Write your name here

Surname	Other names

Pearson Edexcel GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Physics

Unit P3: Applications of Physics

Foundation Tier

Friday 23 June 2017 – Morning
Time: 1 hour

Paper Reference
5PH3F/01

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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P 4 8 8 0 4 A 0 1 2 0

Pearson

FORMULAE

You may find the following formulae useful

power of lens = $\frac{1}{\text{focal length}}$

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

The relationship between temperature and volume for a gas $\qquad V_1 = \frac{V_2 T_1}{T_2}$

The relationship between volume and pressure for a gas $\qquad V_1 P_1 = V_2 P_2$

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Questions begin on next page.

Answer ALL questions.

Some questions must be answered with a cross in a box ☒.
If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Ionising and non-ionising radiations

1 (a) (i) Which of these radiations is **non-ionising**?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** gamma rays

☒ **B** light

☒ **C** alpha radiation

☒ **D** X-rays

(ii) State a medical use for an ultrasound scanner.

(1)

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.....

(b) Some patients are treated with ionising radiation.

Describe some of the risks to patients who are treated with ionising radiation.

(2)

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(c) Explain why all medical technicians must be outside the treatment room when a patient is treated with ionising radiation.

(2)

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(d) Positrons are needed for a PET scanner to work.
The positrons are provided by isotopes.

Explain why these isotopes have to be produced at or near to the hospital.

(2)

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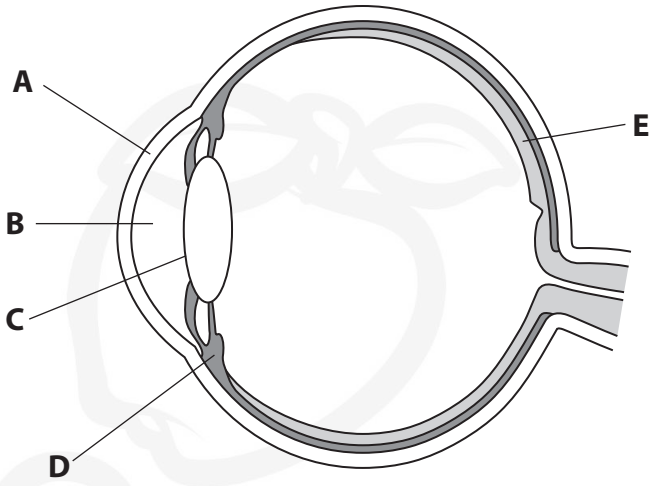
(Total for Question 1 = 8 marks)

The eye and lenses

2 The diagram shows the features of the eye.



(a) Draw one straight line from each feature to the correct label.

(3)

feature	label
ciliary muscle	A
cornea	B
retina	C
	D
	E

(b) Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

The average adult human eye has a near point

☒ **A** at infinity

☒ **B** 10 cm from the eye

☒ **C** 25 cm from the eye

☒ **D** 100 cm from the eye

(c) Short sight is a defect of vision that can be corrected using a lens.

(i) State **one** symptom of short-sightedness.

(1)

.....

.....

(ii) Give **one** reason for a person being short-sighted.

(1)

