Centre No.						Surname	Initial(s)
Candidate No.						Signature	

Paper Reference(s)

4420/2H

London Examinations IGCSE

Physics

Paper 2H

Higher Tier

Monday 21 May 2007 – Afternoon

Time: 2 hours

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
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12	
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14	
15	
16	
17	
Total	

Materials required for examination

Ruler, protractor, compasses, pencil and calculator

Items included with question papers

Nil

Instructions to Candidates

In the boxes above, write your centre number and candidate number, your surname, initial(s) and signature.
The paper reference is shown at the top of this page. Check that you have the correct question paper.
Answer **ALL** the questions in the spaces provided in this question paper.
Show all the steps in any calculations and state the units.
Calculators may be used.

Information for Candidates

The total mark for this paper is 120. The marks for parts of questions are shown in round brackets: e.g. **(2)**.
This paper has 17 questions. Any blank pages are indicated.
Useful formulae are given on page 2.

Advice to Candidates

Write your answers neatly and in good English.

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Turn over

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FORMULAE

You may find the following formulae useful.

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

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

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

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

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

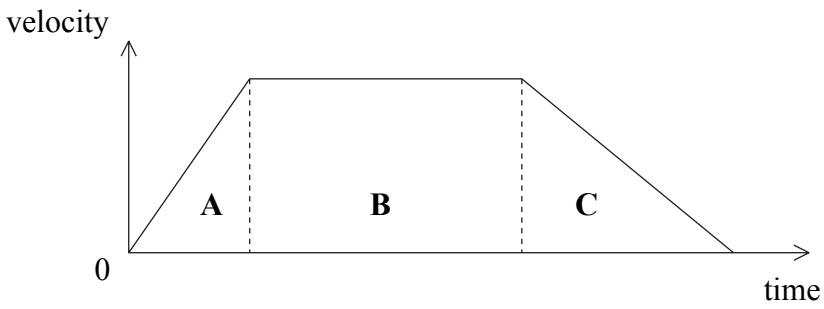
$$\text{power} = \frac{\text{energy transferred}}{\text{time taken}} \qquad P = \frac{W}{t}$$

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

N 2 6 2 5 9 A 0 2 2 8

Leave blank

1. A model train travels between two stations. The velocity–time graph shows the train's motion.



(a) (i) State in which part of the journey **A**, **B** or **C** the train is decelerating.

.....

(1)

(ii) Explain your answer.

.....

(1)

(iii) What does the graph show about the deceleration?

.....

(1)

(b) (i) What feature of the graph represents the distance travelled between the two stations?

.....

(1)

(ii) A second train travels between the two stations at a constant velocity. It takes the same time as the first train. On the axes above, draw a line showing the motion of the second train.

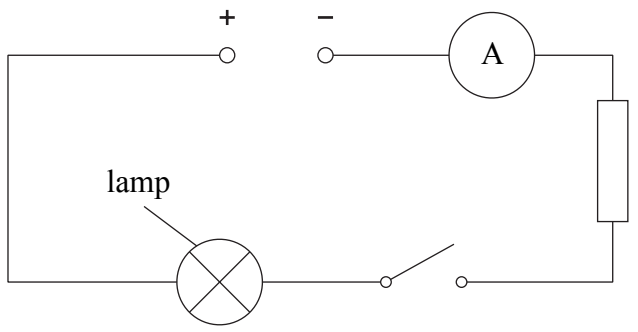
(3)

Q1

(Total 7 marks)

Leave blank

2. A student connects a series circuit as shown.



(a) (i) The switch is closed. Name two components in the circuit, other than the lamp, which affect the size of the current.

1 .....

2 .....

(2)

(ii) The current is 0.40 A. Calculate the charge that flows during a time of 20 s.

.....

.....

Charge = ...C

(2)

(b) You are asked to connect a second lamp so that each lamp can be switched on and off independently. Show, by drawing on the circuit above, how this can be done.

