JELET Physics Sample Paper – 11

Duration: 35 Minutes **Maximum Marks: 35**

Instructions

- This paper contains **30 questions** modelled on the Physics portion of **JELET** (WBJEEB Joint Entrance for Lateral Entry). The exam is **OMR-based.**
- **Questions 1–25 (Category I)** are single-correct MCQs. Each correct answer carries **+1 mark**; $\frac{1}{4}$ **mark is deducted** for every wrong answer. Only one option is correct.
- **Questions 26–30 (Category II)** may have **one or more** correct options. Marking **all** correct options earns **+2 marks**; partial credit applies when only some correct options are marked and no wrong option is marked. **There is no negative marking** in Category II, but marking any incorrect option gives **zero** for that question.
- Personal calculators, log tables, mobile phones, and other electronic gadgets are strictly prohibited.

Q1. The coefficient of viscosity of a liquid has the same dimensional formula as which of the following choices?

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

(B) $[MLT^{-2}]$

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

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

Q2. Which one of the following pairs of physical quantities has the *same* dimensions?

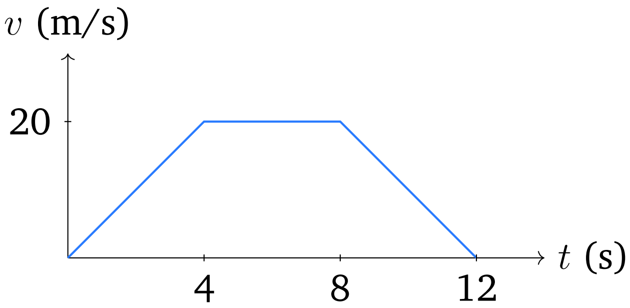
(A) Force and linear momentum

(B) Work and torque

(C) Pressure and force

(D) Impulse and kinetic energy

Q3. The velocity–time graph of a body moving in a straight line is shown below. The total distance travelled by the body in the 12 s interval is:



(A) 120 m

(B) 140 m

(C) 160 m

(D) 200 m

Q4. A stone is dropped from rest at the top of a tower and reaches the ground in 4 s. Taking $g = 10$ m/s^2, the height of the tower is:

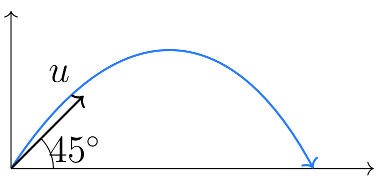
(A) 20 m

(B) 40 m

(C) 60 m

(D) 80 m

Q5. A projectile is launched with a speed of 20 m/s at 45° to the horizontal, as shown. Taking $g = 10$ m/s^2, its maximum height is:



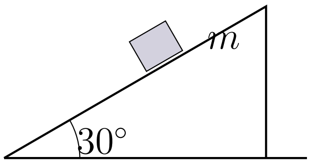
(A) 10 m

(B) 20 m

(C) 30 m

(D) 40 m

Q6. A block is released from rest on a smooth (frictionless) inclined plane of inclination $30°$, as shown. Taking $g = 10$ m/s^2, its acceleration down the incline is:



(A) 2.5 m/s^2

(B) 5 m/s^2

(C) 7.5 m/s^2

(D) 10 m/s^2

Q7. A constant force of 10 N acts on a body of mass 2 kg, initially at rest, for 3 s. The speed acquired by the body is:

(A) 5 m/s

(B) 10 m/s

(C) 15 m/s

(D) 30 m/s

Q8. A body of mass 5 kg is raised slowly to a height of 4 m above the ground. Taking $g = 10$ m/s^2, the gain in its gravitational potential energy is:

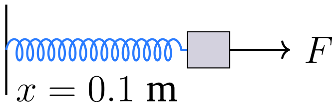
(A) 50 J

(B) 100 J

(C) 150 J

(D) 200 J

Q9. A spring of force constant $k = 200$ N/m is stretched slowly by $x = 0.1$ m by an external force, as shown. The work done in stretching the spring is:



