Name: _____ ( ) Class: _____

華僑中學
HWA CHONG INSTITUTION
Sample Paper C

PHYSICS
Paper 2

Level: Secondary Three
Duration: 1 hour 45 mins

Do not open this booklet until you are told to do so.

INSTRUCTIONS TO CANDIDATES

Write your name, index number and class on the top of this page.

Answer the questions in **Section A and B** in the spaces provided. All workings must be shown.

*In **Section B**, for **Question 10** answer* '**EITHER**' or '**OR**'.

INFORMATION FOR CANDIDATES

In **Sections A and B** the intended marks for each question or part of a question are given in brackets [ ]. Any working should be done in the space provided.

When necessary, take g to be 10 m s^{-2} or 10 N kg^{-1}

SECTION A (40 MARKS)

Answer **all** *the questions in this section.*

1 The diagram below shows an oscillating pendulum made from a light inextensible string and a light container filled with water. The *length of the pendulum, l, may be determined from the pivot to the centre of the liquid column*.

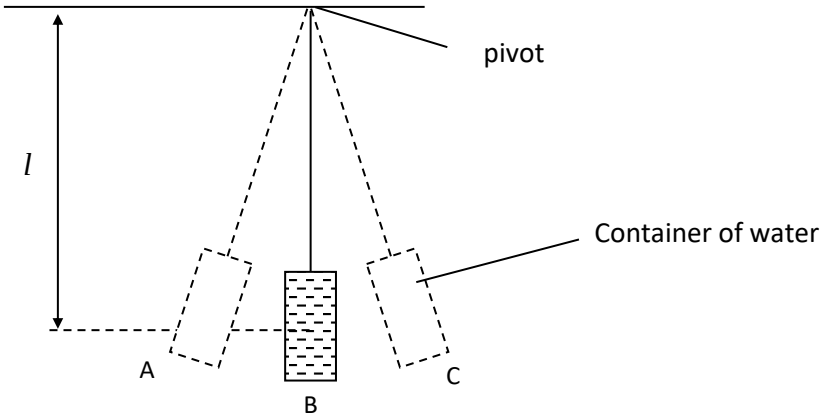

Figure 1.1

a) With reference to the positions of Figure 1.1, state what is meant by a complete oscillation. [1]

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b) Identify a systematic error in this experiment and state a precaution you would take to reduce the effect of the error. [2]

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c) Suggest what would happen to the period of the oscillation if mercury is used instead of water. [1]

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d) Liquid in the container leaks out as the pendulum is moving. The axes of the graph of the displacement from rest position against time taken is shown below. Sketch a graph to show the effect of a leaking container by drawing two consecutive oscillations. [2]

2 Figure 2.1 shows a ray of light entering a triangular prism from air. The absolute refractive index of the prism is 1.54 and the speed of light in air is 3.00 X 10^8 m s^{-1}.

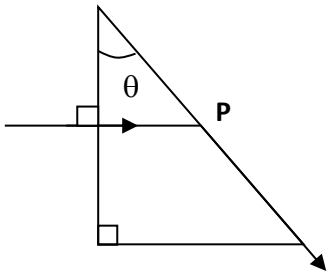

Figure 2.1

a) Determine the speed of light in the prism. [2]

b) Explain why the light does not bend when it enters the prism. [1]

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c) Calculate the angle θ for the ray of light to travel along the surface of the prism after it exits from **P**. [2]

3 Figure 3.1 shows the position of an object and its image formed through a converging lens.

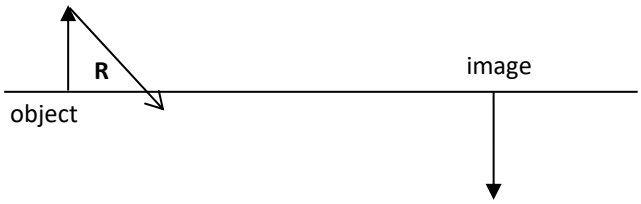

Figure 3.1

a) Draw two principal rays to show how you can determine the focal point, **F** and the position of the lens, **C**. Label these points clearly. [3]

b) Complete the ray **R** from the object to the image. [1]

c) State how the focal length and the property of the image would change if the original lens is replaced by another lens in which the light ray bends more after passing through it. [2]

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4 Figure 4.1 below shows an ordered section of the electromagnetic spectrum.