(2) **Q2**

(Total 6 marks)

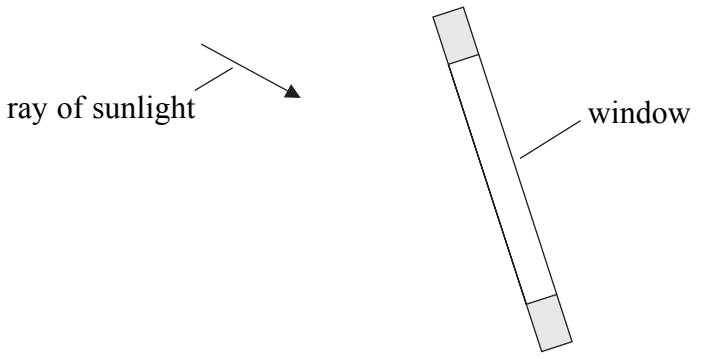
Leave blank

3. (a) State the law of reflection.

.....

(1)

(b) A student is playing in goal in a football match. The window of a nearby building reflects sunlight into his eyes.



(i) Complete the diagram to show the reflection of the ray from the front of the window.

(2)

(ii) What could you do to stop sunlight being reflected into the student's eyes from this window?

.....

(1)

(c) Light is part of the electromagnetic spectrum. If players are not protected from some electromagnetic waves they can suffer ill effects. State which part of the electromagnetic spectrum can cause

(i) skin burns

.....

(1)

(ii) blindness.

.....

(1)

(d) What do all parts of the electromagnetic spectrum have in common?

.....

(1)

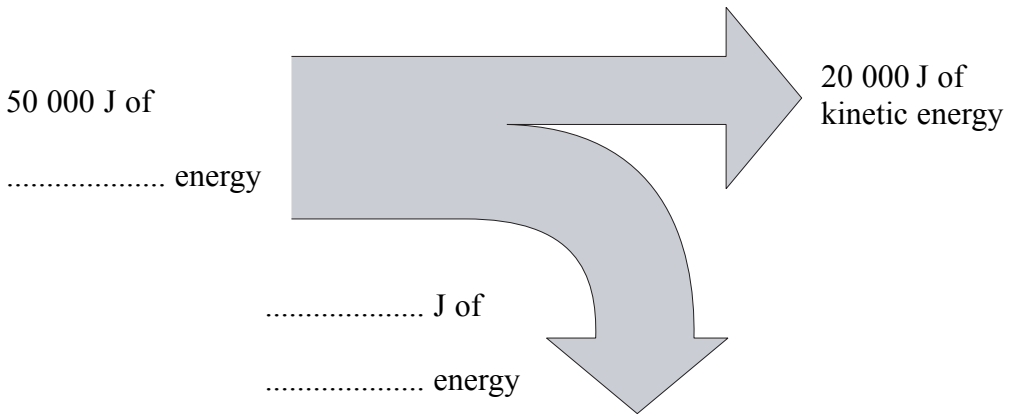
Q3

(Total 7 marks)

N 2 6 2 5 9 A 0 5 2 8

Leave blank

4. (a) The diagram shows an energy flow for a motorbike.
Fill in the gaps in the diagram.



(3)

(b) The motorbike travels 2.0 km. The driving force is 700 N. Calculate the work done in joules by this driving force.

.....

.....

Work done = ... J

(3)

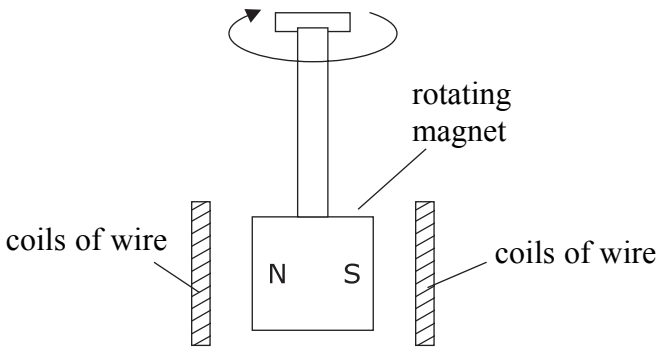
Q4

(Total 6 marks)

N 2 6 2 5 9 A 0 6 2 8

Leave blank

5. (a) A student has a dynamo on her bicycle. When the front wheel turns, a magnet rotates within coils of wire and a lamp on the bicycle lights up.



Explain how the rotation of the magnet causes the lamp to light.

.....

.....

.....

(3)

(b) State one way in which the brightness of the lamp could be increased.

.....