(A) 1 J

(B) 2 J

(C) 5 J

(D) 10 J

Q10. At the surface of the Earth $g = 10$ m/s^2. At a height equal to the radius of the Earth above its surface, the acceleration due to gravity is:

(A) 1.25 m/s^2

(B) 2.5 m/s^2

(C) 5 m/s^2

(D) 10 m/s^2

Q11. A body weighs 100 N on the surface of the Earth. Assuming uniform density, its weight at a depth equal to half the radius of the Earth (measured from the surface) is:

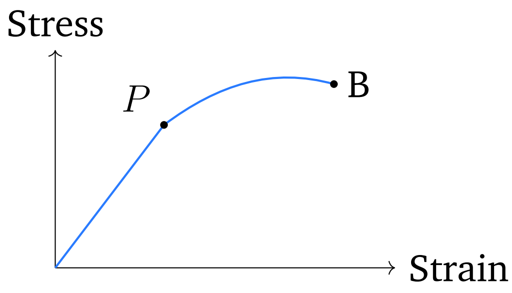
(A) 100 N

(B) 75 N

(C) 50 N

(D) 25 N

Q12. The stress–strain curve for a metal wire is shown. The point P, at the end of the straight-line portion, marks the limit up to which Hooke's law is obeyed. This point is called the:



(A) yield point

(B) breaking point

(C) elastic limit

(D) proportional limit

Q13. A wire of length 4 m and cross-sectional area 2×10^{-6} m^2 is made of a material of Young's modulus 2×10^{11} Pa. The extension produced by a stretching force of 200 N is:

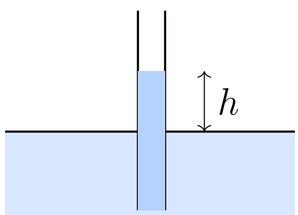
(A) 2 mm

(B) 1 mm

(C) 0.5 mm

(D) 4 mm

Q14. A liquid rises to a height h in a capillary tube of radius r, as shown. If a second capillary tube of radius $r/2$ (same liquid) is used, the height to which the liquid rises becomes:



(A) half of h

(B) double of h

(C) one-fourth of h

(D) four times h

Q15. The surface tension of a soap solution is 0.03 N/m. The excess pressure inside a soap bubble of radius 2 mm formed from this solution is:

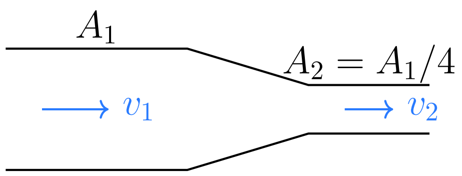
(A) 15 Pa

(B) 30 Pa

(C) 60 Pa

(D) 120 Pa

Q16. Water flows steadily through a horizontal pipe whose cross-sectional area narrows to one-fourth of its initial value, as shown. If the speed in the wider part is 2 m/s, the speed in the narrow part is:



(A) 0.5 m/s

(B) 2 m/s

(C) 4 m/s

(D) 8 m/s

Q17. A solid block floats in water with one-fourth of its volume above the surface. The density of the block is (density of water $= 1000$ kg/m^3):

(A) 750 kg/m^3

(B) 250 kg/m^3

(C) 1000 kg/m^3

(D) 333 kg/m^3

Q18. A metal rod of length 1 m has a linear expansion coefficient $\alpha = 2 \times 10^{-5}$ °C^{-1}. When its temperature rises by 100 °C, the increase in its length is:

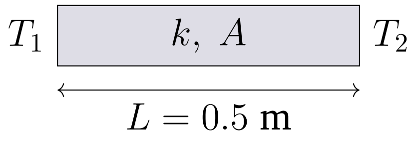
(A) 0.5 mm

(B) 1 mm

(C) 2 mm

(D) 4 mm

Q19. A metal slab of thermal conductivity $k = 200$ W m^{-1}K^{-1}, cross-sectional area $A = 1 \times 10^{-4}$ m^2 and length $L = 0.5$ m has its ends maintained at a temperature difference of 100 K, as shown. The steady rate of heat conduction through it is:



