華僑中學
HWA CHONG INSTITUTION
Sec 3 PHYSICS
Sample Paper C (ANSWERS)

Paper 1 MCQ

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

Paper 2 STRUCTURED

SECTION A (40 MARKS)

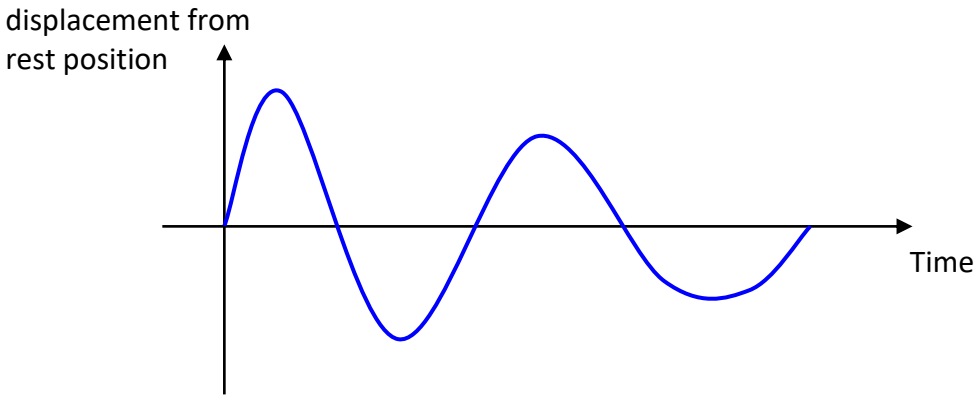
1 (a) A complete oscillation is a complete cyclical motion from B → C→A → B. [1]

(b) Any one of the following:

- Parallax error for measurement of length. [1] Stand directly over marking to take measurement. [1]
- Time taken for elliptical / circular motion of pendulum. [1] Set small angle oscillation for pendulum. [1]
- Measuring instrument e.g. metre rule is not calibrated properly. [1] Repeat experiment with another instrument to check. [1]

(c) Period of oscillation will remain unchanged. [1]
(It is independent of mass of pendulum.)

(d) Two sine waves [1] with progressively longer periods **OR** smaller amplitude [1]
(Period increases as length of pendulum increases. Centre of mass becomes lower as water leaks out.)



2 (a) speed = 3.00 x 10^8 / 1.54 [1]
= 1.95 x 10^8 m s^{-1} [1] (to 3 s.f.)

(b) The angle of incidence is 0°. / Ray is incident perpendicularly to the interface. [1]

(c) Let c be the critical angle.

c = $\sin^{-1}$ (1/1.54) [1]
= 40.5°(to 3 s.f.) [1]

3 (a)

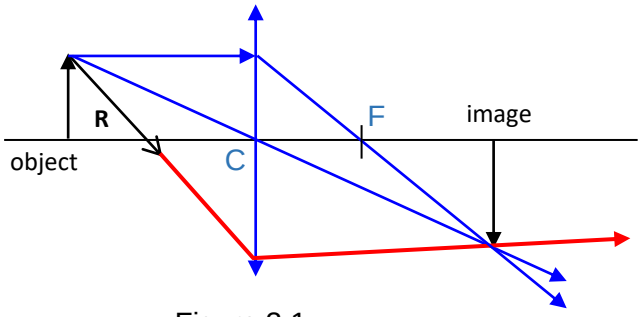


Figure 3.1

Two correct rays with arrows: [2] [Two correct rays without arrows: [1]]
Correct label of position of C and F. [1]

(b) Correct ray (See red line in above diagram.)

(c) Focal length is smaller. [1]
Object is now further from new principal focus, so the <u>image becomes size smaller / image distance decrease</u> [1].

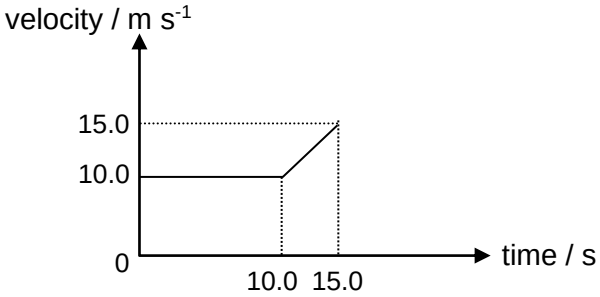
4 (a) Infrared radiation [1]
Thermal sensors / thermometers / heat treatment etc… [1] remote control signals

Other possible answers accepted. No ecf within question.

(b) Both travel at the same speed (or 3.0 X 10^8 m s^{-1}) <u>in vacuum</u>.
Both are transverse waves. [1]

(c) Gamma rays penetrate cells/ ionize cells [1] and separates the double chromosomes causing defects and genetic mutations, kill cells. [1]

5 (a) Correct shape [1]; Axes show quantities with units and critical points labelled [1]



(b) s = 10.0 (10.0) + ½ (5.0)(10.0 + 15.0) [1]
= 162.5
= 160 m [1] (to 2 s.f.)