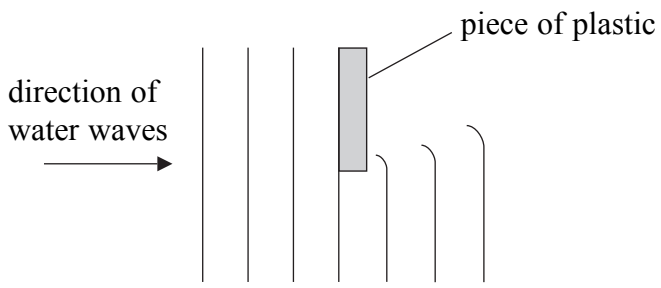
(1)

(Total 4 marks)

Q5

Leave blank

6. (a) The diagram shows what happens when water waves pass close to the edge of a piece of plastic.

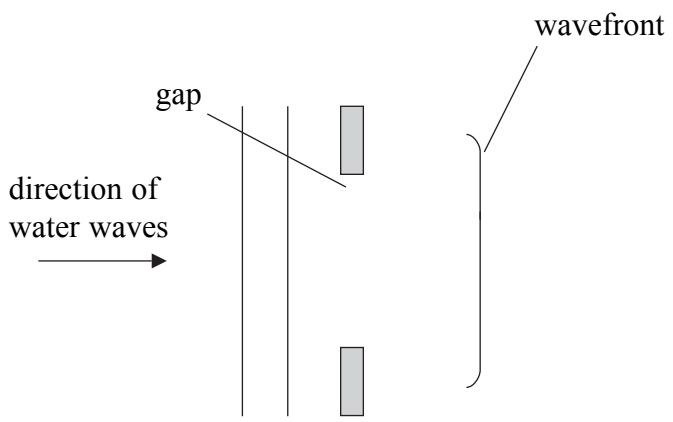


Name the wave behaviour shown.

.....

(1)

(b) The diagram below shows water waves about to pass through a gap.
One wavefront is shown after it has passed through the gap.



(i) On the diagram, draw two more wavefronts that have passed through the gap.

(3)

(ii) State two changes which would each make the wavefronts become more curved after passing through the gap.

1 .....

2 .....

(2)

Leave blank

(c) (i) Sound waves with a frequency of 25 000 Hz are directed at a gap. Give a reason why they are not heard on the other side of the gap.

.....

(1)

(ii) Calculate the wavelength in metres of these sound waves.

The speed of sound is 340 m/s.

.....

.....

Wavelength = ... m

(3)

Q6

(Total 10 marks)

QUESTION 7 IS ON THE NEXT PAGE

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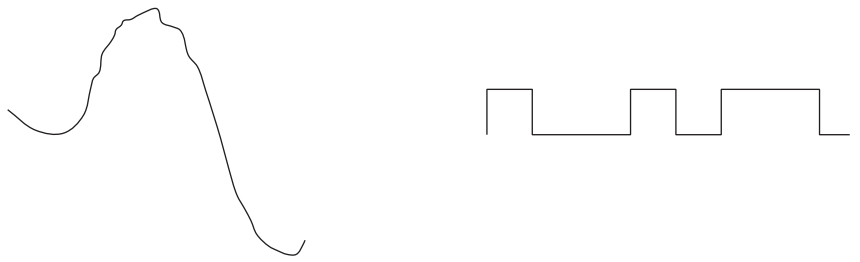
Leave blank

7. A teacher draws a diagram on the board showing an analogue signal and a digital signal.



..... signal ..... signal

(a) (i) Complete the labels to show which is the analogue signal and which is the digital signal.

(1)

(ii) Give two reasons for your answer.

1 .....

2 .....

(2)

(b) State one advantage of using digital signals rather than analogue signals.

.....

.....

(1)

(c) Give one example from everyday life of the use of a digital signal.

.....

(1)

Q7

(Total 5 marks)

Leave blank

8. (a) State the principle of moments.