(A) 2 W

(B) 4 W

(C) 8 W

(D) 16 W

Q20. A black body radiates energy at a certain rate at an absolute temperature T. If its absolute temperature is doubled to $2T$, the rate at which it radiates energy becomes:

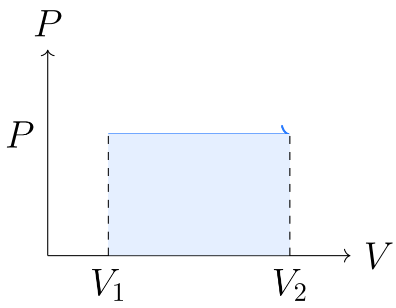
(A) 2 times

(B) 4 times

(C) 8 times

(D) 16 times

Q21. An ideal gas expands at constant pressure $P = 2 \times 10^5$ Pa from volume 1×10^{-3} m^3 to 3×10^{-3} m^3, as shown on the P–V diagram. The work done by the gas is:



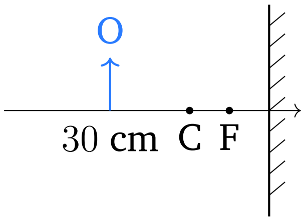
(A) 100 J

(B) 200 J

(C) 400 J

(D) 600 J

Q22. An object is placed 30 cm in front of a concave mirror of focal length 20 cm, as shown. The distance of the image from the mirror is:



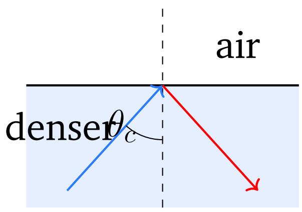
(A) 60 cm

(B) 12 cm

(C) 30 cm

(D) 10 cm

Q23. Light travelling inside a medium of refractive index 1.5 strikes the boundary with air, as shown, and undergoes total internal reflection. The critical angle θ_c for this medium is:



(A) $\sin^{-1}(0.50)$

(B) $\sin^{-1}(0.67)$

(C) $\sin^{-1}(1.50)$

(D) $\sin^{-1}(0.33)$

Q24. A thin convex lens has a focal length of 25 cm. The power of the lens is:

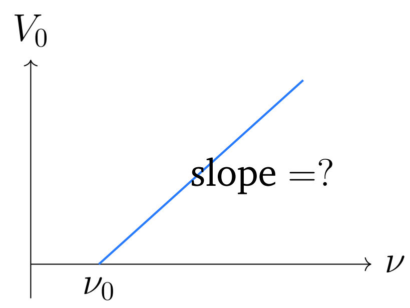
(A) $+25$ D

(B) $+0.25$ D

(C) $+2$ D

(D) $+4$ D

Q25. In a photoelectric experiment, the stopping potential V_0 is plotted against the frequency ν of the incident light, giving the straight line shown. The slope of this line equals:



(A) h (Planck's constant)

(B) the work function ϕ

(C) h/e

(D) e/h

Q26. **[MSQ: one or more options may be correct]**

Which of the following statements about friction are correct?

(A) The maximum (limiting) static friction can be greater than the kinetic friction between the same surfaces.

(B) Limiting friction is independent of the apparent area of contact.

(C) Kinetic friction increases appreciably with the relative speed of sliding.

(D) The coefficient of friction between two surfaces can have a value greater than 1.

Q27. [MSQ: one or more options may be correct]

Regarding total internal reflection of light, which of the following statements are correct?

(A) It can occur only when light travels from an optically denser medium to a rarer medium.

(B) The angle of incidence must be greater than the critical angle.

(C) Optical fibres transmit light using this phenomenon.

