TWGHs Wong Fut Nam College

Form 6 Mock Examination 2014-15

Suggested solutions

Paper I

Section A: MC

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

Section B: Questions

1. (a) (i) To facilitate the heat transfer in water **by convection**. 1A

(ii) $P = E / t = m L / t = 0.2 \times (2.26\times10^6) / (5\times60)$ 1M

$= 1510$ W (3 s.f.) 1A

(iii) $P \times t = E = mc\Delta T$

$1507 \times (10\times60) = m \times 4200 \times (100 - 20)$ 1M

$m = 2.70$ kg (3 s.f.) 1A

(b) (i) Total resistance $= 20 + (1/20 + 1/20)^{-1}$ 1M

$= 30\ \Omega$ 1A

(ii) $P = I^2R$

$1510 = I^2 (30)$ 1M

$I = 7.09$ A (3 s.f.) 1A

(iii) Y 1A

2. (a) (i) $\begin{cases} P_1V = n_1RT_1 \\ P_2V = n_2RT_2 \end{cases}$ 1M

i.e. the percentage of air molecule remain $= n_2 / n_1 = P_2T_1 / P_1T_2$ 1M

$= \{80$ kPa $\times$ $(87 + 273)$ °C$\} / \{100$ kPa $\times$ $(47 + 273)$ °C $\}$

$= \{80$ kPa $\times$ 360 K$\} / \{100$ kPa $\times$ 320 K$\}$

$= 90$ % 1A

(ii) Temperature decreases, ➔ the impact force decreases. 1A

Temperature decreases, ➔ the frequency of collision of the envelope decreases. 1A

Number of molecules decreases, ➔ the frequency of collision of the envelope decreases. 1A

(b) $4 \times T \cos 30^o - mg = ma$

$4 \times T \cos 30^o - 800 \times 10 = 800 \times 0.5$ 2M

i.e. $T = 2.42\times10^3$ N 1A

3. (a) Δ K.E. = Δ P.E.

$mv^2/2 = mgh$ 1M

$(1) \times v^2 / 2 = (1) \times 10 \times (0.05 \times \sin 25^o)$

i.e. $v = 0.650$ m s^{-1} (3 s.f.) 1A

(b) $m_1 u = (m_1 + m_2) \times v$

$0.02 \times u = (1) \times 0.65$ 1M

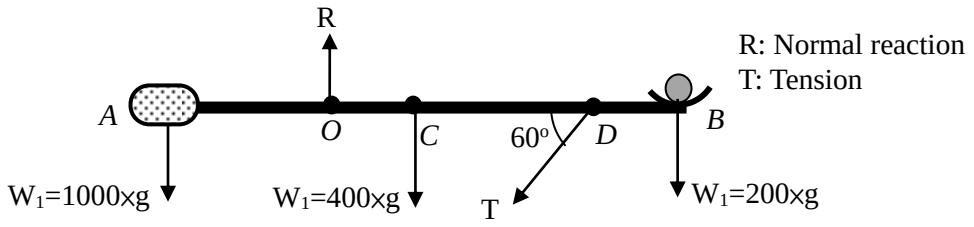
i.e. $u = 32.5$ m s^{-1} (3 s.f.) 1A

(c) Collide with the plasticine: K.E. of the bullet → K.E. of the trolley + heat and sound 1A

Moving up inclined plane: K.E. of the bullet and trolley → P.E. of the bullet and trolley 1A

(d) The same height 1A

4. (a) (i) 1A



Take moment at O:

(ii) $(1000 \times 10) \times 6 = (400 \times 10) \times 2 + (T \times \sin 60^o) \times 8 + (200 \times 10) \times 10$ 2M

i.e. $T = 4.62 \times 10^3$ N 1A

(b) (i) $X = u_X \times t$

$100 = (40 \times \cos 30^o) \times t$ 1A

i.e. $t = 2.89$ s (3 s.f.)

(ii) $Y = u_y \times t - gt^2 / 2$

$Y = (40 \times \sin 30^o) \times (2.89) - 10 \times (2.89)^2 / 2$ 1M

$Y = 16.0$ m 1A

The height of the stone above the ground at 2.89 s is (10 + 16.0) m > 20 m

i.e. The stone will pass over the wall of the castle. 1A

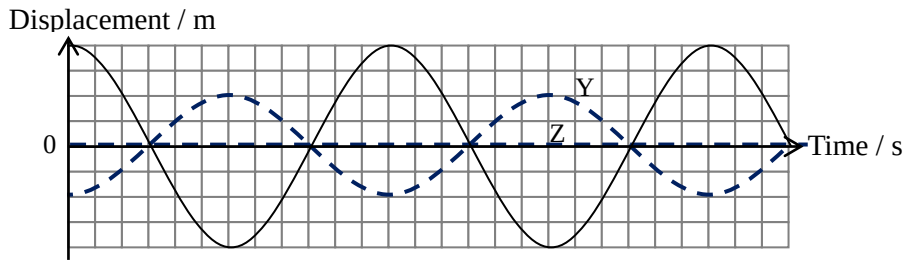
5. (a) (i) Transverse Stationary / Standing Wave 1A

