TWGHs Wong Fut Nam College

Form 6 Mock Examination 2017-18

Suggested solutions

<u>Paper I</u>

Section A: MC (33 Marks)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	C	D	C	C	B	C	B	C	A	D	B	D	C	D	B	D	A	A	A
21	22	23	24	25	26	27	28	29	30	31	32	33			A	B	C	D	
B	D	A	C	D	D	B	A	C	A	C	B	D			8	8	8	9	

Section B: Questions (84 Marks)

1. (a) (i) $Q = ml = 0.2 \times (1.98 \times 10^5) = 39600$ J — 1A

(ii) Energy absorbed in vaporizing Nitrogen = energy absorbed in forming mango balls

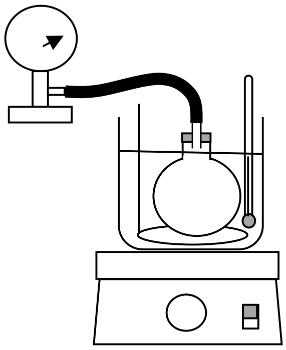
$39600 = 0.1 \times (4000) \times (15 - (-2)) + 0.1 \times (3.12 \times 10^5) + 0.1 \times (3000) \times ((-2) - T)$ — 1M

$39600 = 6800 + 31200 - 600 - 300T$

⇨ $T = -7.33$ °C — 1A

(b) When liquid nitrogen vaporizes, <u>the number of gas molecules in the jar increases</u>. So the <u>frequency of collision</u> (the number of collision in unit time) with the all of container also increases. So the gas pressure increases. — 1A, 1A

2. — 1A



Connect the round-bottom flask to the pressure gauge with a rubber tubing. Put the round-bottom flask, stirrer and the thermometer into the beaker and covered with water. Place the beaker on top of the hotplate — 1A

Heat up the water slowly and record down the pressure of the gas at several different temperatures. — 1A

Plot a graph of Pressure against temperature in °C. — 1A

The graph will be a straight with positive slope — 1A

and cut the temperature axis (x-axis) at absolute zero. — 1A

3. (a) Take moment at R:

$(400 \times 9.81) \times (30) + (30000) \times (15) = (T_2 \sin 30^\circ) \times (25)$ — 1M

⇨ $T_2 = 4.54 \times 10^4$ N (or 45600 N if g = 10 m s^{-2}) — 1A

(b) (i) Area in v-t for 0 – 8s = $(0.5 \times 8) / 2 = 2$ m — 1A

(ii) $(t_1 - 8) \times 0.5 = 20 - 2$ — 1M

➔ $t_1 = 44$ s — 1A

(c) (i) $a = 0.5 / 8 = 0.0625$ m s^{-2} — 1M+1A

(ii) $T_1' - mg = ma$

$T_1' - (400 \times 9.81) = (400) \times (0.0625)$ — 1M

$T_1' = 3949$ N (or 4025 N if g = 10 m s^{-2}) — 1A

(d) $$< P > = \frac{F \times s}{t} = \frac{4025 \times 2}{8} = 987.25 \text{ W}$$ (or 1006.25 W if g = 10 m s^{-2}) — 1M, 1A

or $<P> = (\Delta KE + \Delta PE) / t = \{(400)(0.5)^2 / 2 + (400)(9.81)(2)\}/8$ $= 987.25$ W (1006.25 W if g = 10 m s^{-2})

4. (a) $a = (20 - 25)/2 = -2.5 \text{ m s}^{-2}$ 1M

i.e. $S_1 = (20^2 - 25^2) / (2 \times (-2.5)) = 45$ m

$S_2 = 4 \times 2 = 8$ m 1M

⇨ $X = S_2 - S_1 = 45 - 8 = 37$ m 1A

(b) (i) By the conservation of momentum:

$(2000) \times (20) + (8000) \times (4) = (2000) \times (v) + (8000) \times (10)$ 1M

➔ $v = -4 \text{ m s}^{-1}$ 1A

i.e. The car moves backwards. 1A

(ii) Force of impact $F = \dfrac{mv - mu}{t} = \dfrac{2000 \times (-4) - 2000 \times (20)}{0.4} = -120000$ N 1M+1A

(iii) The air bag increases the time of impact of the driver with the car and 1A

it reduces the impact force acting on the driver during the collision. 1A

5. (a) By the conservation of mechanical energy:

$KE_A + PE_A = KE_B + PE_B$

$$\frac{mu^2}{2} + m(9.81)(2.8) = \frac{m \times 8^2}{2} + 0$$ 1M

⇨ 3.01 m s^{-1} (or 2.83 m s^{-1} if $g = 10 \text{ m s}^{-2}$) 1A

(b) (i) Consider the x-direction of motion:

$v_x = x / t$ 1M

$8 \cos 30^\circ = 6.92 / t$ 1A

⇨ $t = 0.999$ s

(ii) Consider the vertical motion:

