^2$ (a ring, not a disc).
- (C) 500 J forgets both factors of $\frac{1}{2}$.
- (D) 62.5 J halves the kinetic energy once too often.

Final Answer: $KE_{\text{rot}} = 125$ J $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q5

Q6.

Solution

Concept — Gravity below the surface: For a uniform Earth, $g_d = g\left(1 - \dfrac{d}{R}\right)$, since only the mass within radius $(R - d)$ contributes.

Step 1 — Substitute: $d = 3200$ km, $R = 6400$ km, so $\dfrac{d}{R} = \dfrac{3200}{6400} = \dfrac{1}{2}$.

Step 2 — Compute: $g_d = 9.8\left(1 - \frac{1}{2}\right) = 9.8 \times 0.5 = 4.9\ \text{m s}^{-2}$.

Why other options are wrong:

- (A) $7.35\ \text{m s}^{-2}$ uses $d/R = \frac{1}{4}$.
- (C) $2.45\ \text{m s}^{-2}$ uses $d/R = \frac{3}{4}$.
- (D) $9.8\ \text{m s}^{-2}$ ignores the depth correction entirely.

Final Answer: $g_d = 4.9\ \text{m s}^{-2} \Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q6

Q7.

Solution

Concept — Excess pressure in a soap bubble: A soap bubble has *two* liquid surfaces, so the excess pressure is $\Delta P = \frac{4T}{r}$ (compared with $\frac{2T}{r}$ for a single-surface drop).

Step 1 — Convert radius: $r = 1$ cm $= 0.01$ m.

Step 2 — Substitute: $\Delta P = \frac{4T}{r} = \frac{4(0.03)}{0.01} = \frac{0.12}{0.01} = 12$ Pa.

Why other options are wrong:

- (A) 3 Pa uses $\frac{T}{r}$ only.
- (B) 6 Pa uses $\frac{2T}{r}$ (treats it as a single-surface drop).
- (D) 24 Pa uses $\frac{8T}{r}$ (an extra factor of 2).

Final Answer: $\Delta P = 12$ Pa $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q7

Q8.

Solution

Concept — Specific heats of an ideal gas: Mayer's relation gives $C_P = C_V + R$, and $\gamma = \frac{C_P}{C_V}$.

Step 1 — Find C_P: $C_P = C_V + R = \frac{5}{2}R + R = \frac{7}{2}R$.

Step 2 — Ratio: $\gamma = \frac{C_P}{C_V} = \frac{\frac{7}{2}R}{\frac{5}{2}R} = \frac{7}{5} = 1.4$.

Why other options are wrong:

- (A) $\frac{5}{3}$ is γ for a monatomic gas ($C_V = \frac{3}{2}R$).
- (B) $\frac{3}{2}$ does not correspond to any standard ideal-gas value here.
- (C) $\frac{4}{3}$ applies to a polyatomic gas with more degrees of freedom.

Final Answer: $\gamma = \frac{7}{5} \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q8

Q9.

Solution

Concept — RMS speed and temperature: $v_{\text{rms}} = \sqrt{\frac{3RT}{M}} \propto \sqrt{T}$ for a fixed gas.

Step 1 — Ratio of speeds: $\frac{v'}{v} = \sqrt{\frac{2T}{T}} = \sqrt{2}$.

Step 2 — New speed: $v' = \sqrt{2}\, v \approx 1.41\, v$.

Why other options are wrong:

- (A) $4v$ would require temperature scaling as v^2 wrongly applied (a factor of 16).
- (B) $2v$ assumes $v \propto T$ instead of $\sqrt{T}$.
- (C) $\frac{v}{2}$ has the dependence inverted.

Final Answer: $v' = \sqrt{2}\, v \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q9

Q10.

Solution

Concept — SHM of a floating body: When pushed down by x, the extra buoyant restoring force is $F = -(\rho A g)x$, an effective spring constant $k = \rho A g$.

Step 1 — Effective spring constant: A displacement x submerges extra volume Ax; restoring force $= \rho(Ax)g$, so $k = \rho A g$.

Step 2 — Period: $T = 2\pi\sqrt{\frac{m}{k}} = 2\pi\sqrt{\frac{m}{\rho A g}}$.

Why other options are wrong:

- (A) inverts m and k inside the root (wrong dimensions for period).
- (C) drops the area A from the restoring force.
- (D) places m and A on the wrong sides of the fraction.

Final Answer: $T = 2\pi\sqrt{\frac{m}{\rho A g}} \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q10

Q11.