(ii) Wavelength $\lambda = 2 / (1.5) = 1.33$ m (3 s.f.) 1A

And $v = f\lambda = 60 \times 1.33 = 80$ m s^{-1} 1A

(iii) Y: 1A

Z: 1A



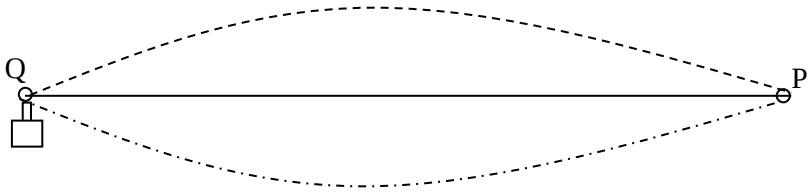
(b) **Differences:**

Wave on the string	**Sound wave**
Transverse	Longitudinal
Stationary	Travelling
Different wavelength / speed / amplitude	

2A

(Any TWO of the above)

(c) 1A



6. (a) **<u>Convex lens</u>**. 1A

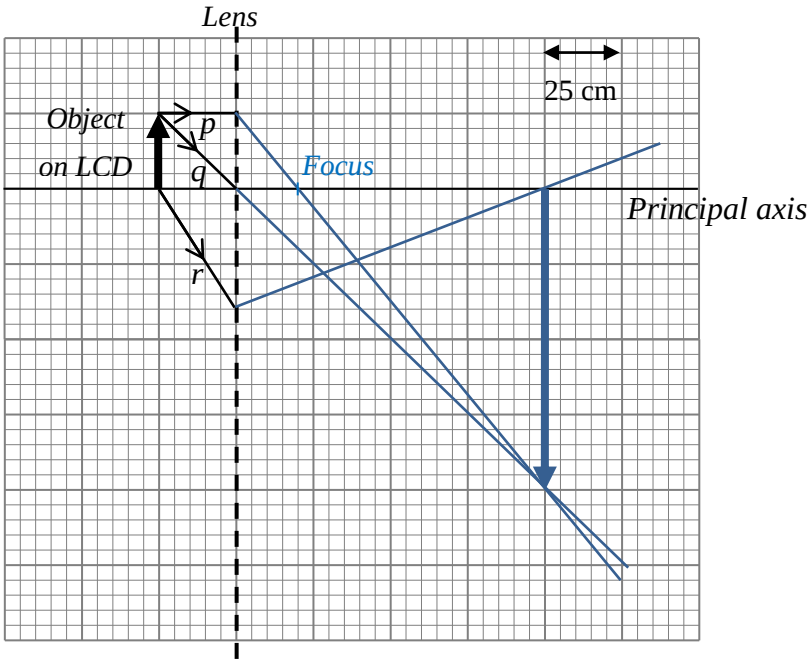
To project **<u>real image</u>** onto the screen. 1A

(b) (i) m = v / u

4 = v / 25 cm

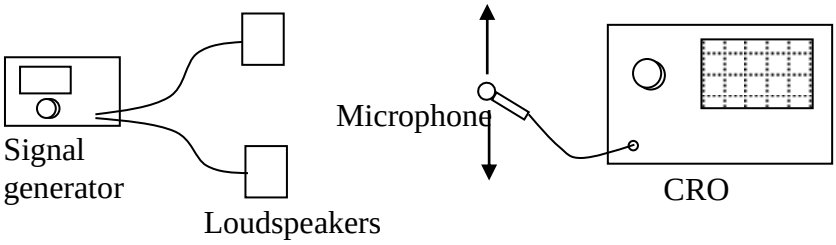
i.e. v = 100 cm (or 1m) 1A

(ii) Correct ray 1A@
Correct image 1A



(iii) Focal length = 20 cm 1A

7. (a)



1A

Connect the two loudspeakers in parallel to the same signal generator and connected the microphone to the CRO as shown in the diagram.

