Mock Exam 2

PHYSICS **9702**

Paper 2 AS Level Structured Questions

MARK SCHEME

Maximum Mark: 60

Published

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1 (a) (i) product of force and distance moved — M1
(by force) in the direction of the force — A1 [2]

(ii) work (done) per unit time (*idea of ratio needed*) — B1 [1]

(b) *either* work/time *or* power = (force × distance)/time — M1
to give power = force × velocity — A1 [2]

(c) (i) kinetic energy (= $\frac{1}{2}mv^2$) = $\frac{1}{2} \times 1900 \times 27^2$ — C1
power = 692550 / 8.1 = 8.55×10^4 W — A1 [2]

(ii) *either* for equal increments of speed, increments of E_K are different — M1
so longer time (to increase speed) at high speeds — A1 [2]
or air resistance increases with speed (M1)
so driving force (and acceleration) reduced (A1)
or P (= Fv) = mav (M1)
(P and m constant) so when v increases, a decreases (A1)

2 (a) (i) point at which whole weight of body — M1
may be considered to act — A1 **[2]**

(ii) sum of forces in any direction is zero — B1
sum of moments about any point is zero — B1 **[2]**

(b) *either*:
T and W have zero moment about P — M1
so F must have zero moment, i.e. pass through P — A1 **[2]**
or:
if all pass through P, distance from P is zero for all forces (M1)
so sum of moments about P is zero (A1)

(c) (i) $F\cos\alpha = T\cos\beta$ — B1 **[1]**

(ii) $W = F\sin\alpha + T\sin\beta$ — B1 **[1]**

(iii) $2W = 3T\sin\beta$ — B1 **[1]**

3 (a) sum of (random) kinetic and potential energies — M1
of the atoms/molecules of the substance — A1 **[2]**

(b) (i) potential energy unchanged as atoms remain in same positions — M1
allow 'reduced because atoms slightly closer together'
vibrational kinetic energy reduced because temperature lower — M1
so internal energy less — A1 **[3]**

(ii) potential energy increases because separation increases — M1
kinetic energy unchanged because temperature unchanged — M1
so internal energy increases — A1 **[3]**

4 **(a)** **(i)** vibrations (in plane) normal to direction of energy propagation — B1 [1]

(ii) vibrations in one direction (normal to direction of propagation) — B1 [1]

(b) **(i)** at (displacement) antinodes / where there are no heaps, wave has maximum amplitude (of vibration) — B1
at (displacement) nodes/where there are heaps, amplitude of vibration is zero/minimum — B1
dust is pushed to / settles at (displacement) nodes — B1 [3]

(ii) $2.5\lambda = 39$ cm — C1
$v = f\lambda$ — C1
$v = 2.14 \times 10^3 \times 15.6 \times 10^{-2}$
$= 334$ m s^{-1} (*allow 330, not 340*) — A1 [3]

(c) Stationary wave formed by interference / superposition / overlap of — B1
either wave travelling down tube and its reflection
or two waves of same (type and) frequency travelling in opposite directions — B1
speed is the speed of the incident / reflected waves — B1 [3]

5 **(a)** no hysteresis loop/no permanent deformation
(*do not allow 'force proportional to extension'*)
so elastic change — M1

work done = area under graph line OR average force × distance — A0 **[1]**

(b) — B1

$= \frac{1}{2}Fx$ $\frac{1}{2}(F_2 + F_1)(x_2 - x_1)$ — A1

$F = kx$, so work done = $= \frac{1}{2}kx^2$ $\frac{1}{2}k(x_2 + x_1)(x_2 - x_1)$ — A1

work done = $\frac{1}{2}k(x_2^2 - x_1^2)$ — A0 **[3]**

(c) gain in energy of trolley $= \frac{1}{2}k(0.060^2 - 0.045^2) + \frac{1}{2}k(0.030^2 - 0.045^2)$ — C1
$= 0.36$ J — C1
kinetic energy $= \frac{1}{2} \times 0.85 \times v^2 = 0.36$ — C1
$v = 0.92$ m s^{-1} — A1 **[4]**

6 **(a)** potential difference/current — B1 **[1]**

(b) **(i)** **1)** 1.13 W
2) 1.50 V — B1 **[1]**

(ii) power = V^2 / R or power = VI and $V = IR$ — C1
$R = 1.50^2/1.13$
$= 1.99\ \Omega$ — A1 **[2]**

(iii) either $E = IR + Ir$ or voltage divided between R and r — C1
$I = 1.5 / 2.0$ (=0.75 A) p.d. across R = p.d. Across r = 1.5 — C1
$3.0 = 1.5 + 0.75r$
$r = 2.0\ \Omega$ so $R = r = 1.99\ \Omega$ — A1 **[3]**

(c) larger p.d. across R means smaller p.d. across r — M1
smaller power dissipation at larger value of V — A1
since power is VI and I is same for R and r — A1 **[3]**

7	**(a)**	**(i)**	2 protons and 2 neutrons	B1	[1]
		(ii)	e.g. positively charged 2*e* mass 4u constant energy absorbed by thin paper *or* few cm of air (3 cm → 8 cm) (*not low penetration*) highly ionizing deflected in electric/magnetic fields (*One mark for each property, max 2)*	B2	[2]
	(b)		mass-energy is conserved difference in mass 'changed' into a form of energy energy in the form of kinetic energy of the products / γ-radiation photons / e.m. radiation	B1 B1 B1	[3]