(D) It can occur when light travels from a rarer medium to a denser medium.

Q28. [MSQ: one or more options may be correct]

For an ideal gas undergoing an *adiabatic* process, which of the following are correct?

(A) No heat is exchanged with the surroundings.

(B) The change in internal energy equals the negative of the work done by the gas.

(C) The temperature of the gas remains constant.

(D) $PV^\gamma =$ constant, where γ is the ratio of specific heats.

Q29. [MSQ: one or more options may be correct]

Which of the following statements about a thin convex (converging) lens are correct?

(A) It can form a virtual, erect and magnified image when the object lies between the lens and its focus.

(B) It always forms a real image, whatever the position of the object.

(C) Its power is positive.

(D) For an object placed at twice the focal length, the image is real, inverted and of the same size as the object.

Q30. **[MSQ: one or more options may be correct]**

Which of the following statements about the photoelectric effect are correct?

(A) The maximum kinetic energy of the emitted photoelectrons increases with the frequency of the incident light.

(B) For light above the threshold frequency, the photoelectric current increases with the intensity of the light.

(C) There is a threshold frequency below which no emission occurs, however intense the light.

(D) The stopping potential depends on the intensity of the incident light.

Detailed Solutions

Q1.

Solution

Concept — Dimensional analysis of viscosity: The viscous force is $F = \eta A \dfrac{dv}{dx}$, so $\eta = \dfrac{F}{A\,(dv/dx)}$.

Step 1 — Substitute dimensions: $[F] = MLT^{-2}$, $[A] = L^2$, velocity gradient $\left[\frac{dv}{dx}\right] = \dfrac{LT^{-1}}{L} = T^{-1}$.

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

Why other options are wrong:

- (B) MLT^{-2} is force. (C) $ML^{-1}T^{-2}$ is pressure/stress. (D) ML^2T^{-1} is angular momentum.

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

Answer: (A) Go Back to Q1

Q2.

Solution

Concept — Same dimensions: Two quantities share dimensions only when their defining products of M, L, T match.

Step 1 — Work and torque: Work = force × distance = ML^2T^{-2}. Torque = force × perpendicular distance = ML^2T^{-2}. They are dimensionally identical (though physically different).

Step 2 — Check the rest: Force MLT^{-2} vs momentum MLT^{-1} (differ). Pressure $ML^{-1}T^{-2}$ vs force MLT^{-2} (differ). Impulse MLT^{-1} vs kinetic energy ML^2T^{-2} (differ).

Why other options are wrong: Only (B) gives an exact dimensional match; the others differ in the powers of L and/or T.

Final Answer: Work and torque $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q2

Q3.

Solution

Concept — Distance from a v–t graph: The distance travelled equals the area between the graph and the time axis.

Step 1 — Split the area: The graph is a triangle (0–4 s), a rectangle (4–8 s), and a triangle (8–12 s), all above the axis, with peak speed 20 m/s.

Step 2 — Add the areas: $\frac{1}{2}(4)(20) + (4)(20) + \frac{1}{2}(4)(20) = 40 + 80 + 40 = 160$ m.

Why other options are wrong: 120 m and 140 m omit one of the triangular areas; 200 m treats both ramps as full rectangles.

Final Answer: Distance $= 160$ m $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q3

Q4.

Solution

Concept — Free fall from rest: With zero initial velocity, $h = \frac{1}{2}gt^2$.

Step 1 — Substitute: $h = \frac{1}{2}(10)(4)^2 = \frac{1}{2}(10)(16)$.

Step 2 — Evaluate: $h = 80$ m.

Why other options are wrong: They follow from using $t = 2$ or 3 s, or from dropping the factor of $\frac{1}{2}$.

Final Answer: Height $= 80$ m $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q4

Q5.

Solution

Concept — Maximum height of a projectile: $H = \dfrac{u^2 \sin^2\theta}{2g}$.

