JURONG JUNIOR COLLEGE
PHYSICS DEPARTMENT
2014 Preliminary Examination
8866 H1 Physics Paper 1 Solutions

Qn	Ans	Suggested solution
1	D	**A -** 300 K = 26.85 °C (room temperature) **B -** Diameter of a pen = 1.0 cm; length of pen = 0.100 m Volume = $\pi\left(\frac{0.01}{2}\right)^2(0.1) = 7.85\times10^{-6}$ m^2 **C -** Typical laptop p.d. = 19 V and current = 4.22 A **D -** Diameter of soccer ball = 22 cm Surface Area = $4\pi\left(\frac{0.22}{2}\right)^2 = 0.15$ m^2
2	B	Using the parallelogram addition of vectors, R = P + Q S = P + (-Q) Using end to tail addition of vectors, Q = P + T T = Q – P
3	C	At the maximum height, it should be a turning point. As such, the velocity at that moment should be zero. Between A and C, A is the point at which the ball hits the floor momentarily to switch directions (which explains why it is at the intersection of positive and negative region) and the vertical line suggests a sudden change. Prior to that change, the ball is moving downwards (dropped) represented by a positive value. C is the point at which the ball goes from negative velocity to positive velocity (with values) which suggests moving upwards to downwards, Therefore C is the suitable choice.
4	A	Taking upwards as positive, Acceleration of ball relative to Earth, a = 4.0 – (–9.81) = 13.81 m s^{-2} u = 0, s = 2.5 m $s = ut + \frac{1}{2}at^2$ $2.5 = 0 + \frac{1}{2}(13.81)t^2$ $t = 0.60$ s
5	B	A and D obviously wrong. Try taking moments about C, clockwise moment = (3m)(1.5x) = 4.5mx anti-clockwise moment = (3m)(1.5x) + (m)(0.5x) = 4.5mx + 0.5mx = 5 mx Therefore C is also wrong and centre of gravity is slightly to the left side of C.
6	C	Smooth wall means no frictional force, only normal reaction from wall, hence A and D are wrong. For option B, by taking moment abt c.g., the contact forces on ladder by smooth wall and rough floor will produce resultant clockwise moment, so B is wrong.
7	C	By conservation of momentum: (2.0)(0.5) = (2.0 + 0.500)v_f → v_f = 0.4 m s^{-1}. Change in momentum = $p_f - p_i$ = 2.0 (0.4 – 0.5) = - 0.2 N s

JURONG JUNIOR COLLEGE
PHYSICS DEPARTMENT
2014 Preliminary Examination
8866 H1 Physics Paper 1 Solutions

Qn	Ans	Suggested solution
8	**A**	After the parachutist jumps out of a plane, the net force, *ma* acting on him is $mg - R$ ($mg - R = ma$). *R* is the resistive force (proportional to velocity) acting on him. As he moves faster, *R* increases and thus acceleration *a* will decrease. When he pulls the cord to release his parachute, there is a strong upward force acting on the parachute to slow down his descent. Hence the acceleration is in the negative section of the graph.
9	**D**	From conservation of linear momentum: Total linear momentum before collision = Total linear momentum after collision $4.0(5.0) + 3.0\,(2.0) = 4.0\,v_1 + 3.0\,v_2$ For elastic collision, relative speed of approach = relative speed of separation: $5.0 - 2.0 = -\,(v_1 - v_2)$ Solving simultaneously, $v_1 = 2.4\text{ m s}^{-1}$, $v_2 = 5.4\text{ m s}^{-1}$ Since both velocities are positive, hence the two masses move to the right after the collision.
10	**B**	Net loss in G.P.E = Net gain in K.E Loss of G.P.E of X - gain in G.P.E of Y = Gain in K.E by system $m_x g(2\sin 30^o) - m_y g(2)$ = Gain in K.E by system Gain in K.E by system = 78.48 - 58.86 = 19.6 J
11	**D**	Effective power = total work done / time taken = $\dfrac{\rho V g h + \frac{1}{2}\rho V v^2}{t} = \dfrac{2\rho V g h + \rho V v^2}{2t}$
12	**A**	Loss of G.P.E = Gain in thermal energy due to friction + Gain in K.E mgh = Fs + Gain in K.E (1)(9.81)(1) = (0.5)(10.0) + Gain in K.E Gain in K.E = 4.81 J
13	**D**	Recall
14	**A**	Recall definition of e.m.f.
15	**C**	Recall $E = IR + Ir$ If K_1 is closed and K_2 is opened, $E = 2.0(1.0) + 2.0r = 2.0 + 2.0r$ --------*(1)* If K_2 is closed and K_1 is opened, $E = 1.0(4.0) + 1.0r = 4.0 + r$ --------*(2)* (1) – (2): $r = 2.0\ \Omega$
16	**D**	Option **A** and **C** has the same effective resistance, which is less than *R*. Option **B** has an effective resistance of *R/2.* Option **D** has an effective resistance of *R.*
17	**A**	By considering that resistors in series share the same current, it can be shown that $V_{\text{Thermistor}} = \dfrac{R_{\text{Thermistor}}}{R_{\text{LDR}} + R_{\text{Thermistor}}} = \dfrac{1}{\left(\dfrac{R_{\text{LDR}}}{R_{\text{Thermistor}}}\right) + 1}$ R_{LDR} is high when illumination is low and vice versa. $R_{\text{Thermistor}}$ is high when temperature is low and vice versa. $V_{\text{Thermistor}}$ is smallest when $\left(\dfrac{R_{\text{LDR}}}{R_{\text{Thermistor}}}\right)$ is highest or when R_{LDR} is high while $R_{\text{Thermistor}}$ is low.