(c) $162.5 = ½ \text{ a } 15.0^2$ [1]
$a = 1.4 \text{ m s}^{-2}$ (to 2 s.f.) [1]

6 (a) When a fixed mass of gas absorbs thermal energy from its surrounding, the average kinetic energy of the molecules increases [1] and the molecules move faster / average speed of the molecules increases. [1]

(b) The gas molecules exert a force on the walls of the bag each time they collide into it. [1] Pressure is the force exerted per unit area of the walls. [1]

(c) After some time in the sun, the molecules move faster and frequency of collision of molecules with the wall increases and force exerted by the molecules on the wall increases. [1]
The size of bag expands so that surface area of the walls increases to keep pressure inside bag to be the same as pressure outside bag (or atmospheric pressure). [1]

7 (a) wavelength = 28.0 / 6 = 4.67 m (to 3 s.f.) [1]

(b) speed of wave = 28.0 / 3.2 [1]
$= 8.75 \text{ m s}^{-1}$

$v = f\lambda$ => frequency = 8.75 / 4.667 [1]
= 1.9 Hz (to 2 s.f.) [1]

(c) 3.2 s. [1]
Speed of wave depends on the nature of the medium. Since there is no change in the medium in which the wave propagates, there is no change in its speed. [1]

No marks for discussing about frequency and wavelength.

8 (a) Principle of conservation of energy states that the total energy of an isolated system is constant.

(b) expected speed = $\sqrt{(2gh)}$ [1]
$= \sqrt{[(2(10)(2.00))}$
$= 6.32 \text{ m s}^{-1}$ (to 3 s.f.) [1]

(c) Friction exists between the cart and the plane. / There is work done against friction. [1]

Loss in G.P.E. = Gain in K.E. + work done against friction [1]

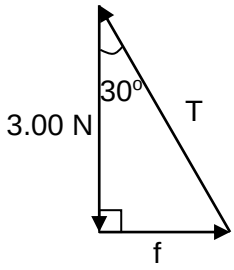
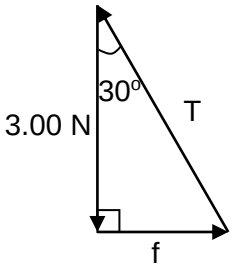
Since the cart has a smaller gain in K.E., this means its measured speed is lower. [1]

(d)(i) Efficiency of incline plane system = $[½ (100)(5.92)^2] / [(100)(10)(2.00)] \times 100\%$ [1]
= 87.6 % (to 3 s.f.) [1]

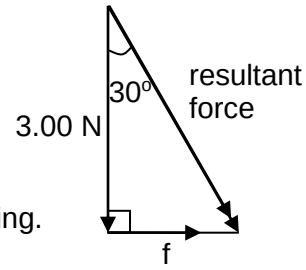
(ii) As the drop height is kept constant at 2.00 m, the cart travels a shorter distance along the plane as θ increases. [1]

Since there is less energy dissipated due to friction or there is smaller work done against friction, the gain in K.E. increases (or the cart has a larger final speed), thus efficiency of system increases. [1]
[Accept larger resultant force along slope. [1]]

9 (a)

Scale diagram method:	**Mathematical method:**
[1]: Scale: 1.0 cm represents 0.50 N  [1]: Labelled vector diagram drawn to scale. [1]: T = 6.9 X 0.50 = 3.45 N (Range for T: 3.35 N to 3.55 N) [1]: f = 3.5 X 0.50 = 1.75 N (Range for f: 1.65 N to 1.85 N)	 [1]: Sketch of labelled vector diagram. [1]: T cos 30° = 3.00 N T = 3.46 = <u>3.5 N</u> (correct to 2 s.f.) [1]: f = 3.00 tan 30° f = 1.73 = <u>1.7 N</u> (correct to 2 s.f.) [1]: Both answers correctly evaluated.

(b)[1]: Sketch of labelled vector diagram. (Note: Draw double arrow for resultant!)



[1]: Resultant force = $\sqrt{(3.00^2 + 1.732^2)}$ = 3.464 N
Since Fnet = ma,
a = 3.464 / 0.300
[1]: a = 11.5 m s^{-2} (correct to 3 s.f.)(Also accept 2 s.f.)

[1]: Direction of acceleration is opposite to that of tension in the string.
OR 60° clockwise from the right-side horizontal
OR 30° anticlockwise from the downward vertical or weight of ball

(c)[1]: For any of the following.
Resultant force acting on an object is equal to the product of its mass and its acceleration.
Resultant force acting on an object is directly proportional to the rate of change of momentum of the object.
For a constant mass object, resultant force acting on an object is directly proportional to its acceleration.