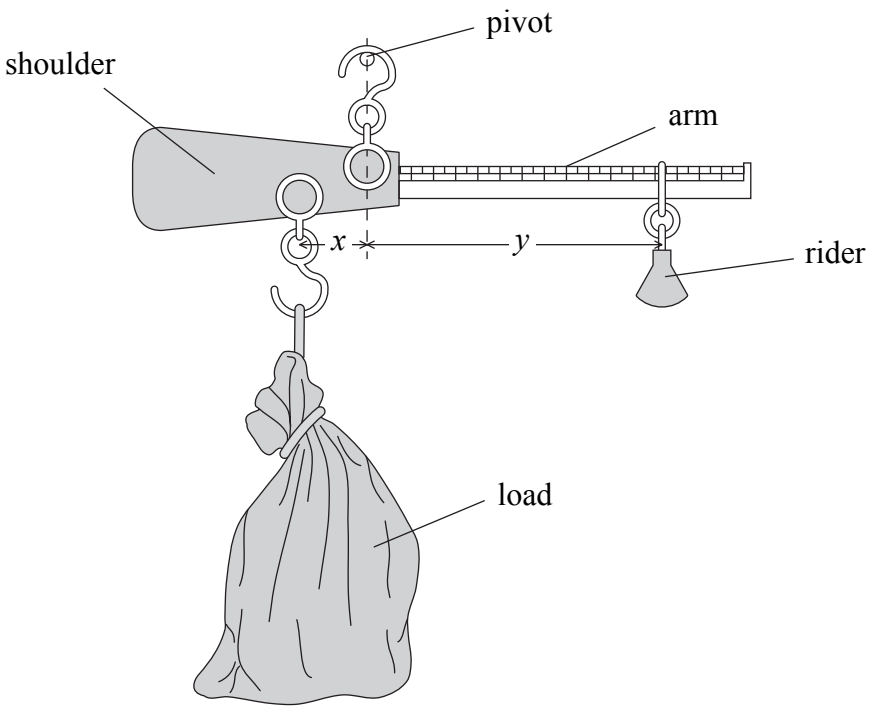
.....

.....

.....

(2)

(b) The diagram shows a weighing device called a steelyard.



The weight of the shoulder balances the weight of the arm. The weight of the rider is 8.0 N and this balances the weight of the load when $x = 0.12$ m and $y = 0.60$ m.

Calculate the weight of the load in newtons.

.....

.....

Weight of load = ... N

(2)

Q8

(Total 4 marks)

Leave blank

9. Complete the sentences about sound waves.

(a) We cannot see a sound wave. However we can see a representation of it by connecting a microphone to .....

(1)

(b) The pitch of a sound depends on .....

(1)

(c) The loudness of a sound depends on .....

(1)

Q9

(Total 3 marks)

Leave blank

10. Use the information in the box to answer the questions.

Absolute zero is −273 °C.

The pressure in a gas cylinder is 850 kPa when the temperature is 20 °C.

$$\frac{p_1}{T_1} = \frac{p_2}{T_2}$$

(a) Convert the temperature 20 °C to the kelvin scale.

.....

Temperature = ... K

(1)

(b) Calculate the pressure in the gas cylinder to the nearest 10 kPa when the temperature rises to 40 °C.

.....

.....

.....

Pressure = ... kPa

(3)

Q10

(Total 4 marks)

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11. Hydroelectric power stations (HEP stations) are used to produce large quantities of electricity. There are advantages and disadvantages of producing electricity in this way.

(a) State two advantages other than cost.

Advantage 1 .....

.....

Advantage 2

.....

(2)

(b) State two disadvantages other than cost.

Disadvantage 1 .....

.....

Disadvantage 2 .....

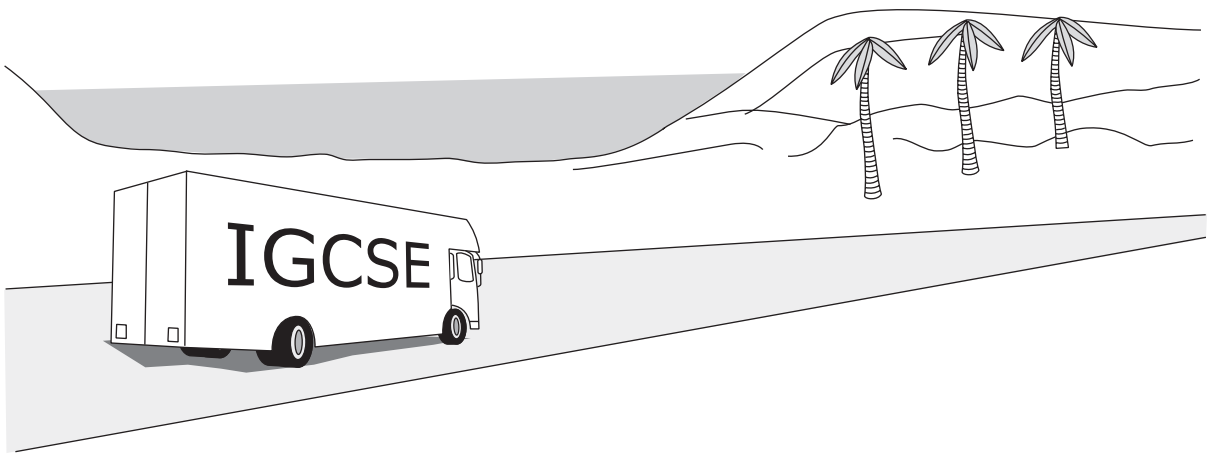
.....

