DULWICH COLLEGE | SINGAPORE |

Year 9 Examination
Physics
May 24th 2017
2pm start.

Name: .....

Teacher:

Time allowed: 75 minutes

Answer all questions on the paper.

Total Marks available	/ 74	Teacher comment:
	%	
Grade		

Student reflection

EQUATIONS

You may find the following equations useful.

energy transferred = current × voltage × time $E = I \times V \times t$

pressure × volume = constant $p_1 \times V_1 = p_2 \times V_2$

$$\text{frequency} = \frac{1}{\text{time period}} \qquad f = \frac{1}{T}$$

$$\text{power} = \frac{\text{work done}}{\text{time taken}} \qquad P = \frac{W}{t}$$

$$\text{power} = \frac{\text{energy transferred}}{\text{time taken}} \qquad P = \frac{W}{t}$$

$$\text{orbital speed} = \frac{2\pi \times \text{orbital radius}}{\text{time period}} \qquad v = \frac{2 \times \pi \times r}{T}$$

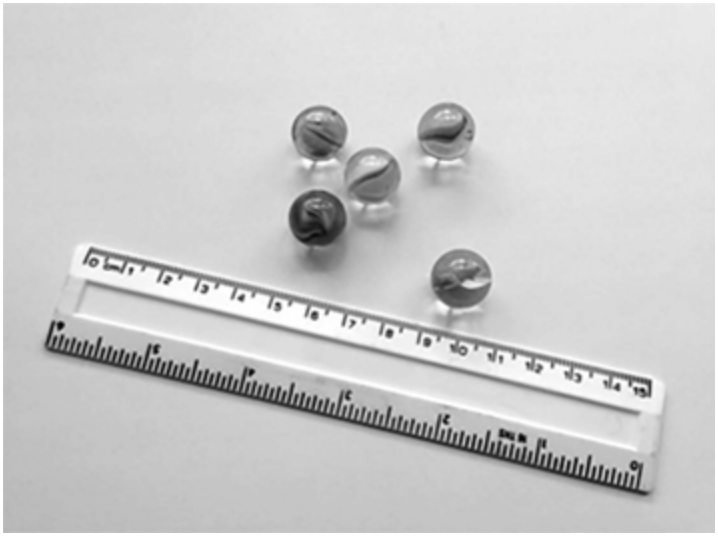
$$\frac{\text{pressure}}{\text{temperature}} = \text{constant} \qquad \frac{p_1}{T_1} = \frac{p_2}{T_2}$$

$$\text{force} = \frac{\text{change in momentum}}{\text{time taken}}$$

Where necessary, assume the acceleration of free fall, $g = 10\ \text{m/s}^2$.

1 Marbles is a game played with small balls of coloured glass.

Each ball is known as a marble.



(a) Describe how a millimetre scale and two set squares can be used to measure the diameter of a marble.

You may draw a diagram to help your answer.

(3)

(b) Describe an experiment to find the density of a marble.

You may draw a diagram to help your answer.

(5)

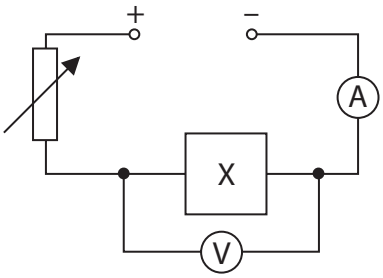
(Total for Question 1 = 8 marks)

2 A student is given an unknown electrical component, X.

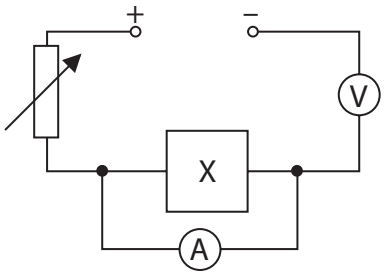
He uses a circuit to investigate how the current in X varies with the voltage across it.

(a) Which of these circuits is correct for his investigation?