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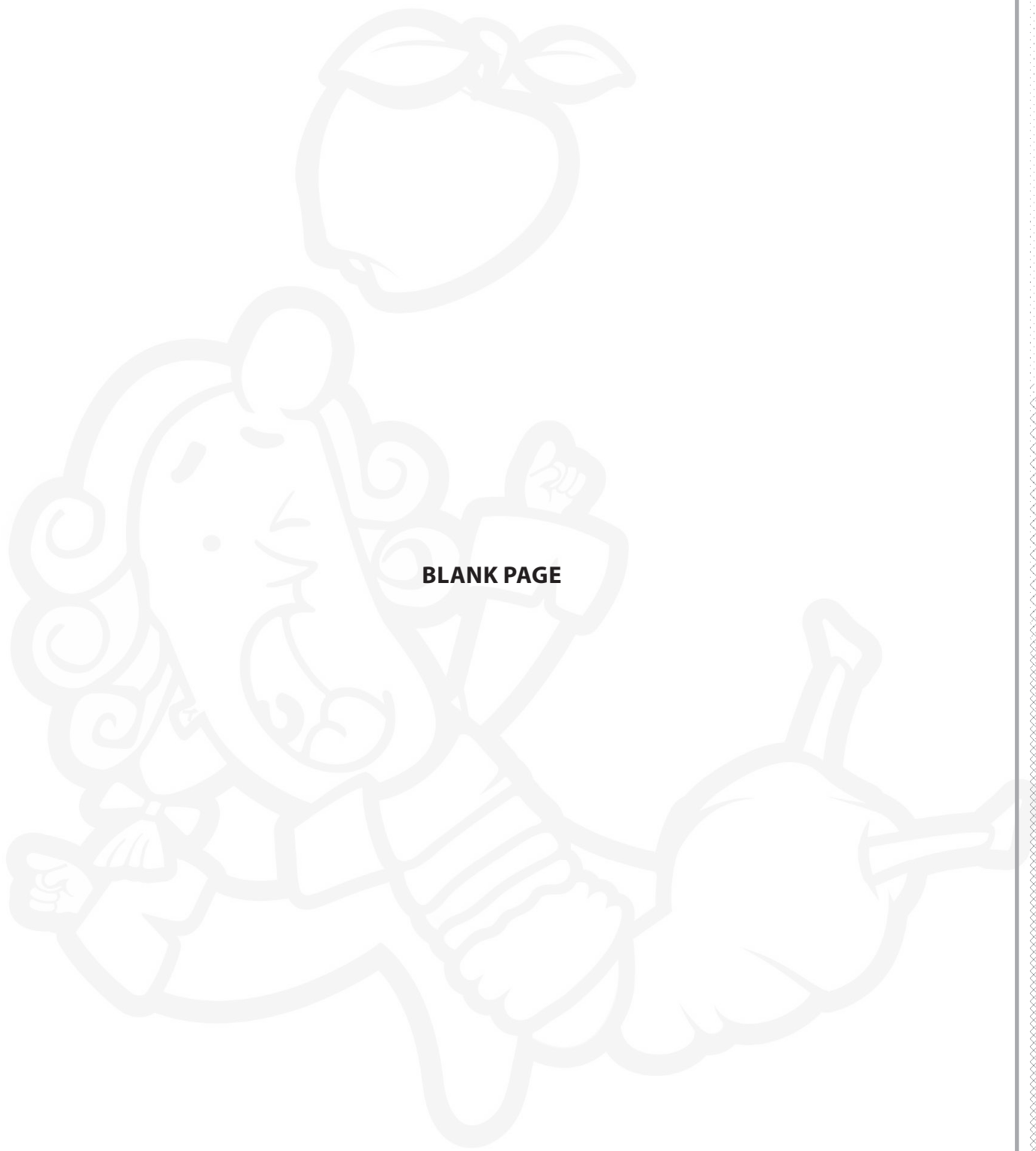
(iii) A lens used to correct short sight has a focal length of –0.5 m.

Calculate the power of the lens.

(2)

power = ... D

(Total for Question 2 = 8 marks)