(2) **Q11**

(Total 4 marks)

Leave blank

12. (a) The diagram shows a lorry. It is travelling in a straight line and it is accelerating. The total forward force on the lorry is *F* and the total backward force is *B*.



(i) Explain which is larger, force *F* or force *B*.

.....

.....

(1)

(ii) State an equation which relates acceleration, mass and unbalanced force.

.....

.....

(1)

(iii) An unbalanced force of 15 000 N acts on the lorry. The mass of the lorry is 12 500 kg. Calculate the lorry's acceleration and give the unit.

.....

.....

Acceleration = ...

(3)

Leave blank

(b) Another lorry is travelling at a steady speed. Explain how this lorry can be accelerating even though its speed stays the same.

.....

.....

.....

.....

(3)

(c) The **thinking distance** is the distance which a vehicle travels in the driver's reaction time. The **braking distance** is the distance which a vehicle travels when the brakes are on.

(i) State one factor which increases the thinking distance.

.....

.....

(1)

(ii) State one factor which increases the braking distance.

.....

.....

(1)

(Total 10 marks)

Q12

Leave blank

13. A wire carries a current. The wire is perpendicular to a magnetic field. A force acts on the wire and the wire moves.

(a) This effect is used in a d.c. motor.

(i) What does the abbreviation **d.c.** stand for?

.....

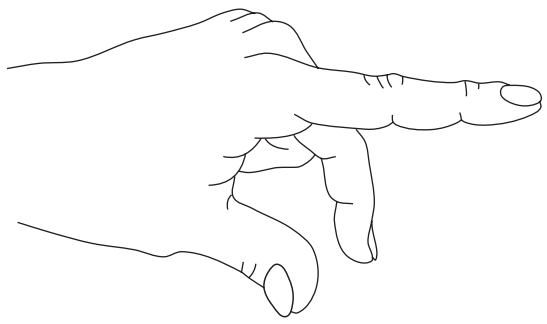
(1)

(ii) Apart from electric motors, name one other device which uses this effect.

.....

(1)

(b) Professor J A Fleming invented a rule to describe the directions involved in this effect. It is known as Fleming's left-hand rule.



Complete the sentences.

The first finger points in the direction of the ..... which is

from ..... to ..... .

The second finger points in the direction of the ..... which is

from ..... to ..... .

The thumb points in the direction of the ..... .

(5)

Leave blank

(c) State two ways in which the force acting on the wire can be increased.

1 .....

2 .....

(2) **Q13**

(Total 9 marks)

QUESTION 14 IS ON THE NEXT PAGE

N 2 6 2 5 9 A 0 1 9 2 8

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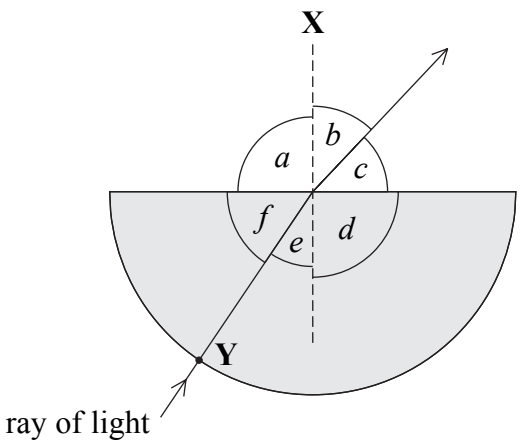
14. (a) The diagram shows a ray of light directed at a semicircular glass block.



(i) Name line **X**.

.....

(1)

(ii) Which angle *a*, *b*, *c*, *d*, *e* or *f* is an angle of incidence?