Solution

Concept — Standing wave on a fixed string: The nth harmonic has frequency $f_n = \frac{nv}{2L}$, and the wire is divided into n loops with adjacent nodes a half-wavelength apart.

Step 1 — Frequency (third harmonic, $n = 3$): $f_3 = \frac{3v}{2L} = \frac{3(120)}{2(1.0)} = \frac{360}{2} = 180$ Hz.

Step 2 — Node spacing: With 3 loops in 1.0 m, each loop is $\frac{L}{3} = \frac{1}{3}$ m; adjacent nodes are exactly one loop apart, so the node spacing is $\frac{1}{3}$ m.

Why other options are wrong:

- (A) 60 Hz, $\frac{1}{2}$ m corresponds to the fundamental, not the third harmonic.
- (B) 120 Hz uses $n = 2$ for the frequency.
- (D) $\frac{1}{6}$ m halves the node spacing (confuses node spacing with half a loop).

Final Answer: $f_3 = 180$ Hz and node spacing $= \frac{1}{3}$ m $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q11

Q12.

Solution

Concept — Field of a charged conducting shell: Inside a uniformly charged conducting shell the field is zero; on (and just outside) the surface it equals $E = \frac{1}{4\pi\varepsilon_0}\frac{Q}{R^2}$.

Step 1 — At the centre P_1: The enclosed charge is zero, so $E_{P_1} = 0$.

Step 2 — At the surface P_2:

$$E_{P_2} = \frac{(9 \times 10^9)(2 \times 10^{-9})}{(0.1)^2} = \frac{18}{0.01} = 1800\ \mathrm{N\,C^{-1}}.$$

Why other options are wrong:

- (A) takes the inside field as 1800, but inside a conductor the field is zero.
- (B) reverses the two points (zero outside, non-zero at centre).
- (C) uses $\frac{1}{2}$ of the surface field at P_2 and a non-zero centre value.

Final Answer: $E_{P_1} = 0$ and $E_{P_2} = 1800\ \mathrm{N\,C^{-1}} \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q12

Q13.

Solution

Concept — Series and parallel capacitors: Parallel capacitances add; series capacitances combine reciprocally.

Step 1 — Parallel pair: $C_{\parallel} = 4 + 4 = 8\,\mu\text{F}$.

Step 2 — Series with the third capacitor:

$$\frac{1}{C_{\text{eq}}} = \frac{1}{8} + \frac{1}{4} = \frac{1}{8} + \frac{2}{8} = \frac{3}{8} \Rightarrow C_{\text{eq}} = \frac{8}{3}\,\mu\text{F} \approx 2.67\,\mu\text{F}.$$

Why other options are wrong:

- (B) $12\,\mu$F adds all three as if purely parallel.
- (C) $4\,\mu$F ignores the series combination.
- (D) $\frac{4}{3}\,\mu$F treats all three in series.

Final Answer: $C_{\text{eq}} = \frac{8}{3}\,\mu\text{F} \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q13

Q14.

Solution

Concept — Resistors in parallel: The reciprocal of the equivalent resistance is the sum of reciprocals; the total current is then $I = \frac{V}{R_{\text{eq}}}$.

Step 1 — Equivalent resistance:

$$\frac{1}{R_{\text{eq}}} = \frac{1}{6} + \frac{1}{6} + \frac{1}{3} = \frac{1}{6} + \frac{1}{6} + \frac{2}{6} = \frac{4}{6} = \frac{2}{3} \Rightarrow R_{\text{eq}} = \frac{3}{2} = 1.5\,\Omega.$$

Step 2 — Total current: $I = \frac{V}{R_{\text{eq}}} = \frac{12}{1.5} = 8$ A. (Check: branch currents $2+2+4 = 8$ A. ✓)

Why other options are wrong:

- (A) 6 A uses $R_{\text{eq}} = 2\,\Omega$ (wrong combination).
- (C) 4 A is the current in the $3\,\Omega$ branch alone.

- (D) 12 A uses $R_{\text{eq}} = 1\,\Omega$.

Final Answer: $I = 8$ A $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q14

Q15.

Solution

Concept — Cyclotron period: A charged particle in a magnetic field circles with period $T = \dfrac{2\pi m}{qB}$, independent of its speed.

Step 1 — Substitute:

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

Step 2 — Simplify: $\dfrac{1.6 \times 10^{-27}}{1.6 \times 10^{-19}} = 10^{-8}$, so $T = \dfrac{2\pi \times 10^{-8}}{0.5} = 4\pi \times 10^{-8} \approx 1.3 \times 10^{-7}$ s.