$y = u_y t + gt^2/2$

$y = 8 \sin 30^\circ (0.999) + (-9.81)(0.999)^2 / 2$ 1M

⇨ $y = -0.895$ m

i.e. H = 0.895 m (or 0.994 m if $g = 10 \text{ m s}^{-2}$) 1A

6. (a) (i) To the right. 1A

(ii) *Q*: Moving upwards 1A

R: momentarily at rest 1A

(iii) 2A

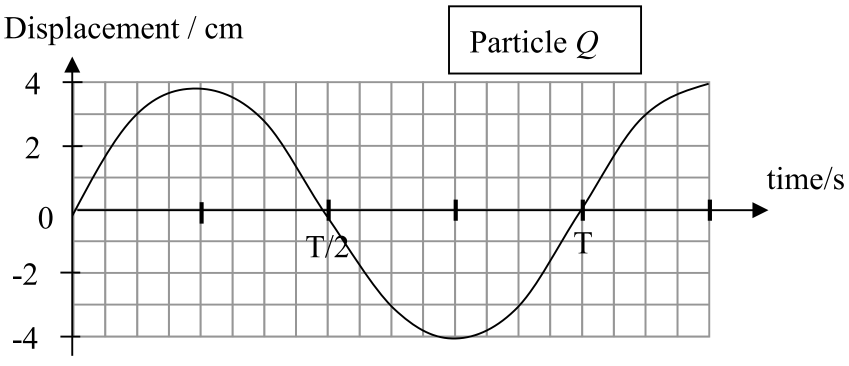


Figure 6.3

(b) (i) Wavelength $\lambda = 0.9 \times (2/3) = 0.6$ m 1A

Wave speed $v = f\lambda = 6 \times 0.6 = 3.6 \text{ m s}^{-1}$ 1A

(ii) When the frequency is set to be 9 Hz, the wavelength $\lambda' = 3.6 / 9 = 0.4$ m

➔ $(\lambda'/2) = 0.2$ m 1M

Since the length of the elastic cord $l = 0.9 \text{ m} = 4.5 \times (\lambda'/2)$ which is not an integer multiple of $(\lambda'/2)$,

i.e. no stationary wave can be formed. 1M

7. (a) (i) As ray *R* is refracted (diverged) away from the principal axis, it must be a concave lens. 1A

(ii) Virtual, Erect, Diminished 2A

(Any TWO)

