Solution to 1617 S6 Physics Mock Exam

Paper 1

Section A

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
B	A	B	D	C	B	C	A	A	D	B	A	A	B	D

16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
C	C	C	C	A	C	D	B	A	D	B	B	B	D	C

31	32	33
A	D	B

8A 10B 8C 7D

Section B

1. (a) $f = ma$

$7500 = 1500a$ 1M

$a = 5\ \text{m s}^{-2}$ 1A

(b) $v^2 = u^2 + 2as$

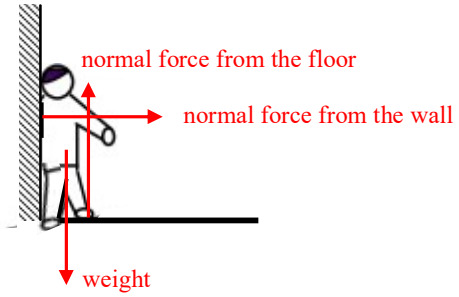
$= \left(\frac{50000}{3600}\right)^2 - 2\times5\times8$ 1M

$v = 10.6\ \text{m s}^{-1}$ 1A

(c) $F = 1500 \times \frac{10.6}{0.15} = 1.06\times10^5\ \text{N}$ 1M+1A

(d) Air bag, seatbelt or collapsible car front 1M+1M

2. (a) 1M(any one corr)+1M



(b) Normal force from the wall 1M

(c) $a = \omega^2 r \rightarrow 5g = \left(\frac{2\pi}{T}\right)^2 r$

$5 \times 9.81 = \left(\frac{2\pi}{T}\right)^2 \times 2$ 1M

$T = 1.27$ s 1A

(d) The force on the rotor by the boy is always outward, 1M

as it is the reaction force of the normal force on the boy. 1M

(e) The outward force on the rotor may topple the rotor/ exert a moment on the rotor. 1M

Another passenger may be seated on the opposite side so as to balance this moment of force. 1M

3. (a) 80°C 1A

(b) 0-3 min: KE decreases and PE unchanged 1M

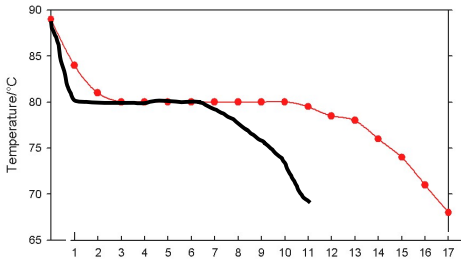
3-10 min: KE unchanged and PE decreases 1M

(c) $\ell = \frac{E}{m} = \frac{1500 \times (10 - 3) \times 60}{0.2}$ 1M

$= 3.15 \times 10^6$ J kg^{-1} 1A

(d) Drop faster 1M

Same melting point 1M



4. (a) When the temperature rises, gas particles vibrate faster. 1M

They hit the wall of container more frequently with larger change in momentum. 1M

To maintain the same pressure, the volume of the gas increases to reduce the frequency of hitting. 1M

(b) Turn off the burner, 1M

and stir the water thoughtfully. 1M

(c) Let the absolute zero be $-x$°C.

$\frac{22 + x}{10} = \frac{90 + x}{12} \rightarrow x = 318$ 1M

Absolute zero = –318°C 1A

(d) Expansion of the gas is more obvious. 1M

Transfer of heat between the water and the gas is faster. 1M

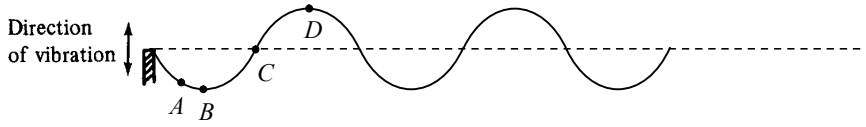
5. (a) Direction of motion of wave is perpendicular to the direction of particles' vibration. 1M