Why other options are wrong:

- (A) 6.3×10^{-8} s ($2\pi \times 10^{-8}$) forgets to divide by $B = 0.5$.
- (B) 2.0×10^{-7} s misplaces the factor 2π.
- (D) 4.0×10^{-7} s overcounts by an extra factor of about 3.

Final Answer: $T = 4\pi \times 10^{-8} \approx 1.3 \times 10^{-7}$ s $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q15

Q16.

Solution

Concept — Energy stored in an inductor: A current I through an inductance L stores magnetic energy $U = \frac{1}{2}LI^2$.

Step 1 — Substitute: $U = \frac{1}{2}(0.5)(4)^2$.

Step 2 — Compute: $U = \frac{1}{2}(0.5)(16) = \frac{1}{2}(8) = 4$ J.

Why other options are wrong:

- (A) 2 J uses $\frac{1}{2}LI$ (forgets to square the current).
- (C) 8 J forgets the factor $\frac{1}{2}$.
- (D) 1 J halves the energy once too often.

Final Answer: $U = 4\text{ J} \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q16

Q17.

Solution

Concept — Ideal transformer: The voltages are in the ratio of the turns: $\frac{V_s}{V_p} = \frac{N_s}{N_p}$.

Step 1 — Turns ratio: $\frac{N_s}{N_p} = \frac{1000}{100} = 10$.

Step 2 — Secondary voltage: $V_s = V_p \times \frac{N_s}{N_p} = 220 \times 10 = 2200$ V.

Why other options are wrong:

- (B) 22 V inverts the ratio (a step-down result).
- (C) 220 V ignores the turns ratio.
- (D) 1100 V uses a turns ratio of 5.

Final Answer: $V_s = 2200\text{ V} \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q17

Q18.

Solution

Concept — Thin lenses in contact: The powers add, $\frac{1}{F} = \frac{1}{f_1} + \frac{1}{f_2}$, using signed focal lengths.

Step 1 — Combine:

$$\frac{1}{F} = \frac{1}{20} + \frac{1}{-30} = \frac{3}{60} - \frac{2}{60} = \frac{1}{60}.$$

Step 2 — Focal length: $F = +60$ cm (a net converging combination).

Why other options are wrong:

- (A) $+50$ cm comes from adding focal lengths directly $(20 + 30)$ instead of powers.
- (B) -60 cm uses the wrong overall sign (would be diverging).

- (D) $+12$ cm adds the powers as $\frac{1}{20} + \frac{1}{30}$ (both taken positive).

Final Answer: $F = +60$ cm $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q18

Q19.

Solution

Concept — Fringe shift due to a thin sheet: Inserting a sheet of refractive index μ and thickness t introduces an extra optical path $(\mu - 1)t$, shifting the pattern by $N = \dfrac{(\mu-1)t}{\lambda}$ fringes.

Step 1 — Extra optical path: $(\mu - 1)t = (1.5 - 1)(6 \times 10^{-6}) = 0.5 \times 6 \times 10^{-6} = 3 \times 10^{-6}$ m.

Step 2 — Number of fringes: $N = \dfrac{(\mu-1)t}{\lambda} = \dfrac{3 \times 10^{-6}}{600 \times 10^{-9}} = \dfrac{3 \times 10^{-6}}{6 \times 10^{-7}} = 5$.

Why other options are wrong:

- (A) 15 uses μt instead of $(\mu - 1)t$.
- (B) 10 uses $(\mu - 1)t$ but with $\lambda = 300$ nm.
- (C) 7.5 uses $(\mu - 1) = 0.75$ instead of 0.5.

Final Answer: The pattern shifts by 5 fringes $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q19

Q20.

Solution

Concept — Half-wave rectifier: A single diode conducts only when it is forward biased. For a sinusoidal input it is forward biased during one half of each cycle and blocks the other half.

Step 1 — Forward-biased half: During the half-cycle when the source makes the anode positive relative to the cathode, the diode conducts and current flows through the load.

Step 2 — Reverse-biased half: During the other half-cycle the diode is reverse biased and no current flows. Hence conduction lasts for 180° of the 360° cycle.

Why other options are wrong:

- (A) 360° describes a full-wave rectifier output, not half-wave conduction by one diode.

- (C) $90°$ has no physical basis for an ideal diode on a sine input.
- (D) "none" would mean the diode never conducts, which is wrong.

Final Answer: The diode conducts for one half of the cycle $(180°) \Rightarrow \boxed{B}$

Answer: (B) Go Back to Q20

Answer Key

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