.....

(1)

(iii) Name angle *b*.

.....

(1)

(iv) State an equation which relates angle of incidence, angle of refraction and refractive index of glass.

.....

.....

(1)

(v) At point **Y** light passes from air to glass but refraction does not take place.

How can you tell this from the diagram?

.....

.....

(1)

(vi) Why does refraction not take place at point **Y**.

.....

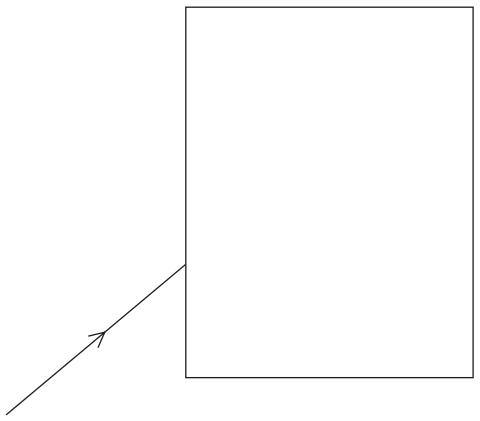
.....

(1)

Leave blank

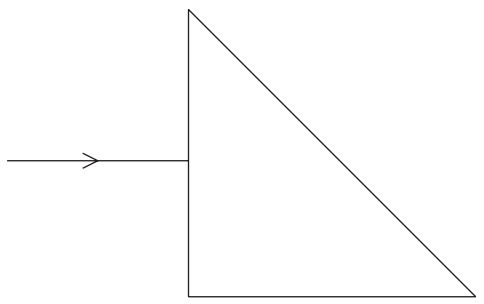
(b) Glass with a critical angle of 42° was used to make the blocks shown below.

(i) Complete the diagram to show how the ray of light passes through the rectangular glass block and out into the air.



(3)

(ii) Complete the diagram to show how the ray of light passes through the triangular glass block and out into the air.



(2) **Q14**

(Total 11 marks)

N 2 6 2 5 9 A 0 2 1 2 8

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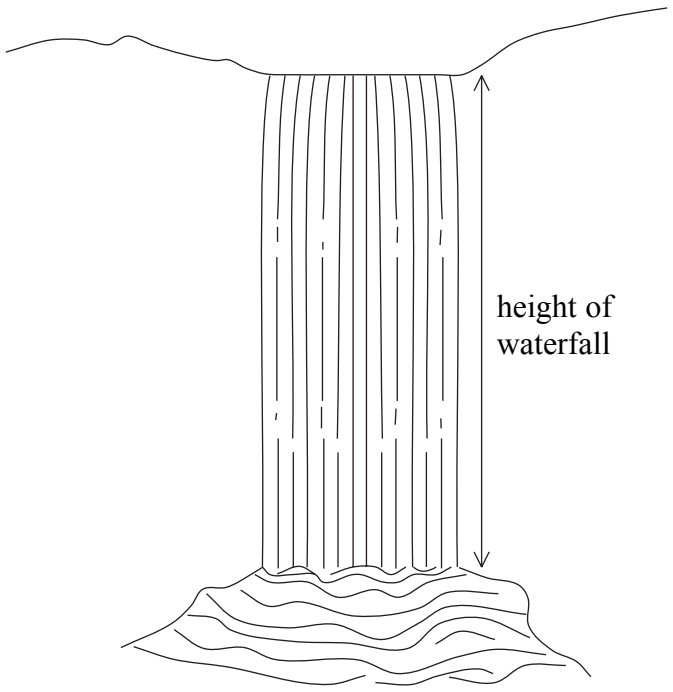
15. (a) The diagram shows a waterfall.



Complete the boxes to give the main energy transfer that takes place between the top of the waterfall and just before the bottom.

..... energy of the water	→	..... energy of the water

(2)

(b) The scientist J P Joule measured the water temperature at the top and the bottom of waterfalls. He found that the temperature of the water was always higher at the bottom.

(i) Suggest a reason for the temperature increase.

.....

.....

(1)

(ii) Suggest the relationship between the temperature increase and the height of the waterfall.

.....

.....