Step 1 — Use $\theta = 45°$: $\sin 45° = \frac{1}{\sqrt{2}}$, so $\sin^2 45° = \frac{1}{2}$.

Step 2 — Substitute: $H = \dfrac{(20)^2(1/2)}{2(10)} = \dfrac{200}{20} = 10$ m.

Why other options are wrong: 20 m uses $\sin^2\theta = 1$; 40 m is the horizontal range, not the height.

Final Answer: $H = 10$ m $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q5

Q6.

Solution

Concept — Block on a smooth incline: The only force along the incline is the gravity component $mg\sin\theta$, so $a = g\sin\theta$ (mass cancels).

Step 1 — Substitute: $a = 10 \times \sin 30° = 10 \times 0.5$.

Step 2 — Evaluate: $a = 5$ m/s^2.

Why other options are wrong: 10 m/s^2 is free fall ($\theta = 90°$); 2.5 and 7.5 do not correspond to $\sin 30°$.

Final Answer: $a = 5$ m/s$^2 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q6

Q7.

Solution

Concept — Newton's second law: $a = F/m$, then $v = u + at$ with $u = 0$.

Step 1 — Acceleration: $a = \frac{10}{2} = 5$ m/s^2.

Step 2 — Final speed: $v = 0 + (5)(3) = 15$ m/s.

Why other options are wrong: 30 m/s comes from using impulse as if it were speed; 5 and 10 use the wrong time or acceleration.

Final Answer: $v = 15$ m/s $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q7

Q8.

Solution

Concept — Gravitational potential energy: $\Delta U = mgh$.

Step 1 — Substitute: $\Delta U = (5)(10)(4)$.

Step 2 — Evaluate: $\Delta U = 200$ J.

Why other options are wrong: They follow from using $g = 5$, halving the height, or omitting a factor.

Final Answer: $\Delta U = 200$ J $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q8

Q9.

Solution

Concept — Elastic potential energy of a spring: Work done $= \frac{1}{2}kx^2$.

Step 1 — Substitute: $W = \frac{1}{2}(200)(0.1)^2 = \frac{1}{2}(200)(0.01)$.

Step 2 — Evaluate: $W = 1$ J.

Why other options are wrong: 2 J uses $W = kx^2$ (no $\frac{1}{2}$); 5 and 10 J mis-square x.

Final Answer: $W = 1$ J $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q9

Q10.

Solution

Concept — Variation of g with height: $g' = g\left(\frac{R}{R+h}\right)^2$.

Step 1 — Put $h = R$: $g' = g\left(\frac{R}{2R}\right)^2 = g \times \frac{1}{4}$.

Step 2 — Evaluate: $g' = \frac{10}{4} = 2.5$ m/s^2.

Why other options are wrong: 5 m/s^2 uses $g/2$ (linear, wrong); 1.25 uses $g/8$; 10 ignores the height.

Final Answer: $g' = 2.5$ m/s^2 $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q10

Q11.

Solution

Concept — Variation of g with depth: For a uniform Earth, $g_d = g\left(1 - \frac{d}{R}\right)$; weight $= mg_d$.

Step 1 — Put $d = R/2$: $g_d = g\left(1 - \frac{1}{2}\right) = \frac{g}{2}$.

Step 2 — Scale the weight: Surface weight $= 100$ N, so weight at this depth $= 100 \times \frac{1}{2} = 50$ N.

Why other options are wrong: 25 N uses $g/4$ (the height law, not the depth law); 75 N uses $d/R = 1/4$.

Final Answer: Weight $= 50$ N $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q11

Q12.

Solution

Concept — Stress–strain curve: Along the initial straight line, stress is directly proportional to strain (Hooke's law). The point where this proportionality ends is the *proportional limit*.

Step 1 — Identify P: P sits at the end of the linear region, so it is exactly the limit up to which Hooke's law holds.

Step 2 — Order of the points: proportional limit $\rightarrow$ elastic limit $\rightarrow$ yield point $\rightarrow$ breaking point B.