JURONG JUNIOR COLLEGE
PHYSICS DEPARTMENT
2014 Preliminary Examination
8866 H1 Physics Paper 1 Solutions

Qn	Ans	Suggested solution
18	**B**	p.d. across 5.0 Ω resistor $= \frac{(1/3+1/4+1/5)^{-1}}{(1/3+1/4+1/5)^{-1}+2}(12)$ Thus, current through 5.0 Ω resistor $= \frac{(1/3+1/4+1/5)^{-1}}{(1/3+1/4+1/5)^{-1}+2}(12)/5 = 0.94\ \Omega$
19	**C**	A: distance XY = half wavelength B: amplitude is the same for all particles D: the phase difference is π rad.
20	**A**	In 2 s, the wave travels 1 cm → speed = 1 cm / 2 s = 0.5 cm s^{-1}
21	**D**	$I = \frac{P}{A} = \frac{P_S}{4\pi r^2}$ → $P = \frac{P_S A}{4\pi r^2} = \frac{(2000)(2.1\times10^{-3})}{4\pi(78)^2}$ = 5.5 × 10^{-5} W
22	**C**	Amount of diffraction depends on the size of the opening relative to the wavelength
23	**B**	No energy is transferred in a stationary wave.
24	**B**	Resultant $A = A_1 + A_2$ Resultant intensity $I = kA^2 = k(A_1 + A_2)^2$
25	**B**	Apply Fleming's Left Hand Rule to the moving electron. The current is directed towards the bottom of the paper (since the electron is moving towards the top of the paper). The magnetic field is directed towards the right side of the paper. The magnetic force will therefore be directed out of the plane of the paper.
26	**C**	Wire X attracts wire Y so its force on wire Y is towards the left. Wire Z repels wire Y so its force on wire Y is also towards the left. Therefore the resultant force on wire Y due to the currents in wires X and Z will be towards the left.
27	**C**	Imagine the external magnetic field is due to a strong North pole on the left side and a weak South pole on the right side. The magnet therefore rotates clockwise. Due to the non-uniform external magnetic field, it will experience a resultant force towards the left.
28	**B**	de Broglie wavelength $\lambda = \frac{h}{mv}$ → $v = \frac{h}{m\lambda}$ Hence the particle with the lowest velocity has the most mass, which is $^{4}_{2}He$. Mass of proton = 1 u, mass of $^{2}_{1}H$ = 2 u, and mass of $^{4}_{2}He$ = 4 u. Mass of electron is negligibly small.
29	**C**	For Fig. 29.1, the spectral lines are closer nearer the high frequency end, i.e. on the right. The arrow points to the 3^{rd} line on the right, i.e. the 3^{rd} highest frequency line, which must be due to the transition that emits photon with the 3^{rd} highest energy.
30	**B**	From the five energy levels of Sodium atoms, there would be 10 possible transitions that would result in 10 emission spectral lines. Photons of energy 3.19 eV and 1.65 eV emitted from transitions from n=3 to n=1 and from n=5 to n=2 respectively would be absorbed by atoms in Gas X. Since 10 – 2 = 8, only eight spectral lines would be observed.