Microwaves	**P**	Visible light	**Q**	Gamma Rays

Figure 4.1

a) Identify the type of EM wave **P** is and state an application that uses **P**. [2]

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b) List one common property between **P** and **Q**. [1]

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c) Describe how absorbing gamma rays affect the cells in the body. [2]

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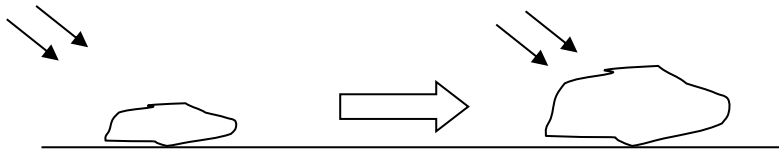
5 A car travels at a constant velocity of 10.0 m s^{-1} for 10.0 s. Then it accelerates constantly to 15.0 m s^{-1} in the next 5.0 s.

a) Sketch the velocity-time graph over the duration of 15.0 s. [2]

b) Calculate the displacement of the car over the duration of 15.0 s. [2]

c) A second vehicle, undergoing constant acceleration, started at the same time with the first car and travelled the same distance from rest. It reached the same position as the first car after 15.0s. Calculate the acceleration of the second vehicle. [2]

6 A sealed, dark coloured and crumpled, plastic bag containing some gas was put under the sun. After some time, the plastic bag seems to be slightly inflated.



a) Using kinetic theory, explain how the behavior of gas molecules in the plastic bag will change over time. [2]

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b) Describe how the gas molecules exert a pressure on the walls of the plastic bag. [2]

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c) Explain why the bag under the sun inflates after some time. [2]

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7 Figure 7.1 shows a cross section of a transverse wave between source **P** and receptor **R**. The distance between **P** and **R** is 28.0 m.

Figure 7.1

a) Calculate the wavelength of the transverse wave. [1]

b) Given that it took 3.2 s for the disturbance at **P** to reach **R**, calculate the frequency of the wave. [3]

c) The source at **P** was given a disturbance with an amplitude twice the original. How long would it take this new disturbance to reach R? Explain your answer. [2]

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SECTION B (30 MARKS)

Answer Question 8, 9 and either 10A or 10B

8 A 100 kg cart rolls down a long incline plane from a vertical height of 2.00 m as shown in Figure 8.1. At the end of the plane is a body of water to bring the cart to a stop. Figure 8.2 is a table of values to show the expected and measured speeds of the cart at the bottom of the plane, just before it enters the body of water, for different values of θ, the angle of the plane to the horizontal.

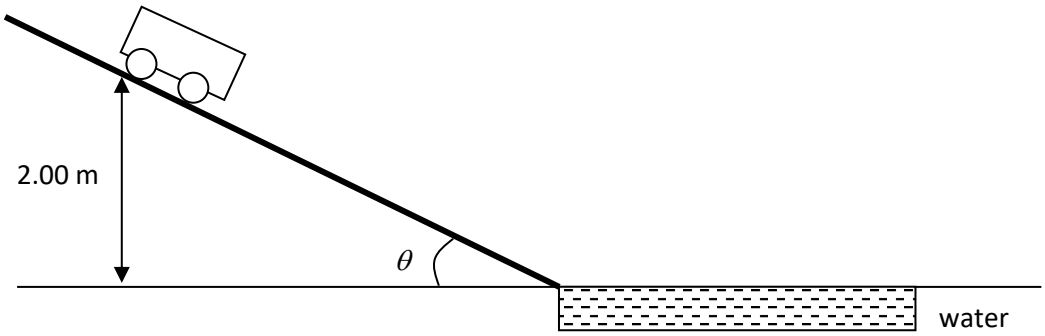

Figure 8.1

Drop height = 2.00 m			
θ / °	Expected Speed/ m s^{-1}	Measured Speed/ m s^{-1}	Efficiency / %
25.0	6.32	5.70	81.3
30.0	6.32	5.83	85.0
35.0	6.32	5.92	
50.0	6.32	6.08	92.4

Figure 8.2

a) State the principle of the conservation of energy. [1]

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b) Show how the expected speed for θ = 30.0° is calculated. [2]

c) Explain, using concept of work done and conservation of energy, how the measured speed is different from the expected speed. [3]

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d) (i) Calculate the efficiency of the incline plane system at 35.0°. [2]

(ii) Explain why the efficiency increases as θ increases. [2]

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9 Figure 9.1 shows a 300 g ball, in equilibrium, suspended at an angle of 30° to the vertical when a horizontal force, **f**, is applied to the ball.