Why other options are wrong: The elastic limit lies just beyond P (material still returns to shape but the line is no longer straight); the yield and breaking points come later.

Final Answer: Proportional limit $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q12

Q13.

Solution

Concept — Young's modulus: $Y = \dfrac{FL}{A\,\Delta L} \Rightarrow \Delta L = \dfrac{FL}{AY}$.

Step 1 — Substitute: $\Delta L = \dfrac{(200)(4)}{(2 \times 10^{-6})(2 \times 10^{11})}$.

Step 2 — Evaluate: Denominator $= 4 \times 10^5$; $\Delta L = \dfrac{800}{4 \times 10^5} = 2 \times 10^{-3}$ m $= 2$ mm.

Why other options are wrong: 1 mm and 0.5 mm drop a factor; 4 mm doubles the length wrongly.

Final Answer: $\Delta L = 2$ mm $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q13

Q14.

Solution

Concept — Capillary rise: $h = \dfrac{2T\cos\theta}{r\rho g}$, so for a given liquid $h \propto \dfrac{1}{r}$.

Step 1 — Halve the radius: Replacing r by $r/2$ multiplies h by 2.

Step 2 — Conclusion: The rise becomes $2h$.

Why other options are wrong: $h \propto 1/r$, not $1/r^2$, so the rise cannot become one-fourth or four times; halving r raises the column, it does not lower it.

Final Answer: Rise $= 2h \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q14

Q15.

Solution

Concept — Excess pressure in a soap bubble: A soap bubble has two surfaces, so $\Delta P = \dfrac{4T}{r}$.

Step 1 — Substitute: $\Delta P = \dfrac{4(0.03)}{2 \times 10^{-3}} = \dfrac{0.12}{0.002}$.

Step 2 — Evaluate: $\Delta P = 60$ Pa.

Why other options are wrong: 30 Pa uses $\dfrac{2T}{r}$ (a single liquid surface, like a drop); 15 Pa uses $\dfrac{T}{r}$; 120 Pa doubles wrongly.

Final Answer: $\Delta P = 60$ Pa $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q15

Q16.

Solution

Concept — Equation of continuity: For an incompressible fluid, $A_1 v_1 = A_2 v_2$.

Step 1 — Use $A_2 = A_1/4$: $v_2 = \dfrac{A_1}{A_2} v_1 = 4v_1$.

Step 2 — Substitute: $v_2 = 4 \times 2 = 8$ m/s.

Why other options are wrong: 0.5 m/s divides instead of multiplies; 4 m/s uses an area ratio of 2; 2 m/s ignores the narrowing.

Final Answer: $v_2 = 8$ m/s $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q16

Q17.

Solution

Concept — Floating (Archimedes): A floating body has weight equal to the buoyant force, so $\frac{\rho_{\text{body}}}{\rho_{\text{water}}}$ = fraction of volume submerged.

Step 1 — Submerged fraction: One-fourth is above water, so $\frac{3}{4}$ is submerged.

Step 2 — Density: $\rho_{\text{body}} = \frac{3}{4} \times 1000 = 750$ kg/m^3.

Why other options are wrong: 250 uses the fraction above water; 1000 would just float level; 333 has no physical basis here.

Final Answer: $\rho_{\text{body}} = 750$ kg/m^3 $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q17

Q18.

Solution

Concept — Linear thermal expansion: $\Delta L = L\alpha\,\Delta T$.

Step 1 — Substitute: $\Delta L = (1)(2 \times 10^{-5})(100)$.

Step 2 — Evaluate: $\Delta L = 2 \times 10^{-3}$ m $= 2$ mm.

Why other options are wrong: They follow from a wrong power of ten or from halving/doubling ΔT.

Final Answer: $\Delta L = 2$ mm $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q18

Q19.

Solution

Concept — Steady-state conduction: $H = \dfrac{kA\,\Delta T}{L}$.

