

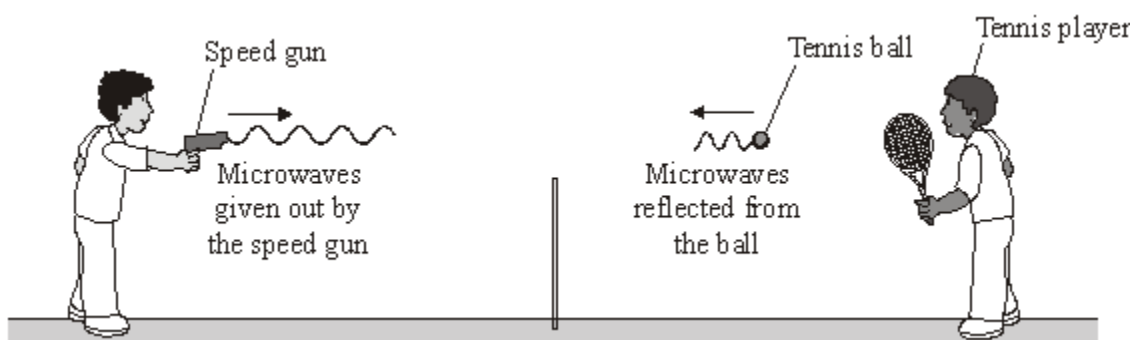
Name of the Student: _____

Max. Marks : 24 Marks

Time : 24 Minutes

Q1.

- (a) The picture shows a speed gun being used to measure how fast a tennis player hits the ball.



Some of the microwaves from the speed gun are absorbed by the ball and some are reflected by the ball.

- (i) Complete the following sentence by choosing **one** of the phrases from the box.

longer than	the same as	shorter than
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The wavelength of the microwaves reflected from the ball are

_____ the wavelength of the microwaves
from the speed gun.

(1)

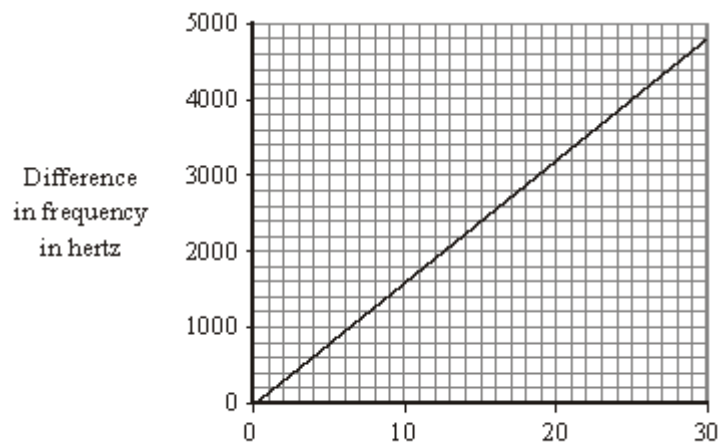
- (ii) Complete the following sentence by drawing a ring around the correct line in the box.

When the ball absorbs microwaves, its temperature will

decrease slightly
not change
increase slightly

(1)

- (b) The microwaves reflected from the ball have a higher frequency than the microwaves from the speed gun.
The graph shows how the difference between the two frequencies depends on the speed of the ball.



- (i) Describe the pattern that links the difference between the two frequencies and the speed of the ball.

(1)

- (ii) The speed gun measures the difference between the two frequencies as 3200 Hz.

Use the graph to find the speed of the tennis ball.
Show clearly on the graph how you obtain your answer.

Speed of the tennis ball = _____ m/s

(2)

- (iii) Which **one** of the following gives the reason why the data has been shown as a line graph and **not** as a bar chart?

Put a tick (✓) in the box next to your choice.

Frequency and speed are both categoric variables.

☐

Frequency and speed are both continuous variables.

☐

Speed is a continuous variable and frequency is a categoric variable.