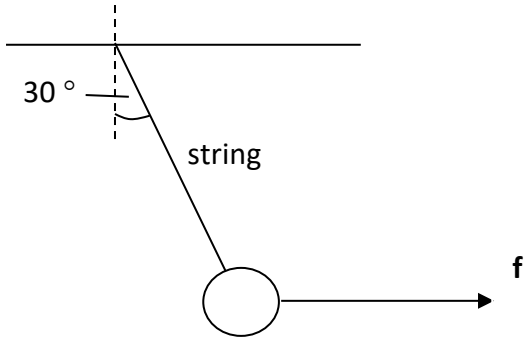

Figure 9.1

a) Using a scale diagram or otherwise, determine the tension in the string, **T** and the force **f**. [4]

b) Determine the **magnitude** and **direction** of the acceleration of the ball at the moment the string is cut. Include a labelled vector diagram of the ball at this moment to support your answer. [4]

c) State Newton's 2nd Law. [2]

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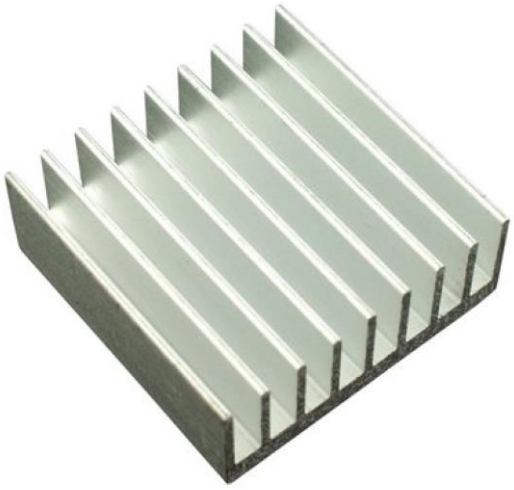
EITHER

10A Figure 10.1 shows a device called a heat sink that is attached to computer processors. The purpose of the heat sink is to transfer thermal energy from the processor to the environment. At higher processing speeds, the thermal power will be higher. The processor will be damaged if it is overheated.



source: http://www.robotshop.com

Figure 10.1

a) Describe, with reference to Figure 10.1, how the design feature of the heat sink fulfills its purpose. [2]

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b) A special adhesive paste is used to secure the device to the processor. Explain, in terms of molecules, how the device gains thermal energy from the processor. [2]