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Collisions and PET scanners

3 (a) Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

PET scanners use radioactive isotopes produced when

☒ **A** a stable element is bombarded with neutrons

☒ **B** a stable element is bombarded with protons

☒ **C** an unstable element is bombarded with neutrons

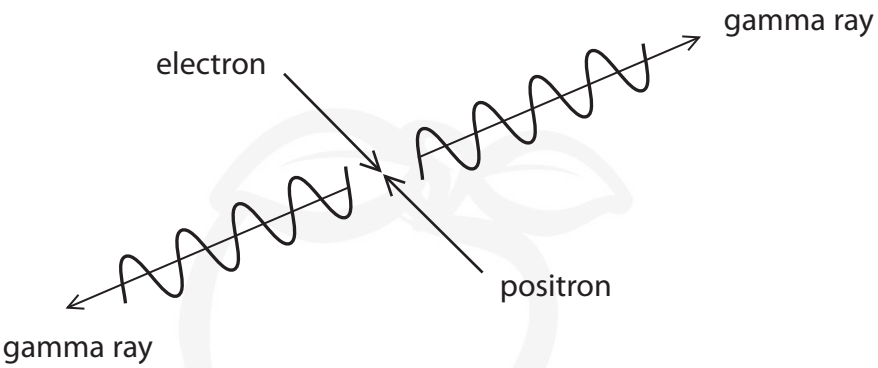
☒ **D** an unstable element is bombarded with protons

(b) The collisions that produce radioactive isotopes are inelastic.

Explain, in terms of kinetic energy and momentum, what is meant by an **inelastic collision**.

(2)

(c) When electrons and positrons collide they are annihilated and gamma rays are produced.



(i) Before the annihilation, the electron and the positron are travelling at the same speed.

Explain why the total momentum of the electron and the positron is zero before the annihilation.

(2)

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(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

Electrons and positrons have opposite charges.
Charge is conserved in electron-positron annihilation because the

☒ **A** gamma rays move in opposite directions

☒ **B** gamma rays have opposite charges

☒ **C** gamma rays have no charge

☒ **D** gamma rays have kinetic energy

(iii) When annihilation of electrons and positrons takes place, mass energy is conserved.

Explain how mass energy is conserved.

(2)

(d) PET scanners use gamma rays to produce detailed images of internal organs of the body.

Describe the properties of gamma rays that make them suitable for this use.

(2)

(Total for Question 3 = 10 marks)