(b) (i) 1A

(ii) 2A

(iii) 1A

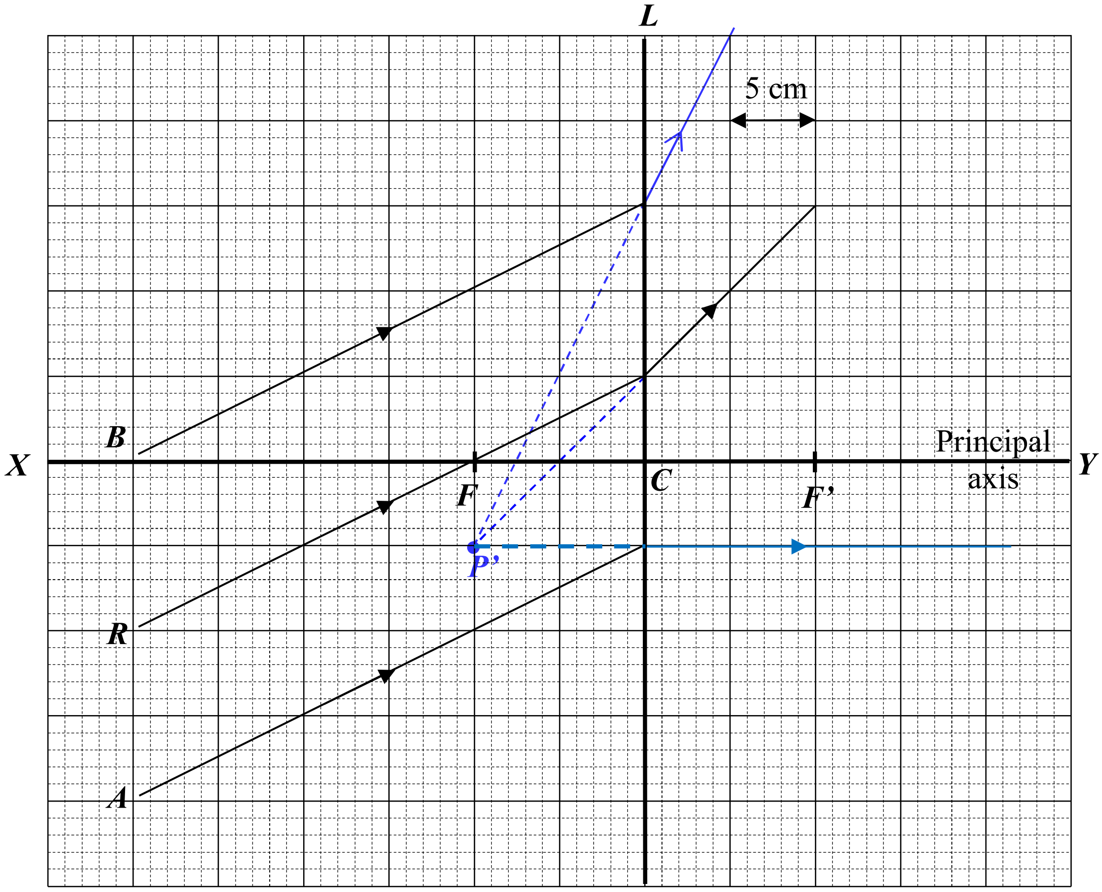


Figure 7.1

(c) Apply the Lens formula:

$$\frac{1}{u}+\frac{1}{v}=\frac{1}{f}$$ 1M

$(1 / 10) + (1 / v) = (1 / (-10))$ 1A

➔ $v = -5$ cm

8 (a) Ideal voltmeter: its internal resistance is infinite. 1A

Ideal ammeter: its internal resistance is zero. 1A

(b) $\varepsilon = 3.8$ V 1A

Since $V = \varepsilon - I r$ 1M

$2.28 = 3.8 - 0.76 \times r$

➔ $r = 2\ \Omega$ 1A

(c) The ammeter reading increases as the equivalent resistance of the circuit decreases. 1A

The voltmeter reading decreases as more current drawn from the battery, the drop in potential (Ir) due to the internal resistance of the dry cell increases. 1A

9. (a) (i) E = V / d — 1M+1A

➔ V = E × d = (2.4 × 10^4) × (0.12) = 2880 V

(ii) *Q* — 1A

(b) (i) Out of the page. — 1A

(ii) Electric force = Magnetic force

$Eq = qvB$ — 1M

➔ $v = E / B$ = (2.4 × 10^4) / 0.016 = 1.5 × 10^6 m s^{-1} — 1A

(c) (i) — 1A

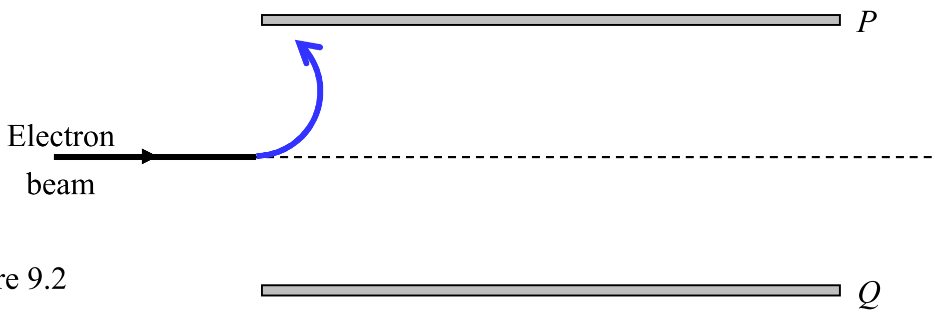


Figure 9.2

(ii) Magnetic force = Centripetal force

$qvB = m v^2 / r$ — 1M

➔ $r = mv / qB = v / (B (q/m))$ = (1.5 × 10^6) / (0.016 × (1.76 × 10^{11})) — 1M

r = 5.33 × 10^{-4} m — 1A

10. (a) (i) *Q* — 1A

(ii) $\varepsilon = B l v \sin\theta$

80 × 10^{-3} = B × 30 × 200 × sin 20° — 1M

➔ B = 3.90 × 10^{-5} T — 1A

(b) As the metal frame *PQRS* is moving in a uniform magnetic field, the total magnetic flux passing through the frame is constant. So there will be no change of magnetic flux in the metal frame. According to the Faraday's law of electromagnetic induction, the emf induced in the metal frame is zero and no induced current is produced. — 1A, 1A

11. (a) (i) $t_{half\text{-}life}$ = (40 – 10) / 2 = 15 hours — 1A

(ii) $\boldsymbol{k} = \ln 2 / t_{half\text{-}life}$ = ln2 / (15 × 3600) = 1.28 × 10^{-5} s^{-1} — 1M+1A

(iii) A = ***k*** N

600 = (1.28 × 10^{-5}) × N

N = 4.67 × 10^7 — 1A

(b) (i) ${}^{24}_{11}Na \rightarrow {}^{24}_{12}Mg + {}^{0}_{-1}\beta$ — 1A

(ii) As the decay constant of ${}^{40}_{19}K$ is much smaller than that of ${}^{4}_{11}Na$, ${}^{40}_{19}K$ has a much longer half-life than that of ${}^{4}_{11}Na$. — 1A

END