2025 H2 Physics Preliminary Examination Paper 1

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

Qn	Key	guide
1	**B**	Area = $[L]\times[L]$ → 1 SI base unit Charge = $[I] \times[T]$ → 2 SI base units Current = $[I]$ → 1 SI base unit Force = $[M]\times[L]\times[T]^{-2}$ → 3 SI base units
2	**C**	An error is systematic if repeating the measurement under the same conditions yields readings with error of the **same magnitude** and **sign**. i.e. ALL measurements are either bigger or smaller than the true value consistently. Readings with systematic error change in a **predictable** manner depending on the conditions. So to reduce systematic error, the source of error has to be identified and removed. Zeroing an instrument is one of such examples.
3	**C**	Jumper at rest when $v = 0$; jumper with zero acceleration when gradient of $v - t$ graph is zero.
4	**D**	Using conservation of momentum $0 = m_\alpha v_\alpha + m_X v_X$ giving $$\frac{v_\alpha}{v_X} = \frac{m_X}{m_\alpha} = \frac{3.89 \times 10^{-25}}{6.65 \times 10^{-27}} = 58$$
5	**D**	acceleration of the system = $\frac{F}{M_1+M_2+M_3}$ Newton's 2nd law for M_3 $\left(\frac{F}{\left(M_1+M_2+M_3\right)}\right)$
6	**B**	Work done is the area under F-x graph.
7	**A**	There are different modes of energy conversion in this scenario, e.g. change in GPE, change in KE as well as work done on the mass due to frictional force. Hence the heat generated is simply Fx, the distance travelled by the system, since the cord is inelastic.
8	**D**	P = Fv Using v = u + at, v = at However, v is non uniform. Have to use average velocity. (v – u)/2 = v/2 Hence, P = ½ aFt Plotting P against t, gives gradient of ½ aF, through origin.
9	**B**	Only actual forces should be presented on a FBD, so there should only be the weight of the aircraft and lift force on the aircraft, directed normal to the plane of the wings.

10	A	At steady state bulb X and Y have the same pressure, so $\frac{V_X}{n_X R T_X} = \frac{V_Y}{n_Y R T_Y}$ giving $\frac{n_X}{n_Y} = \frac{V_X}{V_Y}\frac{T_Y}{T_X}$, but for the same gas, $n \propto m$ (since $n = \frac{m}{m_R}$) Hence $\frac{m_X}{m_Y} = \frac{V_X}{V_Y}\frac{T_Y}{T_X} = 2\left(\frac{400}{200}\right) = 4$ so, $m_Y = \frac{m}{4}$
11	B	work done $= p\Delta V = p_f V_f - p_i V_i = nRT_f - nRT_i$ Since the process happens at constant pressure when volume doubles, temperature doubles. so work done $= p\Delta V = nRT_f - nRT_i = nR(2T - T) = nRT$ work done $= RT$ when $n = 1$
12	C	Option A, B and D are not correct. Internal energy is also affected by the amount of substance in the system. $U = \frac{3}{2}NkT$
13	C	Using g = GM/r^2 and ρ = mass / volume = M / [(4/3)πr^3] , g = G[ρ(4/3)πr^3] / r^2 = (4/3)Gρπr g$_E$/g$_M$ = ρ$_E$r$_E$ / ρ$_M$r$_M$ = ρ$_E$r$_E$ / ρ$_M$r$_M$ 6 = (5/3) / (r$_E$ / r$_M$) r$_E$ / r$_M$ = 3.6
14	C	Change in GPE = mΔϕ = 50 (-60-(-20)) x 10^6 = - 2000 MJ Negative sign indicates a loss of GPE. The mass moves closer to the Earth
15	B	In SHM, the restoring force is changing. → left with options B and C Since options B and C, the only difference is "total energy" and "angular frequency", and that the total energy of any closed system should be conserved.
16	D	Velocity variation with displacement is an ellipse about the origin. Since question is on speed, which is non-directional, the vertical axis should focus only on the positive region.
17	A	Only transverse waves can be polarised. Intensity will change when view light through a polarised sheet.
18	A	Since the wave is moving to the right, R will following the behaviour of the particles to its left, which currently have displacements to the right. B: The distance between P and T is two wavelengths. C: Q vibrates about its position. D: R is not a node.
19	C	y$_1$ = (600 x 10^{-9})(2) / (0.30 x 10^{-3}) = 4.0 mm y$_3$ = 12.0 mm y$_3$ – y$_1$ = 8.0 mm
20	C	When R = r = 3 Ω,

Commented [TYY(1)]: Include potential energy

		$P = I^2R = (\frac{12}{6})^2(3) = 12$ W When $R = 6$ Ω, $P_{new} = (\frac{12}{9})^2(6) = 10.67$ W $P_{new} = 0.89P$
21	**B**	$v_d = neAI$ $A_2 = 2A_1$ $v_{d2} = I/neA_2$ $= I/ne(2A_1)$ $= v_{d1}/2$ $= 2.0 \times 10^{-4} / 2$ $= 1.0 \times 10^{-4}$ m s^{-1}
22	**D**	As oil drop rises at constant speed, no net force is acting on the oil drop and drag force acts downward, hence $mg + D = q\frac{V_1}{d}$. As oil drop falls at the same constant speed, no net force is acting on the oil drop, drag force acts upwards and has the same value as before, so $mg = q\frac{V_2}{d} + D$ Adding the two equations, we can eliminate D on both sides, giving. $2mg = \frac{q}{d}(V_1 + V_2)$, so $q = \frac{2mgd}{V_1+V_2}$
23	**D**	By potential divider principle, voltmeter reading increase when effective resistance across thermistor is increased or resistance R_3 is reduced.
24	**B**	Current source at Q cannot produce the magnetic field at Q. Hence consider only P. Using right hand grip rule, the direction of current must be out of the plane at P.
25	**A**	Due to the direction of current flow in X, the end of X facing Y will produce a magnetic south. As X moves away from Y, the solenoid in Y detects a reduction in magnetic south, and hence according to Lenz's Law, will generate an induced e.m.f. that may produce an effect to oppose that reduction in magnetic south, i.e. generating more magnetic north at the end of Y facing X. The nature of force will be attractive, while the induced current in Y will be flowing from N to M. The induced current will be decreasing, since according to Faraday's Law, $\frac{\Delta \varphi}{\Delta t}$ is decreasing as a result of reducing flux linkage.
26	**D**	$B = \mu_0 nI \propto I$ $E = -N \Delta\Phi/\Delta t = -N \Delta BA/\Delta t = -NA \Delta B/\Delta t$ Identify the gradients of the I-t graph at various points and factoring in Lenz's law
27	**B**	Rms current $= \sqrt{\frac{(4^2 \times 6) + (6^2 \times 2)}{10}}$ $= 4.10$ A

28	A	The average power of R without diode = I_{rms}^2R = 0.50 I_o^2R When the diode is connected in the circuit, the average power of R will be halved (0.25 I_o^2R) since it only received power for half the period.
29	D	Derive using wave particle duality and KE
30	A	Only change is nucleon number is only affected by α-particle. So there are $\frac{238-206}{4} = 8$. So conservation of proton number gives 92 = 82 + 8(2) + n(−1) where n is the number of β^- particles. So n = 6