# ANSWER KEY

FIRST YEAR HIGHER SECONDARY EXAMINATION JAN 2022

PART-I/II/III

SUBJECT: PHYSICS.

CODE NO: EY-424 VERSION:

60 SCORES 2 HOURS

| Qn. No | Sub Qns | Answer Key/Value Points | Score | Total Score |
|---|---|---|---|---|
| 1 | | (ii) Electrodynamics | 1 | 1 |
| 2. | | (iii) $\vec{V} = \vec{\omega} \times \vec{r}$ | 1 | 1 |
| 3. | | (iv) independent of area of contact | 1 | 1 |
| 4. | | $P = \frac{1}{3} nm \bar{v}^2$ / $\frac{1}{3} \rho \bar{v}^2$ | 1 | 1 |
| 5. | | Any two fundamental forces. | 1 | 1 |
| 6. | | Time second s<br>Electric current ampere A<br>Solid angle steradian sr<br>Amount of substance mole mol | ½ × 4 | 2 |
| 7. | (i) | (i) True | 1 | 2 |
| | (ii) | ii True | 1 | |
| 8. | (a) | power | 1 | 2 |
| | (b) | magnitude and direction (line of action) | ½ × 2 | |
| 9. | | $V = r\omega$ / $r \times \frac{2\pi}{T}$ / $r\, 2\pi\nu$ / $\frac{7 \times 2\pi r}{t}$ | 1 | 2 |
| | | $V = 0.12 \times 2\pi \times \frac{7}{100} = 5.3 \times 10^{-2} ms^{-1}$ $(5.28 \times 10^{-2} ms^{-1})$ | 1 | |
| | | [$\nu = \frac{7}{100}$ or $T = \frac{100}{7}$ give ½ score] | | |

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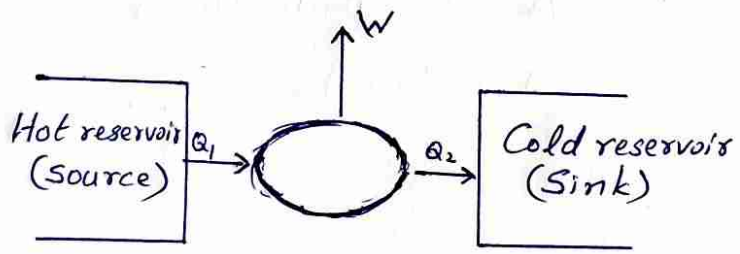
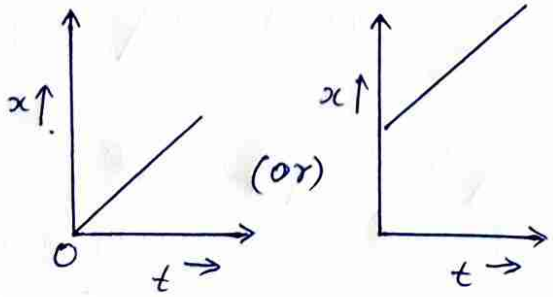
|---|---|---|---|---|
| 10. | | (i) negative (ii) positive<br>(iii) zero (iv) positive | ½ × 4 | 2 |
| 11. | | correct proof of work-energy theorem.<br>(Statement or equation only give 1 score) | 2 | 2 |
| 12 | | Statement or equation of law of gravitation. | 2 | 2. |
| 13. | | Stress = Force / Area / F/A | 1 | 2 |
| | | Definition or equation of strain | 1 | |
| 14. | | Stress - strain curve | 1 | 2 |
| | | marking proportional limit | 1 | |
| 15. | |  | 2 | 2 |
| 16. | | Derivation of $W = \mu R T \ln(\frac{V_2}{V_1})$<br>(equation only give 1 score) | 2 | 2 |
| 17. | (a) | Definition or equation of average velocity | 2 | 3 |
| | (b) |  | 1 | |