Move the microphone in front of the loudspeakers and note the change in the trace shown by the CRO. 1A

Alternate changes in the amplitude of the waves will be noted. 1A

At the positions where constructive interference occurs, a strong signal will be noted. 1A

At the positions where destructive interference occurs, a weak signal will be noted. 1A

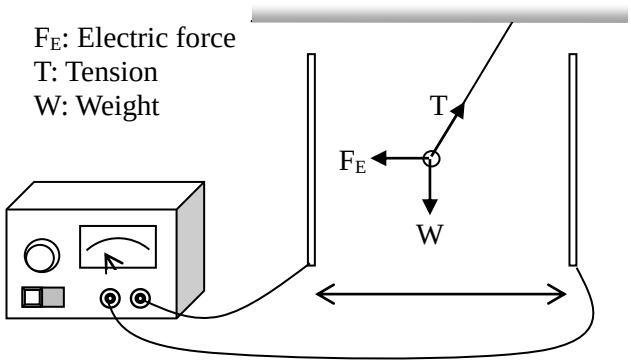
(b) $\lambda = 340 / 300 = 1.13$ m

i.e. separation: several meters (order of magnitude 10^0 m) 1A

(c) (i) The separation between the positions of loud sound (constructive interference) decreases. 1A

(ii) The position of loud (constructive) sound and soft (destructive) sound interchange 1A

8. (a)



2A

(b) (i) $E = V / d = 4000 / 0.5 = 8000\ V\ m^{-1}$ 1A

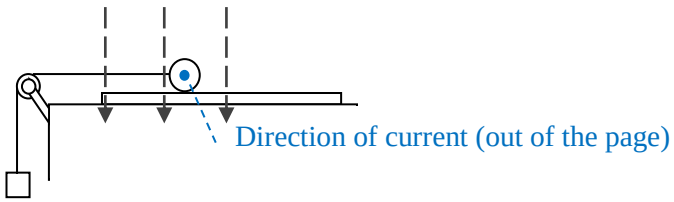
(ii) $\begin{cases} T \sin 70^o = mg \\ T \cos 70^o = Eq \end{cases}$ 1M

➔ $\tan 70^o = mg / Eq$ 1M

➔ $m = Eq \tan 70^o / g = 8000 \times (0.02 \times 10^{-3}) \tan 70^o / 10$

i.e. $m = 0.0440\ kg$ (3 s.f.) 1A

9. (a) (i) 1A



(ii) $mg = F_E$

⇨ $mg = BlI$

⇨ $0.02 \times 10 = 0.6 \times I \times 0.4$ 1M

i.e. $I = 0.833\ A$ (3 s.f.) 1A

(b) (i) $\varepsilon = Blv$

⇨ $\varepsilon = 0.6 \times 0.4 \times 1.2$ 1M

$\varepsilon = 0.288\ V$ 1A

(ii) P

(iii) The lamp bulb becomes <u>brighter and brighter</u>. 1A

As the rod moves faster and faster, <u>the rate of change of flux</u> enclosed by the rod and the circuit <u>increases</u>. (or The <u>rate the rod cuts through the magnetic field lines increases</u>) 1A

10. (a) When the magnet approaches the coil ➔ magnetic flux through the coil increases 1A

➔ induced e.m.f. produced in the coil

When the magnet recedes away from the coil ➔ magnetic flux through the coil decreases 1A

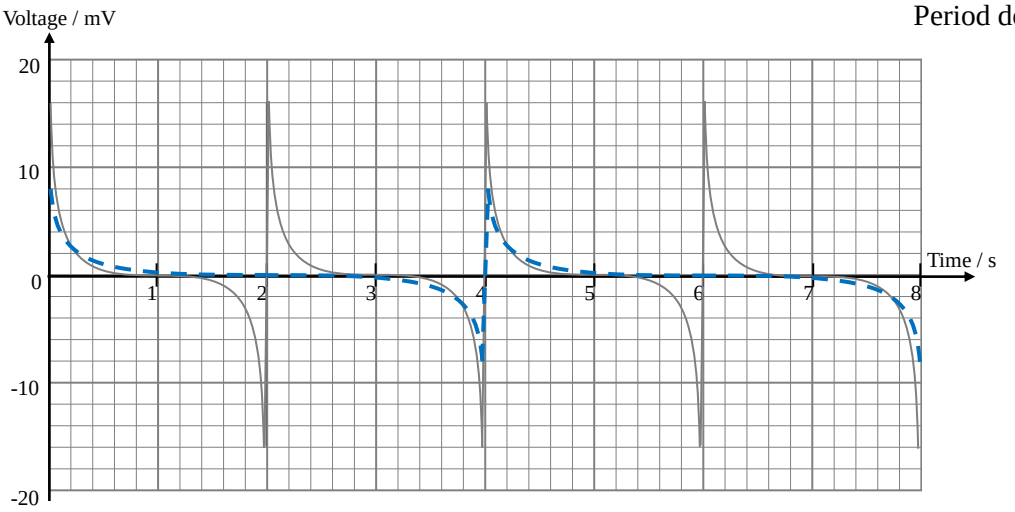
➔ induced e.m.f. produced coil in **opposite direction**. 1A