Properties of alpha and beta radiation

4 (a) Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

Alpha radiation

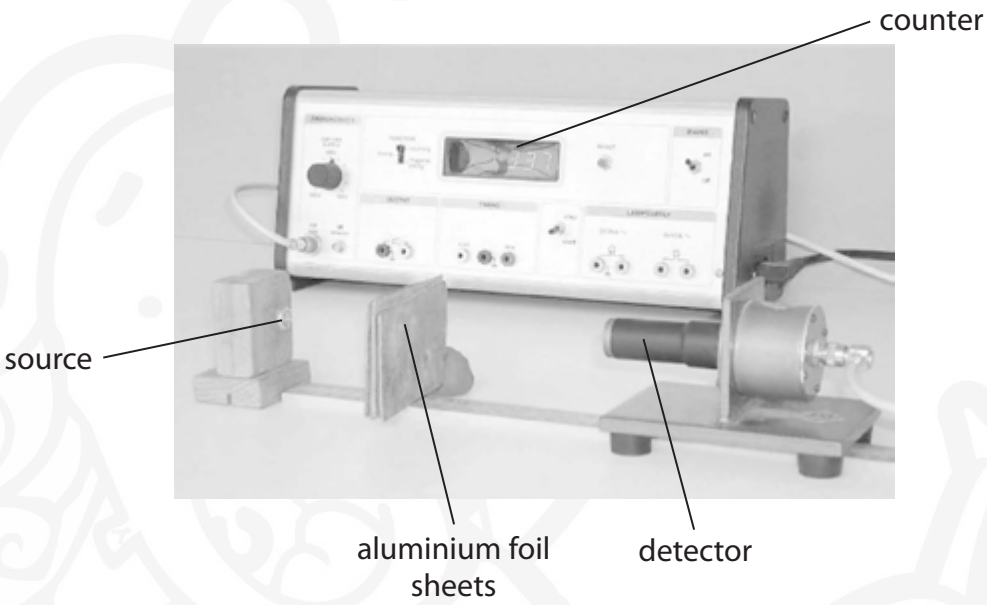
☒ **A** has no charge

☒ **B** is strongly ionising

☒ **C** is a wave

☒ **D** passes through paper

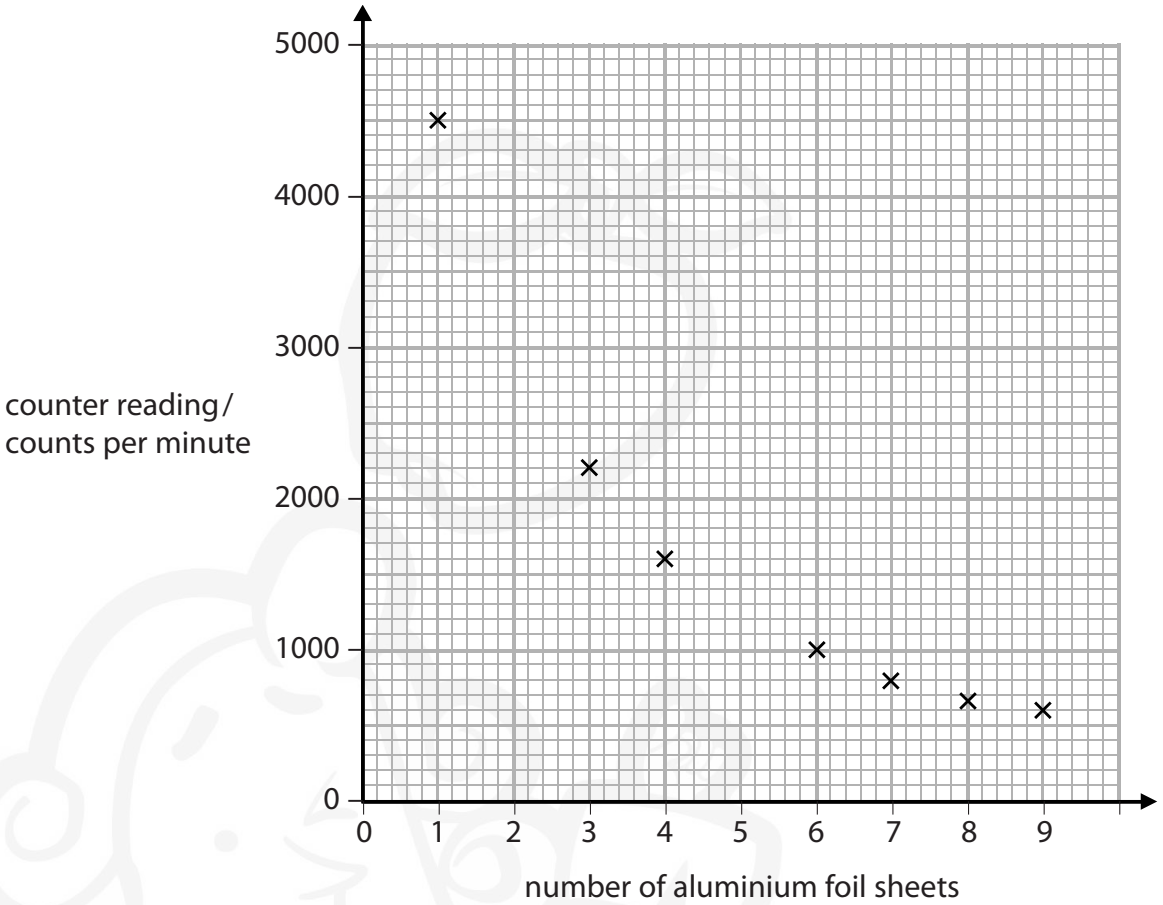
(b) A teacher uses this apparatus to investigate how beta particles are absorbed by aluminium foil sheets.



In the experiment, different numbers of aluminium foil sheets are placed between a beta particle source and a detector.

The aluminium foil sheets are all the same thickness.

The graph shows most of the results.



(i) The table shows the missing results.

Plot these results on the graph.

(2)

number of aluminium foil sheets	counter reading / counts per minute
2	3150
5	1200

(ii) Draw a best fit curve to fit the data.

(1)

(iii) State the relationship between the counter reading and the number of aluminium foil sheets.

(1)

.....

.....

(iv) Suggest why the counter reading does not fall to zero.