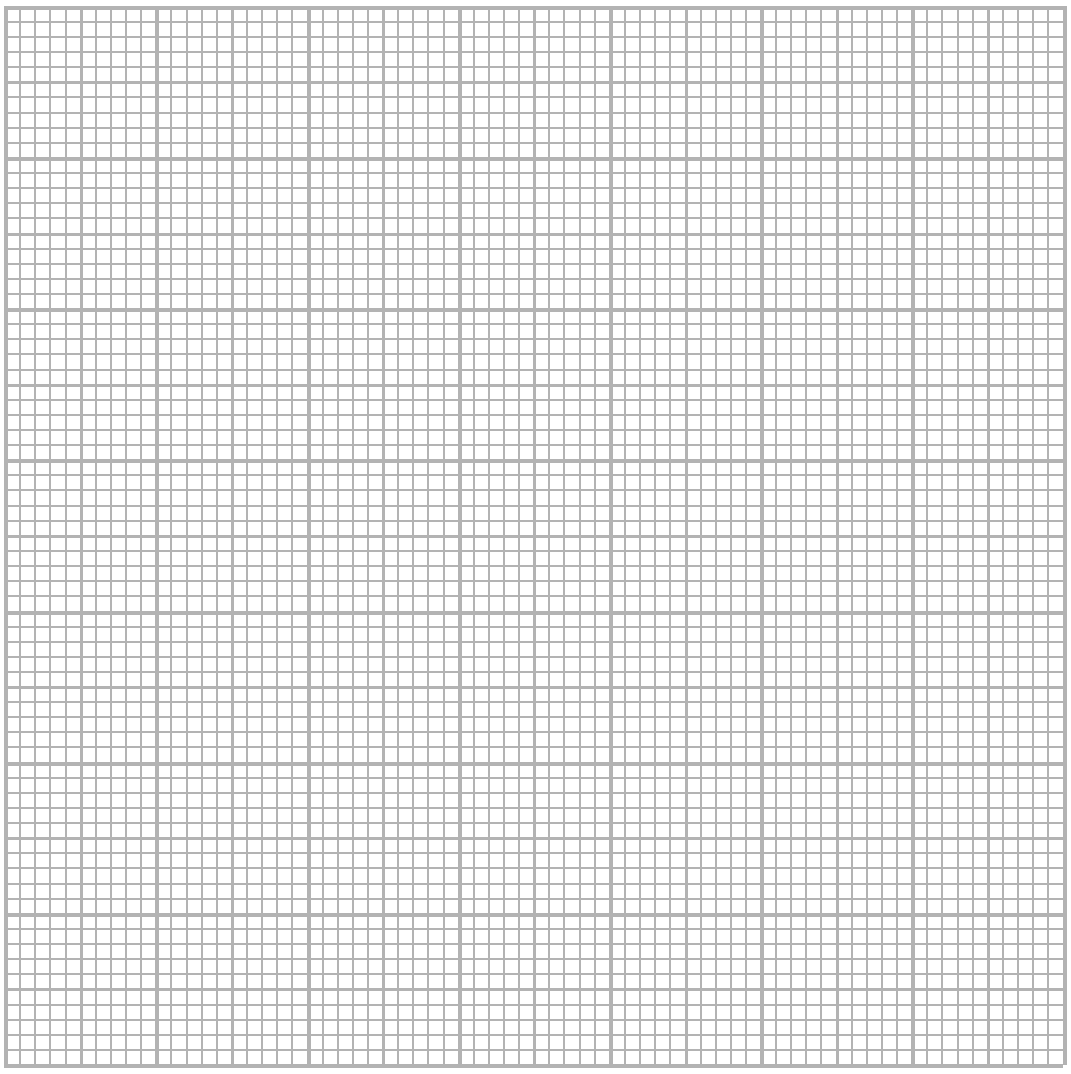
(1)

Leave blank

(c) Waterfalls sometimes cause rocks to fall. The table gives the speed and the kinetic energy of a falling rock.

Speed (m/s)	3.0	5.0	8.0	10.0	13.0
Kinetic energy (kJ)	0.2	0.7	1.7	2.7	4.6

(i) On the grid draw a graph of kinetic energy against speed. Label the axes, use appropriate scales, and draw a curve of best fit for your points.



(6)

(ii) Use your graph to find the kinetic energy in kilojoules of the rock when its speed is 12 m/s.