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|---|---|---|---|---|
| 18. | | Statement of Newton's second law | 1 | 3 |
| | | Derivation. | 2 | |
| 19. | | Any correct proof<br>(or) ($\tau = \frac{dL}{dt}$ → 1 score) | 3 | 3 |
| 20. | | $F \propto m^x v^y r^z$ / $F = k \cdot m^x v^y r^z$ | 1 | 3 |
| | | $MLT^{-2} = M^x (LT^{-1})^y L^z$ | 1 | |
| | | $F = \frac{mv^2}{r}$ | 1 | |
| 21. | | $(m_1 + m_2) R_{cm} = m_1 r_1 + m_2 r_2$ | 1 | 3 |
| | | correct substitution | 1 | |
| | | 1.24 Å from H or 0.03 Å from Cl | 1 | |
| 22. | | $P = \frac{1}{3} \rho \bar{v}^2$ / $PV = \frac{1}{3} nmV\bar{v}^2$ / $P = \frac{1}{3} nm\bar{v}^2$ | 1 | 3 |
| | | $\frac{3}{2} RT = N \times \frac{1}{2} m\bar{v}^2$ | 1 | |
| | | $\frac{1}{2} m\bar{v}^2 = \frac{3}{2} \frac{R}{N} T$ / $K.E = \frac{3}{2} kT$ / $K.E \propto T$<br>or (Any correct proof 3 score) | 1 | |
| 23. | | Correct derivation | 3 | 3 |
| | | or $g = \frac{GM}{R^2}$ / $g = G \times \frac{4}{3} \pi R \rho$ - 1 score | | |
| | | $g(d) = \frac{4}{3} \pi (R - d) \rho G$ - 1 score | | |

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|---|---|---|---|---|
| 24 | (a) | N- normal reaction f- friction | 1+1 | 3 |
| | (b) | $N\sin\theta$ and $f\cos\theta$ | 1 | |
| 25 | (a) | parabola / figure | 1 | 4 |
| | (b) | correct derivation of $H = \frac{V_0^2 \sin^2\theta}{2g}$ or (fig - 1 score final equation - 1 score) | 3 | |
| 26 | (a) | $T = \frac{2V_0\sin\theta}{g}$ | 1 | 4 |
| | | $= \frac{2 \times 28 \times \sin 30}{9.8}$ | 1 | |
| | | $= 2.9\ s$ | | |
| | (b) | $R = \frac{V_0^2 \sin 2\theta}{g}$ | 1 | |
| | | $R = \frac{28^2 \times \sin 60}{9.8} = 69.3\ m$ | 1 | |
| 27 | (a) | Statement | 1 | 4 |
| | (b) | Impulse = $2mv$ / Impulse = change in momentum | 1 | |
| | | correct substitution | 1 | |
| | | Impulse = $0.6\ Ns\ (kg\ ms^{-1})$ | 1 | |
| 28 | (a) | Statement of law of conservation of energy | 1 | 4 |
| | | correct proof or (fig - 1 score) | 3 | |

| Qn. No | Sub Qns | Answer Key/Value Points | Score | Total Score |
|---|---|---|---|---|
| 29. | (a) | $P = FV$ | 1 | 4 |
| | (b) | (iii) kilowatthour | 1 | |
| | (c) | $P = \frac{w}{t} / \frac{Fs}{t} / \frac{mas}{t} / \frac{m(V_t^2 - V_0^2)}{2t}$ | 1 | |
| | | correct substitution | 1 | |
| | | $P = 8250$ w. | | |
| 30. | (a) | Definition of escape speed | 1 | 4 |
| | (b) | Derivation or (final equation only 1 score) | 3 | |
| 31 | | Proof of Bernoulli's principle (fig - 1 score, statement / eqn. - 1 score) | 4 | 4 |
| 32. | (a) | Hydraulic lift | 1 | 4 |
| | (b) | $P_2 = \frac{mg}{A_2} / \frac{F_1}{A_1} = \frac{F_2}{A_2} / P = F/A$ | 1 | |
| | | $= \frac{3000 \times 9.8}{425 \times 10^{-4}}$ | 2 | |
| | | $= 6.92 \times 10^5$ N/m² or Pa | | |
| 33. | (a) | melting point | 1 | |
| | (b) | True | 1 | |
| | (c) | $Q = mL$ | 1 | |
| | | correct substitution | 1 | |
| | | $L = 3.33 \times 10^5$ J kg$^{-1}$ | | |