(1)

.....

.....

(c) Describe what happens inside the nucleus of an atom when a beta particle (β^-) is emitted.

(2)

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(d) Beta particles that are emitted by a source and focused into a beam can be described as an electric current.

Explain why a beam of beta particles can be described as an electric current.

(2)

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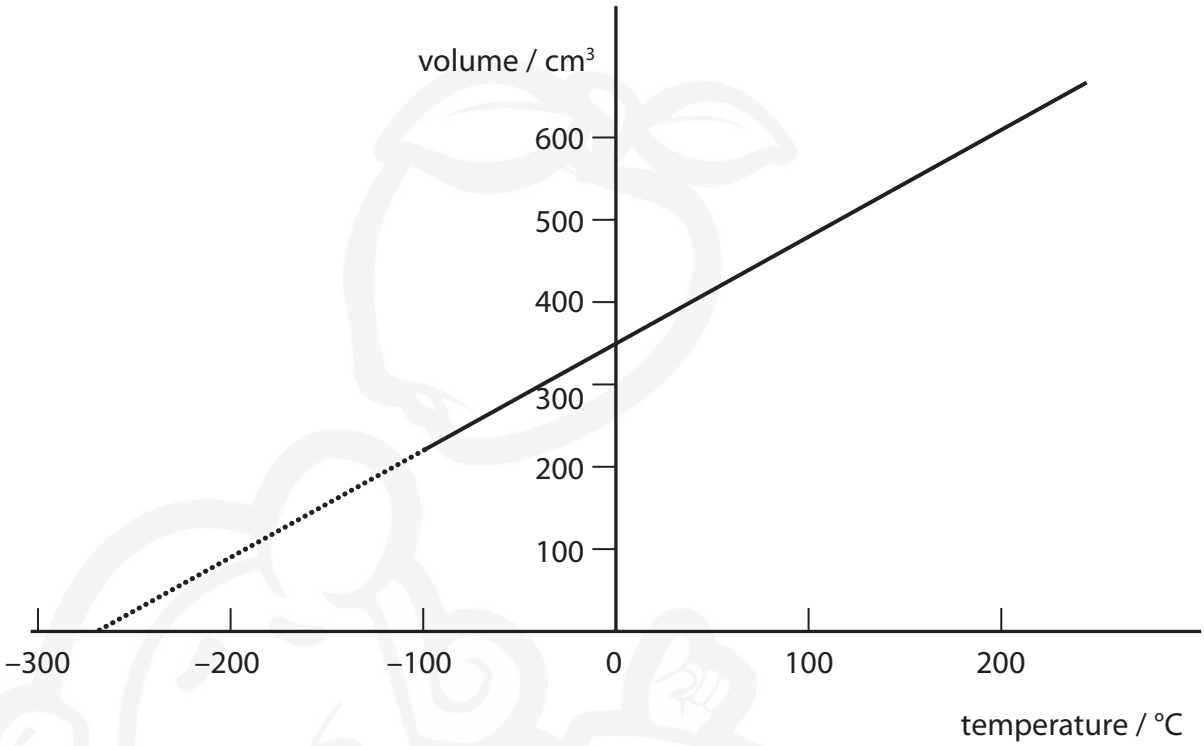
(Total for Question 4 = 10 marks)

Kinetic theory and gases

5 The graph shows the relationship between volume and temperature for an ideal gas.



(a) (i) Estimate the volume of the gas at 0 °C.

(1)

..... cm³

(ii) State the value of –273 °C in kelvin.

(1)

..... K

(iii) Suggest what would happen to a real gas when it is cooled to a very low temperature.