[1]: Direction of resultant force acting on an object is the same as direction of the object's acceleration.

Question 10A:

(a) Large surface area [1]; To increase rate of heat loss by radiation [1]
Vertical fins [1]; To facilitate thermal energy transfer by convection [1]

(b) Thermal energy is transferred from the processor, through the paste, to the heat sink by conduction. [1: Stating direction of energy flow and method]
Molecules in the paste nearer the processor gain kinetic energy and vibrate faster. They collide into neighbouring molecules and transfer some energy to them and cause them to vibrate faster too. [1]

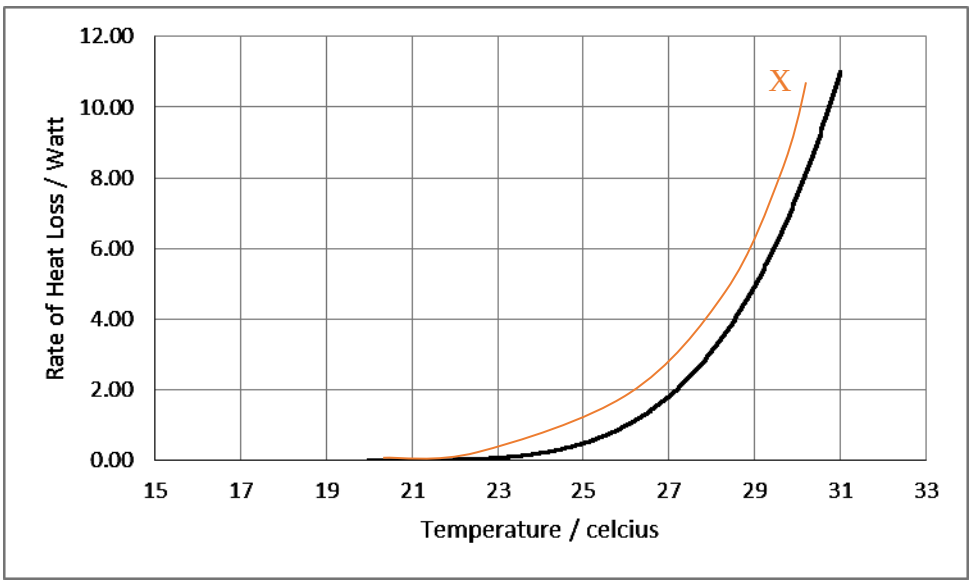
(c)(i) From Graph A, when room temperature is 20 °C, the rate of heat loss by the heat sink is 0 W. From Graph B, the rate of heat generated by the processor is greater than 0 W even for the lowest processing speeds or the minimum rate of heat generated by the processor is 1 W. [1: evidence of graph interpretation]

Since the rate of heat generated by the processor is greater than the rate of heat loss by the heat sink, thermal energy is transferred to the heat sink and this causes its temperature to rise. [1: comparing two rates]

no marks for if student only mentions that thermal energy is still generated at low speeds.

(ii) Accept 2.1 or 2.2 GHz. (Read off Graph B when rate = 6.0 W.)

(iii) Graph translated to the left and must be labelled X. [1]
(Rate of heat loss increases when difference in temperature between object and environment increases.)



(iv) In a cooler room, for the same temperature of the heat sink, the rate of heat loss by the heat sink is greater. This means the processor can operate at higher speeds without overheating or lifespan of processor can be increased. [1]

(d) Add a micro fan on top of the heat sink / paint the heat sink black / increase the length of its fins. [1]

Question 10B:

(a)(i) 2250 J of energy is needed to convert 1 g of water to steam without changing its temperature. [1]

(ii) $Q = ml_v + mc\Delta\theta$ [Q is energy supplied by steam at 100 ^oC.]
$= 100\ (2250)$ [1] $+ 100\ (4.2)(100)$ [1]
$= 267\ 000$
$= 270\ 000$J [1] (Accept 2 or 3 s.f.)

(b) [Mass of water produced per second = Mass of ice melted per second + mass of steam condensed]
Mass of ice melted per second = 0.88 - 0.10 = 0.78 kg [1]

$Q = ml_f$ [Q is energy absorbed by snow at 100 ^oC.]
$267000 = 780\ l_f$ [1]
$l_f = 342$
$= 340$ J / g [1] (correct to 2 s.f.)

(c) The calculated value is higher. [1]
Thermal energy dissipated to the environment means the actual specific latent heat of fusion is lower. [1]

(d) Melted snow may lose thermal energy and form ice which makes the road slippery and dangerous. OR
Direct application of steam on the road is less efficient as more thermal energy is dissipated to the environment. [1]

END OF PAPER