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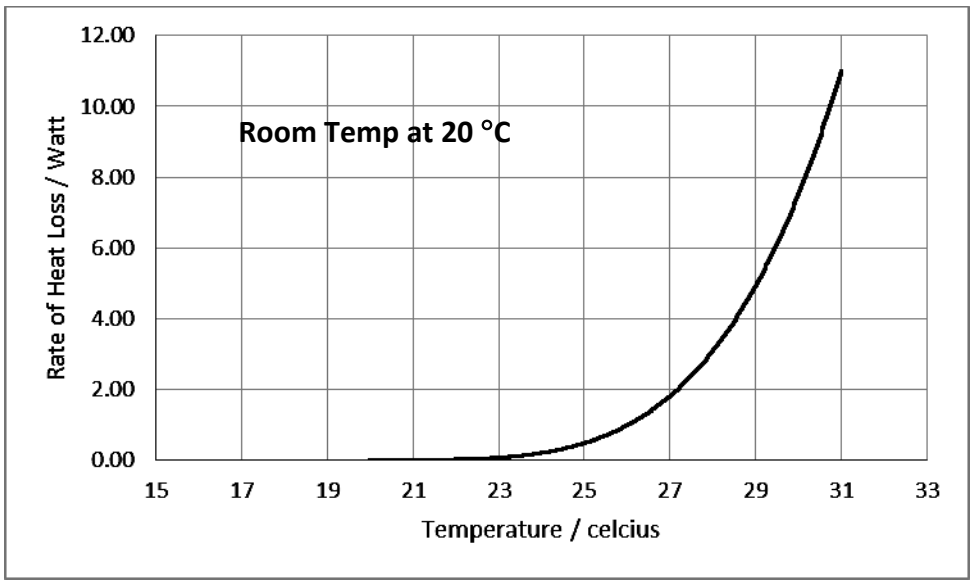
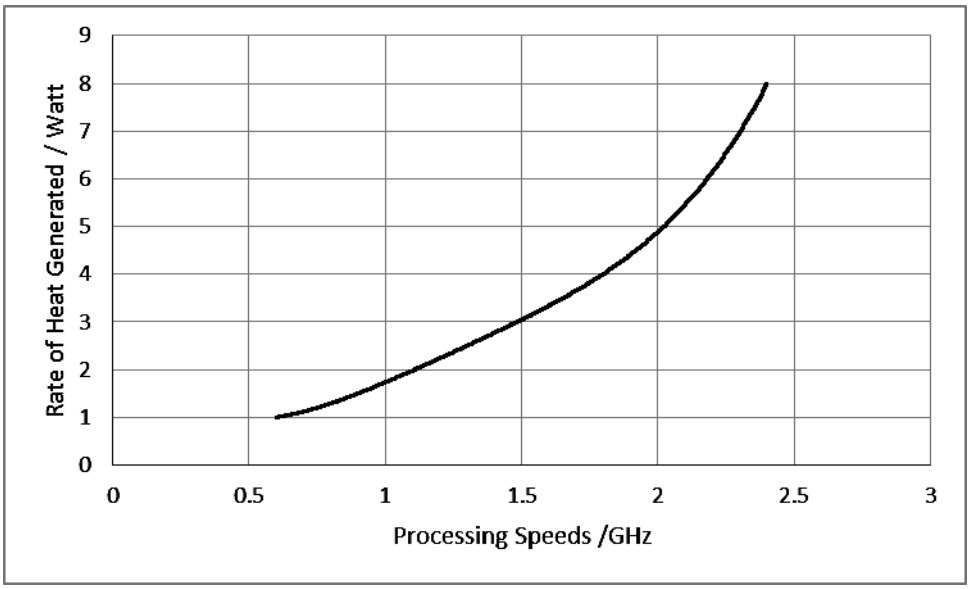
c) A computer is used in a room at 20 °C. Two graphs **A** and **B** are shown below. Graph **A** shows how the rate of heat loss changes with the temperature of the heat sink. Graph **B** shows how the rate of heat generated changes with the processing speed.



A. Graph of rate of heat loss by heat sink against temperature of heat sink



B. Graph of rate of heat generated by processor against processing speeds

Given that the thermal energy is generated at **6.0 W** at **normal processing speeds**,

i) Explain why the temperature of the heat sink rises from 20 °C even at low processing speeds. [2]

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ii) State the normal processing speed at equilibrium temperature. [1]

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iii) On Graph **A**, sketch a new relationship showing the rate of heat loss in a cooler room. Label this new graph **X**. [1]

iv) Using information in the graph, write down an advantage of using the computer in a cooler room. [1]

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d) How else should you modify the device to increase its rate of heat loss? [1]

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OR

10B In temperate countries, snow on the road or tarmac is a hazard to vehicles and aeroplanes. A snow melter is an equipment that uses hot water or steam to melt collected snow.

Source: http://www.snowdragonmelters.com

For one such equipment, steam at 100 °C was delivered at 0.1 kg per second to melt collected snow at 0.0 °C. In the process, a steady stream of 0.88 kg water at 0.0 °C was collected every second.

a) Given that the specific latent heat of vaporization of water is 2250 J / g and the specific heat capacity of water is 4.2 J/ g K.

(i) What is meant by the phrase "specific latent heat of vaporization of water is 2250 J / g "? [1]

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(ii) Determine the thermal energy lost by the steam to melt the collected snow in one second. [3]

b) Determine the specific latent heat of fusion of ice. [3]

c) Is the value you calculate in (b) higher or lower than the actual value? Explain your answer. [2]

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d) The process involves gathering snow and melting them in a collector before dumping the water. Why it is not recommended to apply the steam directly onto the road of tarmac full of snow? [1]

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END OF PAPER