(b) $f = 1/0.4 = 2.5$ Hz 1A

$v = 1.2/0.4 = 3$ m s^{-1} 1A

(c) *B* & *D* 1M

(d) 2.5 periods, upside down 1M+1M



(e) Tie the other end of the string on a fixed wall, 1M

from a distance of $n\lambda / 2$, where $n = 1, 2, 3 \ldots$ 1M

6. (a) Connect both loudspeaker to the same signal generator. 1M

(b) p.d. at $Q = \sqrt{0.8^2 + 0.4^2} - 0.8 = 0.0944$ m 1M

Destructive interference occurred at *Q*

p.d. $= 0.5\lambda$ 1M

$\lambda = 0.189$ m

$f = 340 / 0.189 = 1800$ Hz 1A

(c) (i) *PQ* increases. 1M

(ii) *PQ* decreases. 1M

(d) He is wrong. 1M

As the p.d. is always zero along *MN*, 1M

loud sound is always observed. 1M

7. (a) 50 counts min^{-1} 1M

(b) The decay of radium is a random process. 1M

(c) Activity 550 → 300

$t_{½} = 0.9$ min 1M

(d) ${}^{224}_{88}\text{Ra} \rightarrow {}^{220}_{86}X + {}^{4}_{2}\alpha$ 1M+1M

8. (a) Mass defect of radium 1M

(b) $k = \dfrac{\ln 2}{t} = \dfrac{\ln 2}{1620 \times 365 \times 24 \times 3600}$ 1M

$= 1.36 \times 10^{-11}$ s^{-1} 1A

(c) $P = \dfrac{E}{t}$ 1M

$100 = \dfrac{4.8\times10^{6}\times1.6\times10^{-19}A}{1}$

$A = 1.30\times10^{14}$ Bq 1A

(d) $A = kN$

$1.30\times10^{14} = 1.36\times10^{-11}N$ 1M

$N = 9.60\times10^{24} = 15.9$ moles 1A

$m = 15.9\times0.226 = 3.60$ kg 1A

(e) No burning / Long-lasting / Stable supply of energy (any two) 1M+1M

9. (a) Produce a uniform B-field with current flowing along a solenoid, 1M

and decrease the B-field by steadily decrease the current. 1M

(b) Q 1M

(c) $V = \dfrac{\Delta\Phi}{\Delta t} = \dfrac{A\Delta B}{\Delta t}$

$= 0.1^{2}\pi \times 0.02$ 1M

$= 6.28\times10^{-4}$ V 1A

(d) Wind more turns in the loop. 1M

10. (a) $L = 150\ \Omega$, $M = 100\ \Omega$, $H = 60\ \Omega$ 1M (any one corr) +1M

(b) (i) R and the 2 resistors are in parallel.

$P = \dfrac{V^{2}}{R}$

$1800 = 220^{2}\left(\dfrac{1}{R} + \dfrac{1}{150} + \dfrac{1}{100}\right)$ 1M

$R = 48.7\ \Omega$ 1A

(ii) $I = \dfrac{P}{V} = \dfrac{1800}{220} = 8.18$ A 1A

Peak value $= 8.18\sqrt{2} = 11.5$ A 1M+1A

(iii) 15 A 1M

11. Wind the wires on the two C-cores with number of turns N_1 and N_2 respectively. 1M

Connect the wire (say that with N_1) to the a.c. power supply, and the other (N_2) to the voltmeter. 1M

Put the C-cores touching each other, so that the B-field can pass from one to the other. 1M

Switch on the power supply at V_1. Measure the voltage V_2 by the voltmeter. 1M

Compare the ratio of N_1/N_2 and V_1/V_2. They should be the same. 1M

Paper 2

Section C: Energy and Use of Energy

M.C. (8 marks) 1D 2B 3B 4C 5X 6D 7D 8C (1A 2B 2C 3D)

Structured question (10 marks)

(a) To increase the energy of (OR To vibrate)
the electrons in the filament 1M

(b) Increase the resistance of the filament. 1M
Enlarge the area of emitting light. 1M

(c) To prevent burning of the filament. 1M

(d) LED has longer life/efficiency, 1M
but more expensive/working at d.c. only. 1M

(e) (i) $E = \dfrac{8}{\pi \times 0.02^2} \times \cos 25°$ 1M

$= 5770$ lx 1A

(ii) efficacy $= \dfrac{8}{1.2 / 70\%}$ 1M

$= 4.67$ lm W^{-1} 1A

Section D: Medical Physics

M.C. (8 marks) 1A 2D 3B 4D 5B 6C 7A 8B (2A 3B 1C 2D)

Structured question (10 marks)

(a) [omitted] 1M

(b) X-rays emitted from the X-ray tube
pass through the arm and reach an X-ray film. 1M
The X-rays are attenuated by different amounts
when passing through different body tissues 1M
and hence blacken the film by different amounts. 1M

(c) (i) Most ultrasound is reflected by the bone surface. 1M

(ii) The quality/resolution of the image is poor. 1M

(d) $0.08 = 250e^{-\mu \cdot 2}$ 1M

$\mu = 4.02$ cm^{-1} 1M

$\text{HVT} = \dfrac{\ln 2}{\mu} = \dfrac{\ln 2}{4.02}$

$= 0.172$ cm 1A

(e) Shorter time, less exposure to radiation (any one) 1M