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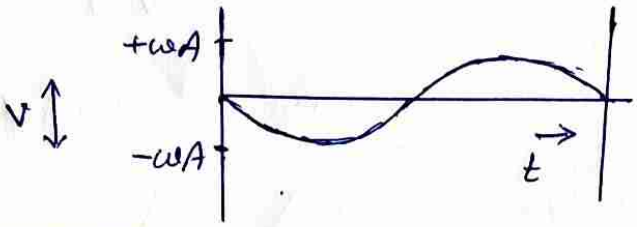
| 34 | (a) |   | 2 | 4 |
| | (b) | $T = 2\pi\sqrt{l/g}$ / $l = \frac{gT^2}{4\pi^2}$ | 1 | |
| | | $l = 99$ cm / 1m | 1 | |
| 35 | (a) | $y = a\sin(kx - \omega t \pm \phi)$ / $y = a\sin(kx - \omega t)$ | 1 | 4 |
| | (b) | $\omega = \frac{2\pi}{T}$ / $2\pi\gamma$ | 1 | |
| | | $k = \frac{2\pi}{\lambda}$ | 1 | |
| | | $\frac{\omega}{k} = \frac{\lambda}{T} = \gamma\lambda$ | 1 | |
| | | (or proof by dimensional method give 3 score) | | |
| 36. | (a) | Homogeneity of dimensions | 1 | 5 |
| | (b) | Any correct pair like speed, velocity / work, torque | 1 | |
| | (c) | $[\frac{1}{2}mv^2] = [ML^2T^{-2}]$ | 1 | |
| | | $[mgh] = [ML^2T^{-2}]$ | 1 | |
| | | dimensionally correct | 1 | |
| 37. | | $V_{(t)} = V_0 + at$ | 1 | 5 |
| | | Velocity - time graph | 2 | |
| | | Derivation of $x = V_0t + \frac{1}{2}at^2$ | 2 | |
| 38. | (a) | Derivation of $V = \sqrt{\mu rg}$ | 3 | 5 |
| | | or (derivation of safe velocity through banked road give 2 score) | | |
| | (b) | $V = \sqrt{\mu rg}$ | 1 | |
| | | $= \sqrt{0.1 \times 20 \times 9.8}$ | | |
| | | $= 4.42\ ms^{-1}$ | 1 | |
| | | since $V = 5\ m/s > V_{max} = 4.42\ ms^{-1}$ car will slip | 1 | |
| | | or $\mu = \frac{v^2}{rg} = 0.127 > 0.1$ car will slip. | | |

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|---|---|---|---|---|
| 39. | (a) | $ML^2$ | 1 | |
| | (b) | statement or eqn $I_z = I_x + I_y$ | 2 | |
| | (c) | $I_d + I_d = \frac{MR^2}{2}$ | 1 | 5 |
| | | $I_d = \frac{MR^2}{4}$ | 1 | |
| | | (or fig only 1 score) | | |
| 40. | (a) | $g = \frac{GM}{R^2}$ | 1 | |
| | (b) | $g_h = \frac{GM}{(R+h)^2}$ | 1 | |
| | | $\frac{mg_h}{mg} = \frac{R^2}{(R+h)^2}$ | 1 | 5 |
| | | $\frac{mg_h}{mg} = \frac{4}{9}$ | 1 | |
| | | $mg_h = \frac{4}{9} \times 63 = 28\,N$ | 1 | |
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