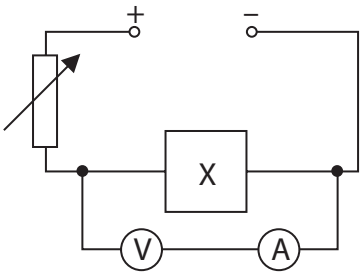
(1)



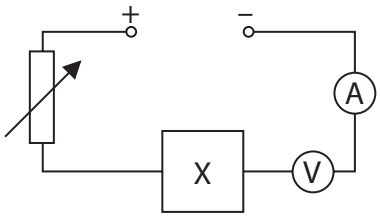
A ☒



B ☒



C ☒



D ☒

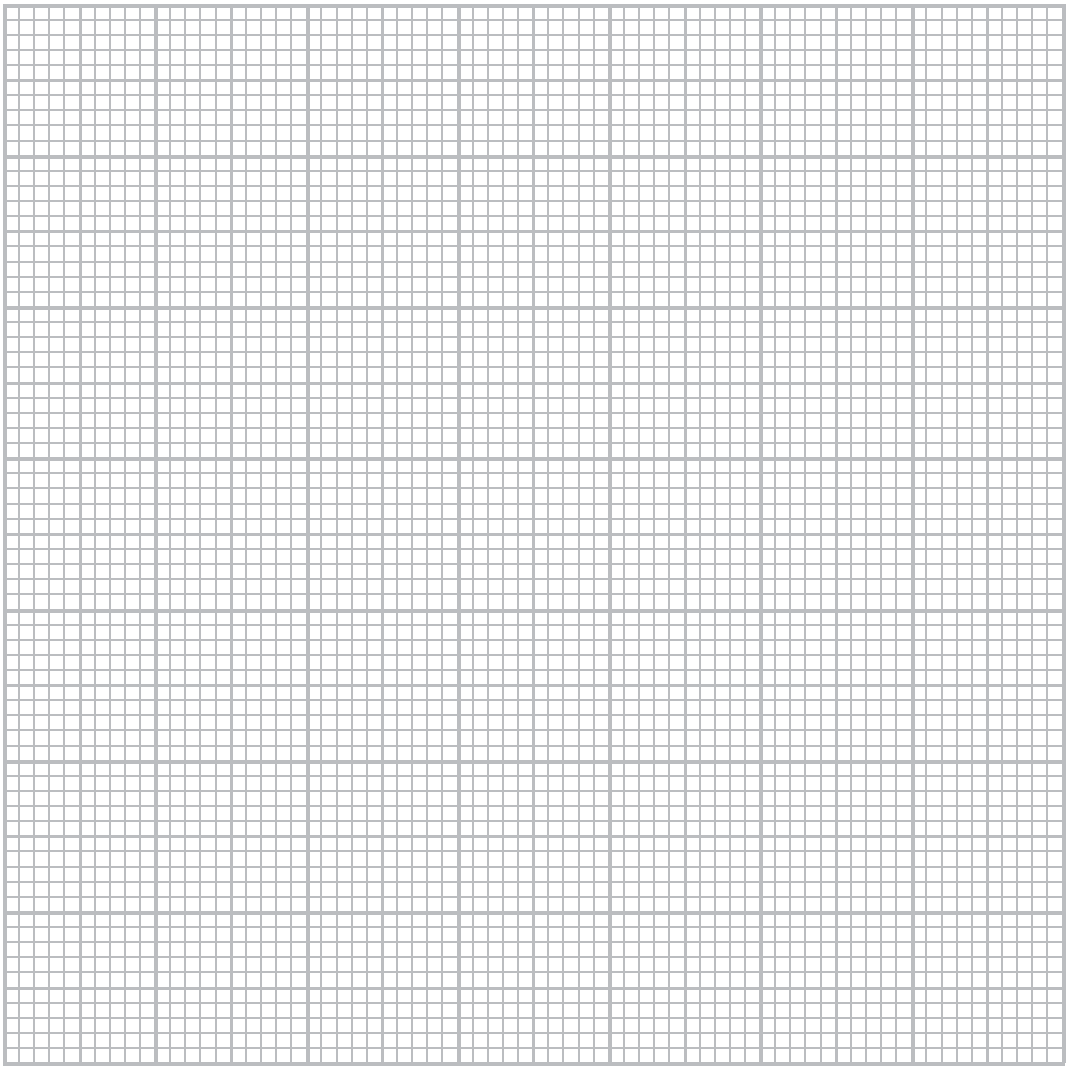
(b) The table shows the student's results.

Voltage across X in V	Current in X in A
0	0
3.0	0.5
14.5	2.3
19.5	2.9
25.0	3.2
29.5	3.3

(i) Plot a graph of these results and draw a curve of best fit.

(4)

current in A



voltage in V

(ii) State the equation linking voltage, current and resistance.

(1)

(iii) Calculate the resistance of component X when the voltage across it is 10.0 V.

Give the unit.

(4)

resistance = ... unit .....

(iv) Describe the pattern shown by this graph.

(3)

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(v) Suggest a conclusion for the investigation.

(2)

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(Total for Question 2 = 15 marks)

3 Different types of waves are used in hospitals.

(a) Some of the waves used are electromagnetic.

(i) Which of these properties is the same for all electromagnetic waves?

(1)

☒ **A** amplitude

☒ **B** frequency

☒ **C** speed in free space

☒ **D** wavelength in free space

(ii) Draw a line linking each type of electromagnetic wave with its use.

(2)

type of electromagnetic wave	**use**
gamma rays	heating food for patients
microwaves	imaging broken bones
x-rays	with medical tracers

(iii) Electromagnetic waves are transverse.

Describe how the vibrations of a transverse wave relate to the direction in which the wave travels.
You may draw a diagram to help your answer.

(1)

.....

.....

(b) Another type of wave used in hospitals is ultrasound.

Ultrasound waves are used to make images of internal organs.

A scanner emits an ultrasound wave into the patient and records any reflections.

(i) The frequency of ultrasound waves is outside the range of human hearing.

Which of these could be the frequency of an ultrasound wave?

(1)

☒ **A** 45 Hz

☒ **B** 450 Hz

☒ **C** 4 500 Hz

☒ **D** 45 000 Hz

(ii) The scanner records the time from when a wave is emitted to when its reflection is received.

A technician calculates the depth of the reflection using the equation

$$\text{depth} = \tfrac{1}{2} \times \text{speed of ultrasound in patient} \times \text{time recorded by scanner}$$

Explain why the technician uses the value $\frac{1}{2}$ in the equation.

(2)

(iii) An ultrasound wave travels faster in the patient than it does in air.

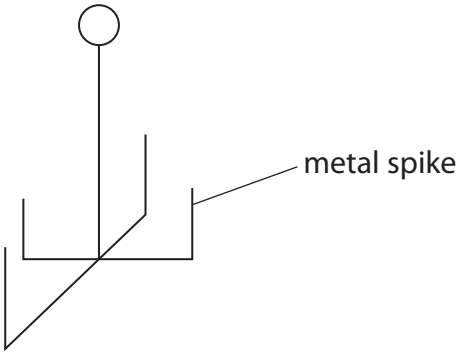
Explain how a change in speed affects the wavelength of the ultrasound wave.

(2)

(Total for Question 3 = 9 marks)

4 The diagram shows a metal device for cooking potatoes.

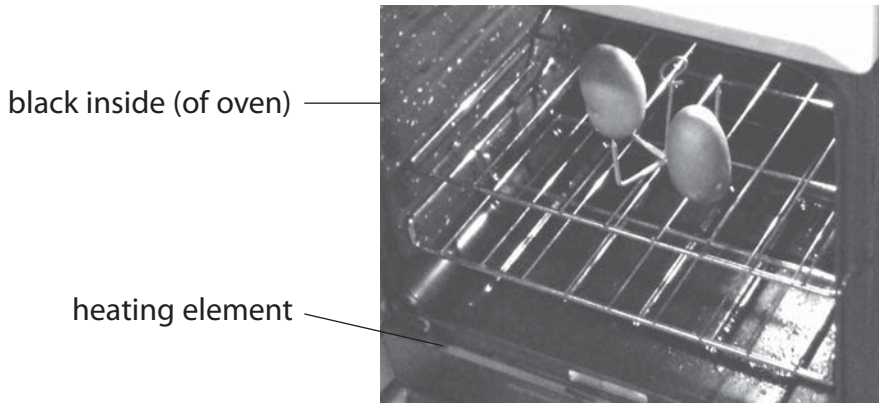
Potatoes are pushed onto the metal spikes.



The photograph shows two potatoes cooking in an electric oven.

The inside of the oven is black.

The heating element is at the bottom of the oven.



Describe the different ways in which energy is transferred to cook the potatoes.

(6)

(Total for Question 4 = 6 marks)

5 (a) The box lists some devices that can be used to transfer energy from one form into another.

an aerial	a loudspeaker	a microphone	a microwave oven

Select a device from the box to complete each sentence.

(2)

Sound energy is changed into electrical energy using .....

Electrical energy is changed into sound energy using .....

(b) A radio station uses a short wavelength radio wave for broadcasting information.

The wavelength is 25 m.

The frequency is 12 000 kHz.

(i) State the relationship between the speed, frequency and wavelength of a wave.

(1)

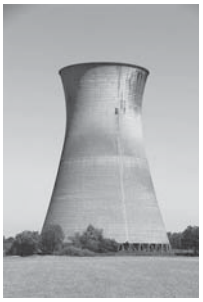
(ii) Calculate the speed of the short wavelength radio wave.

(3)

speed = ... m/s

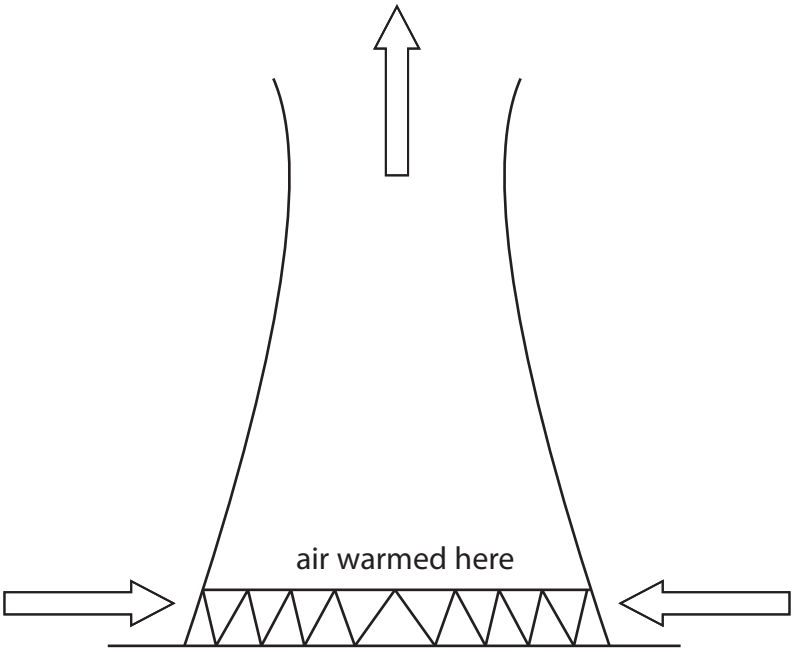
(Total for Question 5 = 6 marks)

6 A cooling tower is designed to transfer thermal energy away from a power station.



(a) Thermal energy from the power station warms the air inside the cooling tower.

Air enters through holes at the bottom of the cooling tower and leaves through the top.



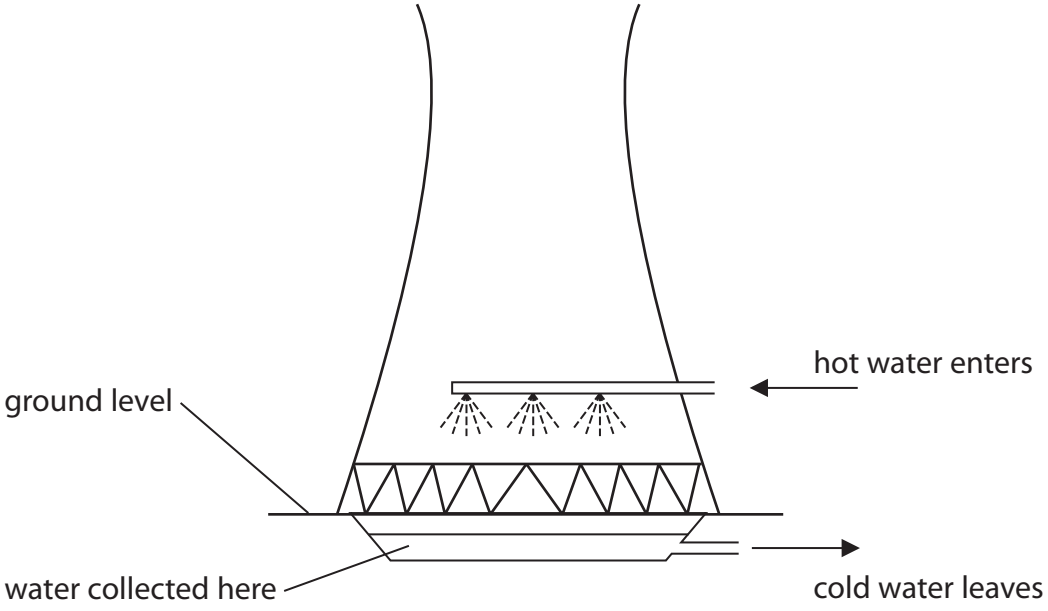
Explain why the air moves as shown by the arrows.

(4)

(b) Hot water from the power station is sprayed into the cooling tower, as shown.

As it falls through the air, some of the hot water evaporates.

The rest of the water is collected and returned as cold water to the power station.



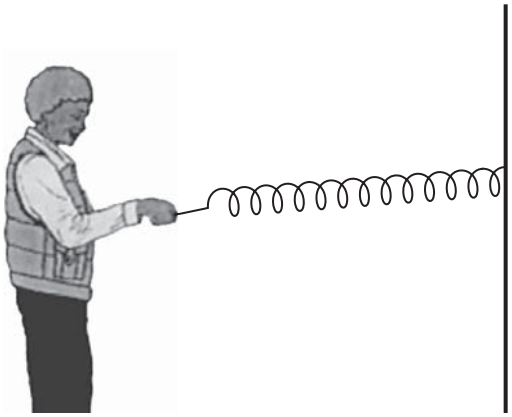
Explain how evaporation cools the water.

(3)

(Total for Question 6 = 7 marks)

7 A teacher demonstrates different types of wave.

(a) He uses a spring to demonstrate longitudinal waves.



(i) Draw arrows on the diagram to show the directions in which the teacher moves his hand.

(1)

(ii) Give an example of a longitudinal wave.

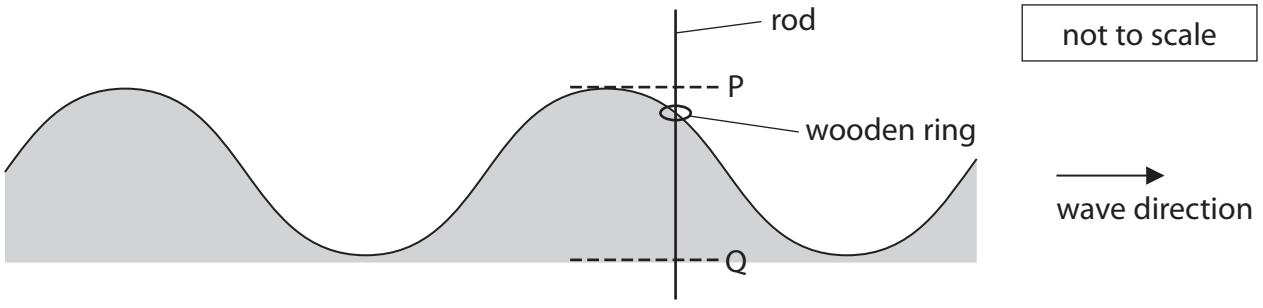
(1)

(b) The teacher then demonstrates transverse waves.

He fixes a vertical rod in a pond.

He places a small wooden ring on the rod.

The ring floats on the water and moves up and down the rod as waves go past.



(i) On the diagram, draw a line to show one wavelength.

Label your line with the letter W.

(1)

(ii) The distance from P to Q is 5.0 cm.

Determine the amplitude of the wave.

(1)

amplitude = ... cm

(iii) The wooden ring reaches point P every 15 s.

Calculate the frequency of the wave.

Give the unit.

(3)

frequency = ... unit .....

(iv) Explain how the movement of the wooden ring demonstrates that this wave is transverse.

(2)

.....

.....

.....

.....

(v) The wave shown is a water wave.

Give a different example of a transverse wave.

(1)

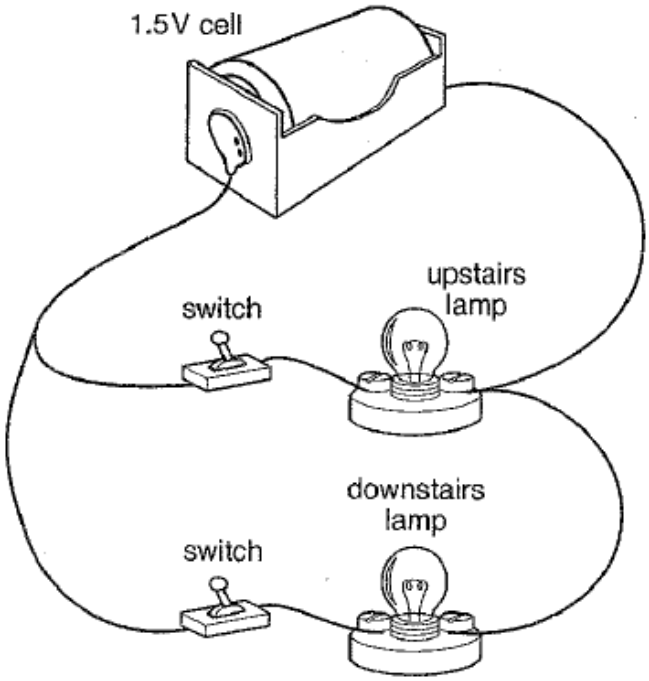
.....

(Total for Question 7 = 10 marks)

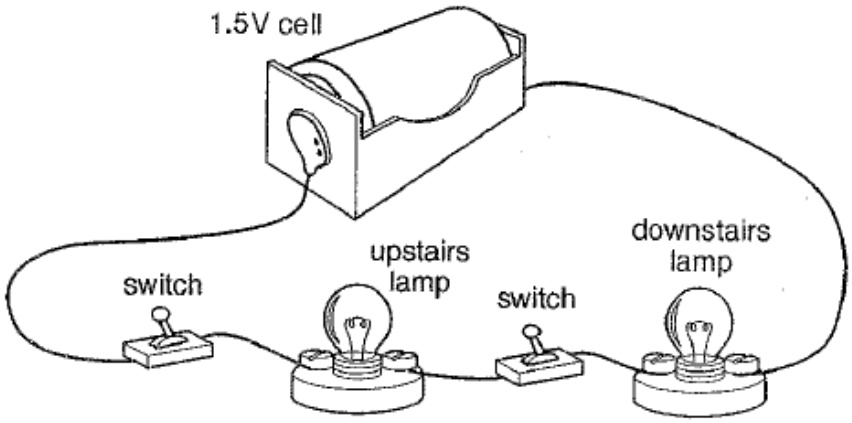
8.

This question is about electric circuits.

(a) Laura has wired up two lamps, two switches and a cell to light her young sister's dolls house.
Both lamps light normally.



Laura's brother, David, thinks that the wiring below would be better.



Use your knowledge of electric circuits to explain why David's circuit is **not** a good idea.

_____

_____

_____

_____

_____ [3]

Total 3 marks

9.

Fig. 11.1 represents the electromagnetic spectrum.

γ-rays	X-rays	ultra-violet	visible light			radio waves

Fig. 11.1

(a) Identify one feature that is the same for all radiations that form the electromagnetic spectrum.

.....

..... [1]

(b) Fill in the blank spaces between visible light and radio waves by adding the names of the radiations. [2]

(c) State the radiation that has the shortest wavelength.

..... [1]

(d) **(i)** Describe a common use of X-rays.

.....

..... [1]

(ii) State a precaution taken by those who work with X-rays.

.....

..... [1]

[Total: 6]

10.

(a) The box below contains the names of some metals.

copper	gold	iron	lead	silver	steel

Circle the metals which may be attracted to a magnet. [2]

(b) A student has 3 metal bars which all look the same. Two of the metal bars are magnets and one is not.

Explain how the student can identify the two magnets without using any other equipment.

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..... [2]

(Total 4 marks)

END OF PAPER