Step 1 — Substitute: $H = \dfrac{(200)(1\times10^{-4})(100)}{0.5}$.

Step 2 — Evaluate: Numerator $= 2$; $H = \dfrac{2}{0.5} = 4$ W.

Why other options are wrong: 2 W forgets to divide by L; 8 and 16 W use the wrong length or area.

Final Answer: $H = 4$ W $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q19

Q20.

Solution

Concept — Stefan–Boltzmann law: The radiated power $\propto T^4$ (absolute temperature).

Step 1 — Double the temperature: Ratio $= \left(\dfrac{2T}{T}\right)^4 = 2^4$.

Step 2 — Evaluate: $2^4 = 16$.

Why other options are wrong: 2, 4, 8 correspond to powers T^1, T^2, T^3, not the fourth power.

Final Answer: 16 times $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q20

Q21.

Solution

Concept — Work in an isobaric process: At constant pressure, $W = P\,\Delta V$ (the shaded rectangular area under the P–V line).

Step 1 — Change in volume: $\Delta V = (3-1)\times10^{-3} = 2\times10^{-3}$ m^3.

Step 2 — Substitute: $W = (2\times10^5)(2\times10^{-3}) = 400$ J.

Why other options are wrong: 200 J uses $\Delta V = 10^{-3}$; 100 and 600 J use the wrong volume change.

Final Answer: $W = 400\ \text{J} \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q21

Q22.

Solution

Concept — Mirror formula: $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$ (using magnitudes for a real object and a concave mirror).

Step 1 — Substitute: $\frac{1}{v} = \frac{1}{20} - \frac{1}{30} = \frac{3-2}{60} = \frac{1}{60}$.

Step 2 — Solve: $v = 60$ cm (a real image, in front of the mirror).

Why other options are wrong: 30 cm would need the object at F; 12 cm corresponds to $u = 30$ with f used as a converging-lens value; 10 cm has no consistent setup.

Final Answer: $v = 60\ \text{cm} \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q22

Q23.

Solution

Concept — Critical angle: At the critical angle, light refracts at 90° into air, giving $\sin\theta_c = \frac{1}{n}$.

Step 1 — Substitute: $\sin\theta_c = \frac{1}{1.5} \approx 0.67$.

Step 2 — Result: $\theta_c = \sin^{-1}(0.67) \approx 41.8^\circ$.

Why other options are wrong: $\sin^{-1}(1.5)$ is impossible (> 1); $\sin^{-1}(0.5)$ uses $n = 2$; $\sin^{-1}(0.33)$ uses $2/n$.

Final Answer: $\theta_c = \sin^{-1}(0.67) \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q23

Q24.

Solution

Concept — Power of a lens: $P = \dfrac{1}{f \text{ (in metres)}}$, positive for a convex lens.

Step 1 — Convert: $f = 25$ cm $= 0.25$ m.

Step 2 — Evaluate: $P = \dfrac{1}{0.25} = +4$ D.

Why other options are wrong: $+25$ D and $+0.25$ D use f in cm; $+2$ D uses $f = 0.5$ m.

Final Answer: $P = +4$ D $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q24

Q25.

Solution

Concept — Einstein's photoelectric equation: $eV_0 = h\nu - \phi$, so $V_0 = \dfrac{h}{e}\nu - \dfrac{\phi}{e}$.

Step 1 — Compare with $y = mx + c$: Plotting V_0 against ν gives a straight line of slope $\dfrac{h}{e}$.

Step 2 — Interpretation: The slope is the same for every metal (a way to measure Planck's constant); only the intercept $\dfrac{\phi}{e}$ changes.

Why other options are wrong: The slope is h/e, not h alone; ϕ is linked to the intercept; e/h is the inverse.

Final Answer: Slope $= \dfrac{h}{e} \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q25

Q26.

Solution

Concept — Laws of friction: Limiting static friction $f_s^{\max} = \mu_s N$ and kinetic friction $f_k = \mu_k N$, with $\mu_s \geq \mu_k$. Friction depends on the normal force, not on the contact area, and μ is roughly independent of sliding speed.

Step 1 — Test each statement:

- (A) True: $\mu_s \geq \mu_k$, so limiting static friction can exceed kinetic friction.
- (B) True: limiting friction depends on N, not on the apparent contact area.

- (C) False: kinetic friction is taken to be (nearly) independent of the relative speed.
- (D) True: for very rough or clean surfaces, μ can be greater than 1.

Step 2 — Collect correct options: A, B and D.

Final Answer: Correct statements are A, B, D $\Rightarrow$ $\boxed{\text{A, B, D}}$

Answer: (ABD) Go Back to Q26

Q27.

Solution

Concept — Total internal reflection (TIR): TIR occurs only when light goes from a denser to a rarer medium *and* the angle of incidence exceeds the critical angle.

Step 1 — Test each statement:

- (A) True: TIR needs denser-to-rarer travel.
- (B) True: the incidence angle must be greater than θ_c.
- (C) True: optical fibres guide light by repeated TIR.
- (D) False: rarer-to-denser light always refracts (bends towards the normal); no TIR.

Step 2 — Collect correct options: A, B and C.

Final Answer: Correct statements are A, B, C $\Rightarrow$ $\boxed{\text{A, B, C}}$

Answer: (ABC) Go Back to Q27

Q28.

Solution

Concept — Adiabatic process: No heat flows ($Q = 0$). The first law $Q = \Delta U + W$ then gives $\Delta U = -W$, and for an ideal gas $PV^\gamma =$ constant.

Step 1 — Test each statement:

- (A) True: by definition $Q = 0$.
- (B) True: with $Q = 0$, $\Delta U = -W$ (work done *by* the gas).
- (C) False: temperature stays constant in an *isothermal* process, not an adiabatic one.
- (D) True: $PV^\gamma =$ constant is the adiabatic relation.

Step 2 — Collect correct options: A, B and D.

Final Answer: Correct statements are A, B, D ⇒ $\boxed{\text{A, B, D}}$

Answer: (ABD) Go Back to Q28

Q29.

Solution

Concept — Convex (converging) lens: Its focal length and power are positive. The image is real and inverted for objects beyond F, but virtual, erect and magnified when the object lies inside F.

Step 1 — Test each statement:

- (A) True: object between lens and focus gives a virtual, erect, magnified image (magnifying-glass use).
- (B) False: it does not *always* form a real image (see A).
- (C) True: a converging lens has positive power.
- (D) True: object at $2F$ gives a real, inverted, same-size image at $2F$ on the other side.

Step 2 — Collect correct options: A, C and D.

Final Answer: Correct statements are A, C, D ⇒ $\boxed{\text{A, C, D}}$

Answer: (ACD) Go Back to Q29

Q30.

Solution

Concept — Photoelectric effect: $K_{\text{max}} = h\nu - \phi$. The maximum kinetic energy (and stopping potential) depends on frequency, while the current depends on intensity, once ν exceeds the threshold ν_0.

Step 1 — Test each statement:

- (A) True: K_{max} rises with frequency.
- (B) True: above threshold, current grows with intensity (more photons, more electrons).
- (C) True: below the threshold frequency there is no emission, however intense the light.
- (D) False: stopping potential depends on frequency, not on intensity.

Step 2 — Collect correct options: A, B and C.

Final Answer: Correct statements are A, B, C $\Rightarrow$ $\boxed{\text{A, B, C}}$

Answer: (ABC) Go Back to Q30

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	A	2	B	3	C	4	D	5	A
6	B	7	C	8	D	9	A	10	B
11	C	12	D	13	A	14	B	15	C
16	D	17	A	18	C	19	B	20	D
21	C	22	A	23	B	24	D	25	C
26	ABD	27	ABC	28	ABD	29	ACD	30	ABC