Kinetic energy = ... kJ

(1)

Q15

(Total 11 marks)

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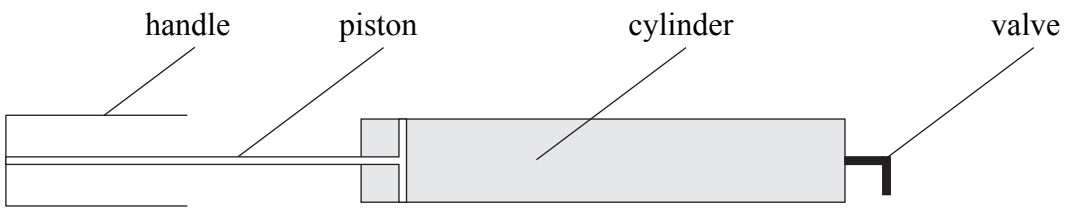
16. The diagram shows the structure of one type of bicycle pump.



(a) Circle **two** words in the box which best describe the motion of the molecules in the air in the cylinder.

backwards	**constant**	**fast**	**forwards**
random	**regular**	**slow**	**steady**

(1)

(b) Explain how the molecules exert a pressure on the inside of the cylinder.

.....

.....

.....

.....

.....

.....

(3)

Leave blank

(c) (i) The pressure inside the pump is 150 kPa when the volume of air in the cylinder is 90 cm^3. Use the equation

$$p_1V_1 = p_2V_2$$

to calculate the pressure in kPa when the air is compressed to a volume of 50 cm^3.

.....

.....

Pressure = ... kPa

(2)

(ii) What assumptions did you make in order to answer (c)(i)?

1 .....

.....

2 .....

.....

(2)

(iii) Name the unit which is represented by the symbol kPa.

.....

(1) **Q16**

(Total 9 marks)

QUESTION 17 IS ON THE NEXT PAGE

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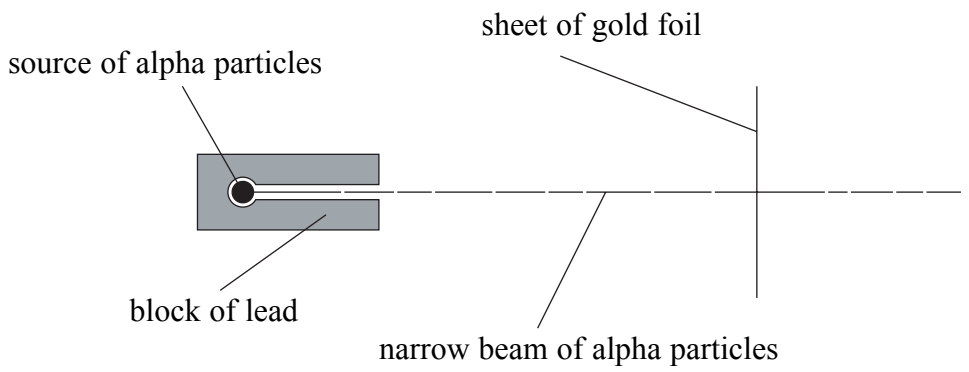
17. (a) Uranium-234 is radioactive. It emits alpha particles and decays to thorium-230. Complete the nuclear equation for this decay.

$$^{234}_{92}\mathrm{U} \rightarrow {}^{\cdots\cdots}_{\cdots\cdots}\mathrm{Th} + {}^{\cdots\cdots}_{\cdots\cdots}\mathrm{He}$$

(2)

(b) Geiger and Marsden studied the structure of atoms. The diagram shows part of the equipment which they used.



(i) The block of lead helped to shield the scientists from radiation. What was its other purpose?

.....

.....

(1)

(ii) Most of the alpha particles went straight through the gold foil. What explanation did the scientists suggest for this?

.....

.....

(1)

Leave blank

(iii) Some of the alpha particles were deflected. What explanation did the scientists suggest for the deflection?

.....

.....

.....

(2)

(iv) Only a small proportion of the alpha particles deflected through a large angle. What explanation did the scientists suggest for the proportion being small?

.....

.....

(1)

(v) Some alpha particles were deflected less than others. What two reasons did the scientists suggest for this?

1 .....

.....

2 .....

.....

(2)

(vi) The alpha particles were detected when they hit a zinc sulphide screen. How did the scientists know that an alpha particle had hit the screen?

.....

.....

(1) **Q17**

(Total 10 marks)

TOTAL FOR PAPER: 120 MARKS

END

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