(1)

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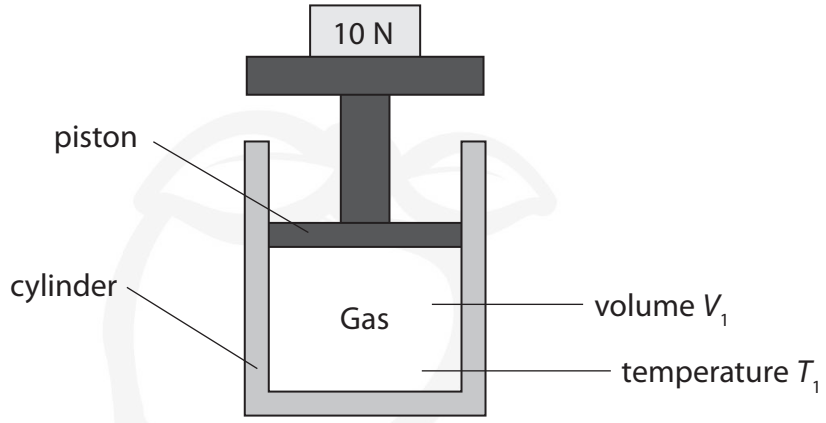
(b) Gas is held in a cylinder by a piston, as shown in the diagram.
The gas is kept at constant pressure.



(i) The original volume of gas V_1 is 25.0 cm^3 at a temperature of 293 K.
The gas is heated to 373 K.

Find the volume V_2 of the gas at 373 K.

Use the equation

$$V_2 = \frac{V_1 T_2}{T_1}$$

(2)

volume V_2 = ... cm^3

(ii) Suggest how the pressure on the gas can be increased.

(1)

.....

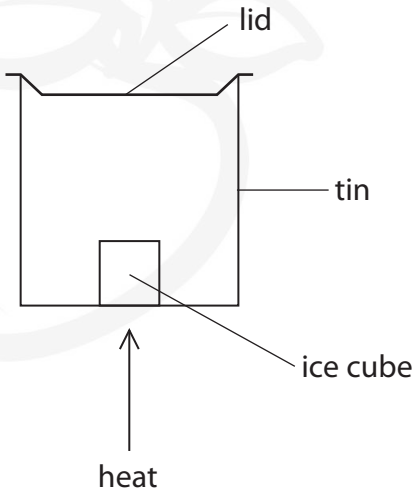
.....

*(c) Kinetic theory describes the movement of particles in the three states of matter.

The diagram shows a cube of ice in a tin.
The tin has a tight fitting lid.
When the tin is continuously heated, the lid explodes off the tin.

Explain why this happens using kinetic theory.

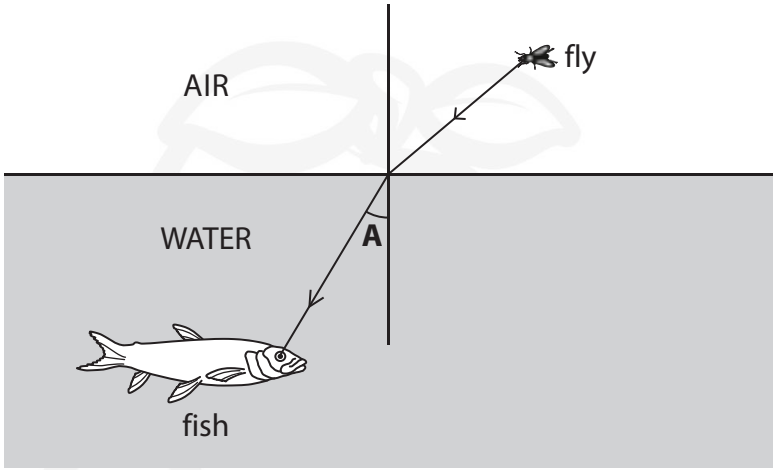
(6)



(Total for Question 5 = 12 marks)

Refraction and reflection

6 (a) The ray of light from the fly to the fish is shown on the diagram.
The fish can see the fly.



(i) Name the effect that produces the change in direction of the light at the surface of the water.

(1)

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.....

(ii) Explain why this change in direction occurs when light passes from air into water.