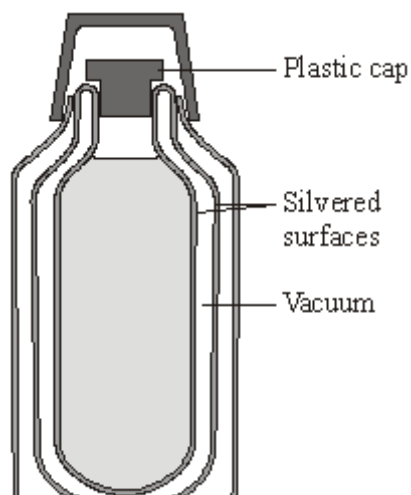
☐

(1)

(Total 6 marks)

Q2.

A vacuum flask is designed to reduce the rate of heat transfer.



- (a) (i) Complete the table to show which methods of heat transfer are reduced by each of the features labelled in the diagram.

The first row has been done for you.

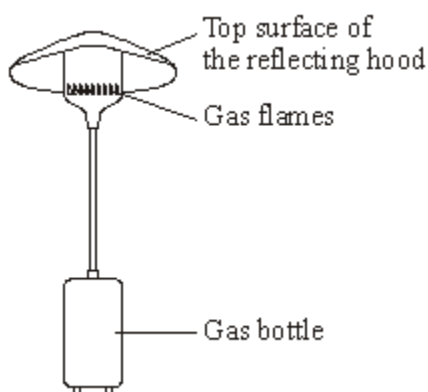
Feature	Conduction	Convection	Radiation
vacuum	✓	✓	
silveredsurfaces			
plastic cap			

(2)

- (ii) Explain why the vacuum between the glass walls of the flask reduces heat transfer by conduction and convection.

(2)

- (b) The diagram shows a gas flame patio heater.



- (i) Explain why the top surface of the reflecting hood should be a light, shiny surface rather

than a dark, matt surface.

(2)

- (ii) Most of the chemical energy in the gas is transformed into heat. A **small** amount of chemical energy is transformed into light.

Draw and label a Sankey diagram for the patio heater.

(2)

- (iii) State why the total energy supplied to the patio heater must always equal the total energy transferred by the patio heater.

(1)

(Total 9 marks)

Q3.

- (a) This information is from a science magazine.

Electronic systems can be used to produce ultrasonic waves. These waves have a frequency higher than the upper limit for hearing in humans.

Complete the sentence by choosing the correct number from the box.

20	2000	20 000	200 000
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The upper limit for hearing in humans is a frequency of _____ Hz.

(1)

- (b) An electronic system produces ultrasound with a frequency of 500 kHz. What does the symbol kHz stand for?

(1)

- (c) (i) State **one** industrial use for ultrasound.

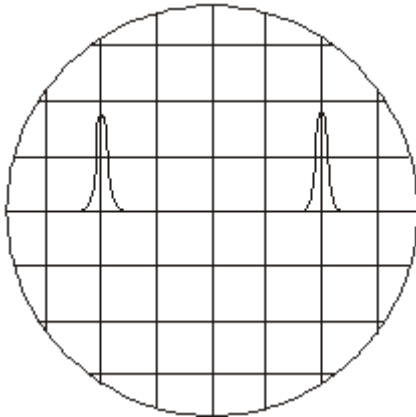
(1)

- (ii) State **one** medical use for ultrasound.

(1)

- (d) An ultrasound detector is connected to an oscilloscope.

The diagram shows centimetre squares on an oscilloscope screen. Each horizontal division represents 2 microseconds.



Calculate the time, in microseconds, between one peak of one ultrasound pulse and the peak of the next.

Time = _____ microseconds

(1)

- (e) Ultrasounds are partially reflected when they reach a boundary between two different media.

The time taken for the reflection from the boundary to reach the detector can be seen from the screen.

What can be calculated from this time interval?

(2)

- (f) Explain what action scientists should take if they find evidence that ultrasonic waves may be harmful to human health.

(2)

(Total 9 marks)