(b) $\omega = 2\pi / T = 2\pi / 2$ 1M

$= \pi$ rad s^{-1} (or 3.14 rad s^{-1}) 1A

(c) Amplitude decreases 1A

Period double 1A



11. (a) The range of alpha particle in air is very short to reach the people in the room. 1A

(b) Long half-life: Steady (the activity of the source is relatively constant) 1A

Emit alpha radiation: strong ionizing power to produce large amount of ion-electron pairs 1A

(c) (i) $k = \ln 2 / t_{1/2} = \ln 2 / \{(432 \times (365 \times 24 \times 3600)) = 5.09 \times 10^{-11}\ s^{-1}$ 1A

(ii) $A = kN$

$40 \times 10^3 = (5.09 \times 10^{-11}) \times N$ 1M

i.e. $N = 7.87 \times 10^{14}$ 1A

Paper II

Section A

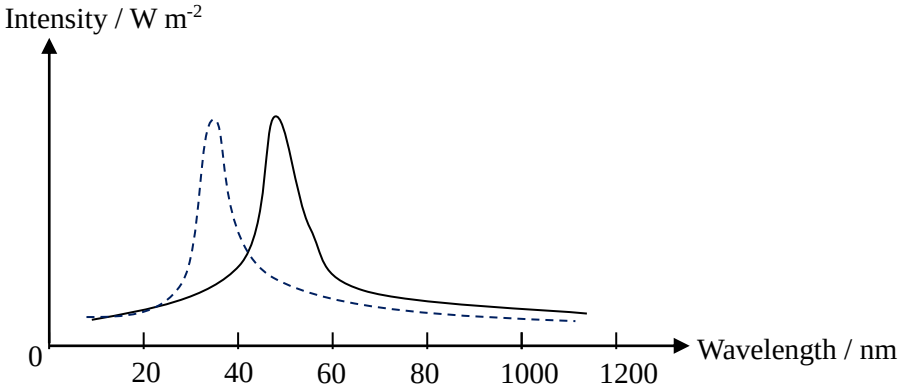
1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8
D	A	D	B	C	B	A	C

Q.1 (a) (i) $\tan 0.000051^o = 1.5\times10^{11} / x$ 1M

i.e. $x = 1.69\times10^{17}$ m 1A

(ii) Star *Y* is further away from the Earth than star *X*. 1A

(b) (i) 1A



(ii) Since $L = \sigma A T^4$ and the two stars have the same luminosity,

⇨ $R_X^2 T_X^4 = R_Y^2 T_Y^4$ 1M

⇨ $(3 R_{SUN})^2 T_X^4 = R_Y^2 (2T_X)^4$

⇨ $R_Y = (9/16)^{0.5} = 0.75$ 1A

(c) (i) Red Shift 1A

The star *Y* is receding from the Earth. 1A

(ii) Since $\left|\frac{\Delta f}{f_o}\right| \approx \frac{v}{c} \approx \left|\frac{\Delta \lambda}{\lambda_o}\right|$

⇨ $v = c\,|\Delta\lambda / \lambda|$

⇨ $v = 3\times10^8 \times |0.7 / 490|$ 1M

i.e. $v = 4.29\times10^5$ m s^{-1} 1A

Section C

3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8
B	C	D	A	A	C	D	B

Q.3 (a) (i) $P_{out} = P_{in} \times 80\%$

$12000 = (80 \times I) \times 80\%$ 1M

i.e. $I = 187.5$ A 1A

(ii) The operation time $t = E / P = (28000 \times 3600 \times 80\%) / 12000$ 1M

$t = 6720$ s

i.e. The distance travelled $s = v \times t = (60 \times 1000 / 3600) \times 6720$ 1M

$s = 112\,000$ m (or 112 km) 1A

(b) (i) During braking, part of the K.E. of the wheel is converted into electrical energy by the generator. The electrical energy generated is then used to recharge the car battery for future use. 1A 1A

(ii) $E = P \times t$

$(28\,000 \times 3600) \times 10\% = \{1200 \times (1.5 \times 2.5) \times \cos 20^{o} \times 15\%\} \times t$ 2M

i.e. $t = 1.59 \times 10^{4}$ s (or 4.41 hours) 1A

END