(2)

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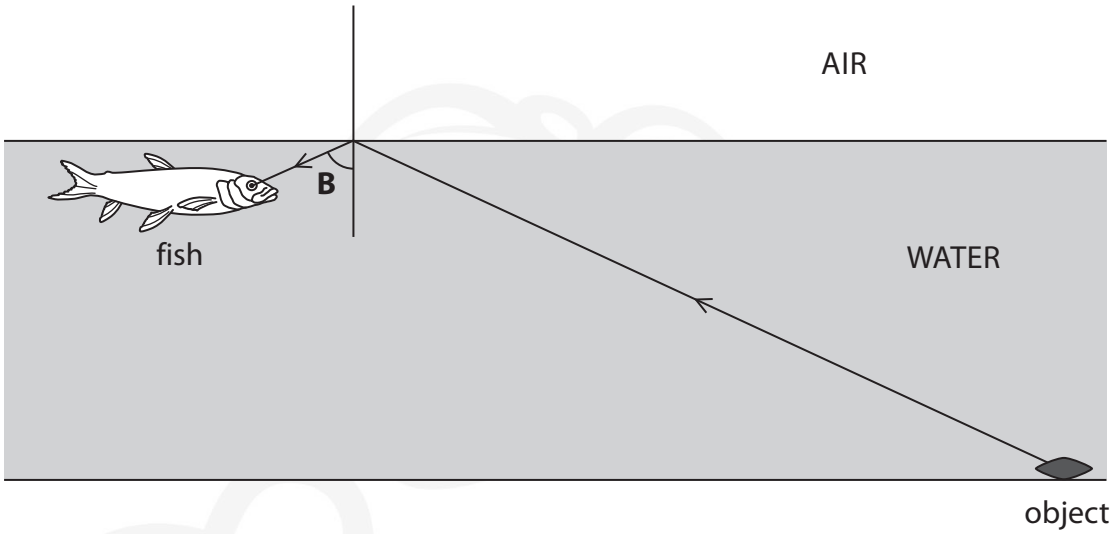
(b) The fish moves and can now see an object in the water.
The ray of light from the object to the fish is shown in the diagram.
The angle B is greater than the critical angle.



Describe what happens to the light at the water surface.

(2)

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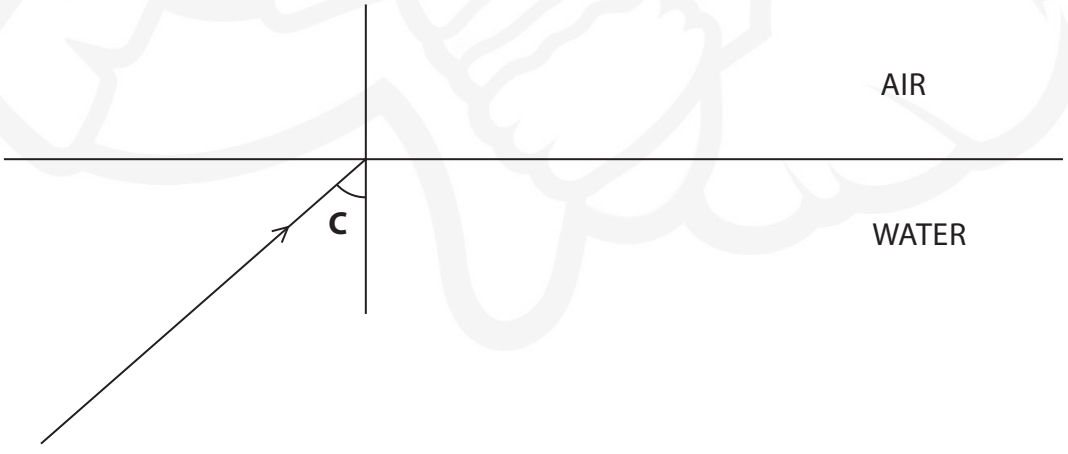
(c) The diagram shows a ray of light inside the water.

Angle C is the critical angle.

Complete the diagram to show what happens to the ray of light after it hits the water surface.

(1)



*(d) Describe how an endoscope works and what endoscopes are used for.

You may include a labelled diagram to help with the description of how the endoscope works.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS