

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

Paper Reference(s)

**4420/2H**

**London Examinations IGCSE**

**Physics**

Paper 2H

**Higher Tier**

Monday 31 October 2005 – Morning

Time: 2 hours

Examiner's use only

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Team Leader's use only

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**Materials required for examination**

Ruler  
Protractor  
Compasses  
Pencil  
Calculator

**Items included with question papers**

Nil

Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
Total	

**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 18 questions. All 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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## FORMULAE

You may find the following formulae useful.

$$\text{energy transferred} = \text{current} \times \text{voltage} \times \text{time} \qquad E = I \times V \times t$$

$$\text{pressure} \times \text{volume} = \text{constant} \qquad p_1 \times V_1 = p_2 \times V_2$$

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

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

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

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

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



Leave  
blank

1. (a) Are sound waves in air transverse or longitudinal?

.....  
(1)

(b) A sound wave has a frequency of 384 Hz and a wavelength of 0.86 m.  
Calculate its speed in m/s.

.....  
.....  
Speed = ..... m/s  
(2)

(c) Another sound wave has a frequency of 38 400 Hz.

(i) Would you be able to hear this sound wave?

.....  
(1)

(ii) Explain your answer.

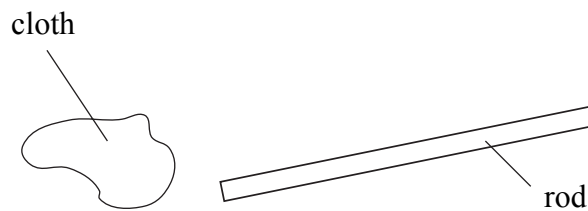
.....  
(1)

(Total 5 marks)

Q1



2. A student holds a rod and charges it by friction using a cloth.

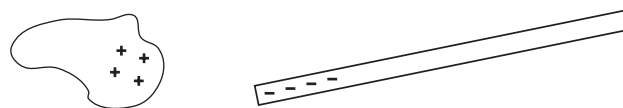


(a) Tick (✓) the boxes to show if the cloth and rod are insulators or conductors.

	Insulator	Conductor
cloth		
rod		

(2)

(b) Explain in terms of electrons how the rod and cloth become charged as shown.



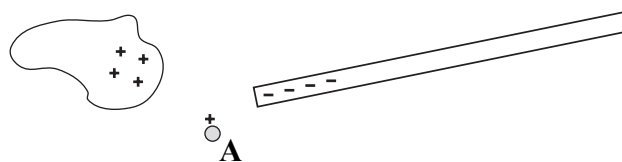
.....

.....

.....

(2)

(c)



A small positively-charged plastic sphere is placed at A.

(i) State the direction in which the sphere moves.

.....

(1)

(ii) Explain your answer.

.....

(1)

(Total 6 marks)

Q2

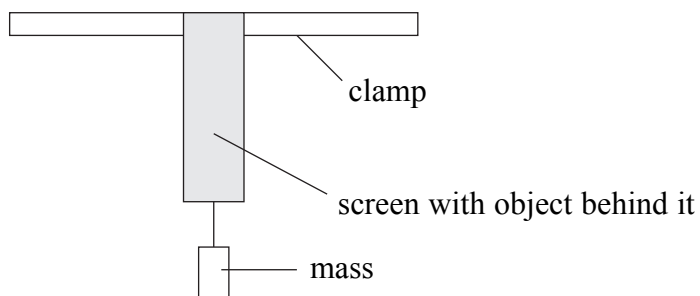


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**TURN OVER FOR QUESTION 3**



3. A teacher suspends an object from a clamp. She places a small screen in front of the object so that the students cannot see it. She then attaches a mass to the bottom of the object. The mass applies a force to the object and the object extends.

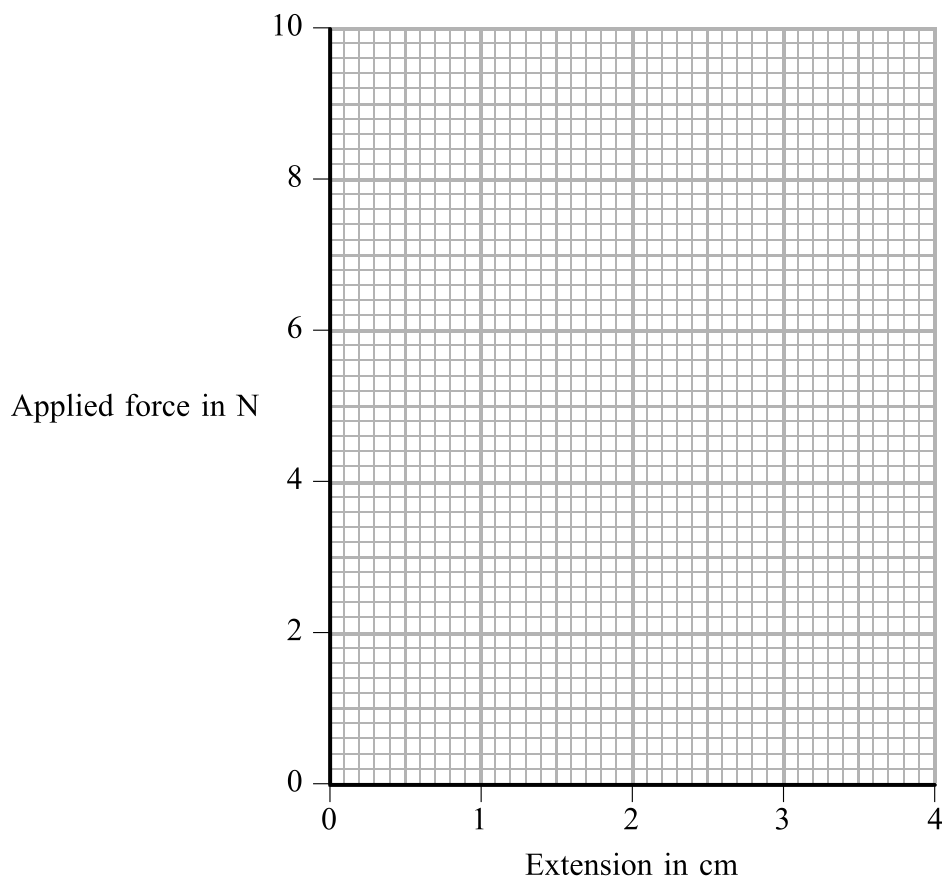


- (a) Different masses are attached to the bottom of the object. The teacher measures the extension and the students calculate the value of the applied force.

The table shows the results.

Extension (cm)	0.0	1.1	1.8	2.5	3.5
Applied force (N)	0.0	3.0	5.0	7.0	9.5

Plot the points on the grid. Draw the best straight line through the plotted points.



(3)



Leave  
blank

(b) Use your graph to find the extension for a force of 8.0 N.

.....  
(1)

(c) Explain why the extension for a force of 800 N is unlikely to be one hundred times the value in (b).

.....  
.....  
(1)

(d) The teacher tells her pupils that the object is one of three things:

- a helical spring
- a metal wire
- an elastic band.

(i) Which one could it be?

.....  
(1)

(ii) Give two reasons for your choice.

1 .....

2 .....

(2)

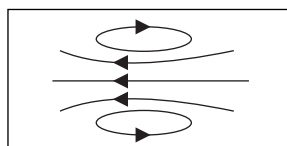
**(Total 8 marks)**

**Q3**

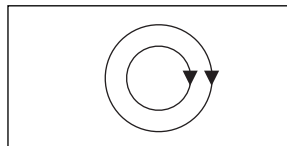


4. (a) An electric current produces a magnetic field.  
Draw a line from each box to its correct magnetic field pattern.

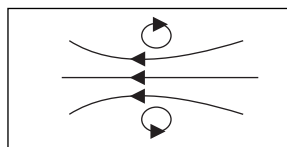
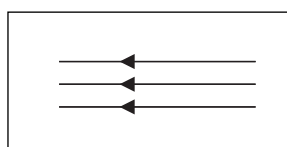
current in a straight wire



current in a flat circular coil

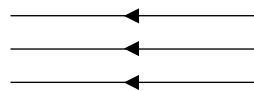
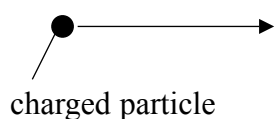


current in a solenoid



(3)

- (b) A charged particle travels towards and enters a magnetic field.



magnetic field

- (i) Describe the magnetic force acting on the charged particle when it is moving in the magnetic field.

..... (1)

- (ii) Explain your answer.

..... (1)

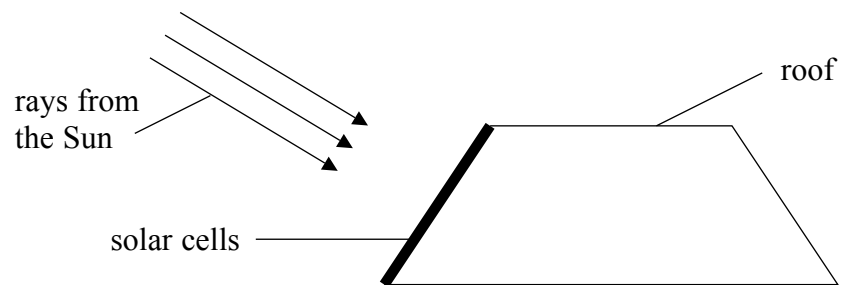
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Q4

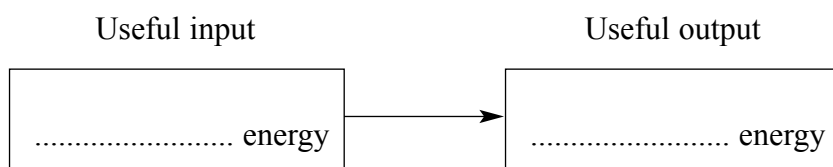




5. There are some solar cells on the roof of a school.



(a) Complete the boxes to show the useful energy transfer taking place in the solar cells.



(2)

(b) At a certain time of day the amount of useful energy transferred is 6000 J during a period of 2 minutes.

(i) Calculate the rate of transfer of energy in watts during this time.

.....  
.....

Rate of transfer of energy = .....W  
(2)

(ii) Give two reasons why the rate of transfer of energy in the solar cells changes throughout the day.

1 .....

2 .....

(2)

Q5

(Total 6 marks)

□

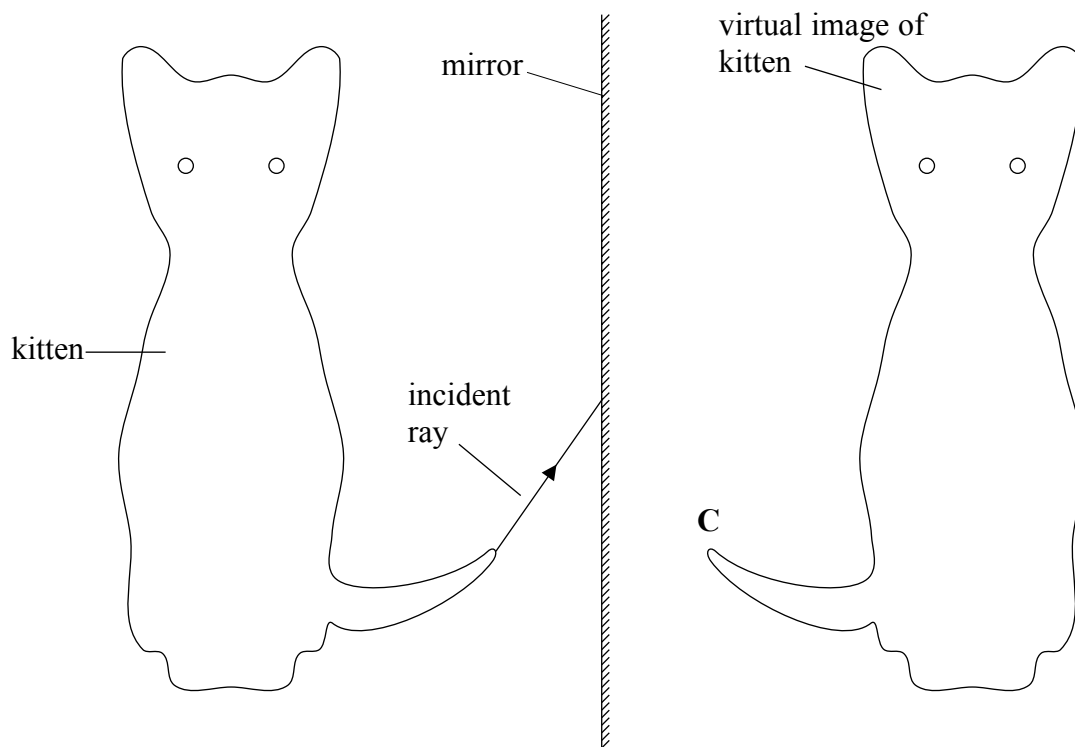


6. (a) Complete the sentence.

When light is incident on a mirror the angle of incidence equals the angle of .....

(1)

(b) The diagram shows a kitten sitting in front of a mirror. A virtual image of the kitten is formed by the mirror.



The image of the end of the kitten's tail is formed at C. One incident ray from the tail is shown. Draw its reflected ray and then construct further rays to show the image formation at C.

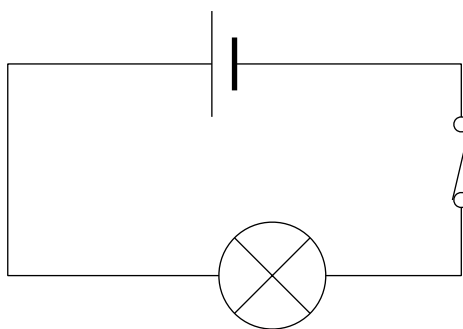
(3)

Q6

(Total 4 marks)



7. In the series circuit below, a lamp is lit to full brightness by direct current from a 1.5 V cell.



(a) State two differences between mains electricity and that supplied by the 1.5 V cell.

1 .....

2 .....

(2)

(b) Draw a parallel circuit using the 1.5 V cell to show how two lamps could be switched on and off independently and lit to full brightness.

(2)

Q7

(Total 4 marks)



Leave blank

8. (a) Two students record the mass and volume for a small cube of copper and a small cube of iron.

The table shows the results.

	Mass (kg)	Volume (m <sup>3</sup> )
copper	1.125	0.000 125
iron	1.728	0.000 216

- (i) Calculate the density in kg/m<sup>3</sup> for copper and iron.

Density of copper = ..... kg/m<sup>3</sup>

Density of iron = ..... kg/m<sup>3</sup>  
**(2)**

- (ii) Which of the two materials is less dense?

.....  
**(1)**

- (iii) Which of the two cubes has less weight?

.....  
**(1)**

- (b) How would you find the volume of the metal cubes?

.....  
.....  
.....  
**(3)**

**(Total 7 marks)**

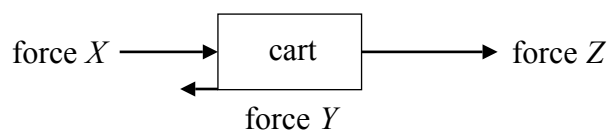
**Q8**



9. (a) A cart becomes stuck in a river bed. A group of people gets it moving again. Some of them push and some of them pull.



The diagram shows the horizontal forces which act on the cart.



- (i) Complete the sentences.

The frictional force is force .....

The pushing force is force ..... and the pulling force is force .....

(1)

- (ii) Forces are vectors. How does the diagram show this?

.....  
 .....

(1)

- (iii) Force  $U$  is the unbalanced force which acts on the cart. Complete the equation for force  $U$  in terms of  $X$ ,  $Y$  and  $Z$ .

$U =$  .....

(1)

- (b) A cart has a mass of 1500 kg. An unbalanced force of 1125 N acts on the cart in an easterly direction.

Calculate the acceleration of the cart and state its unit and direction.

.....  
 .....  
 .....

Acceleration = .....

(4)

(Total 7 marks)

Q9



10. (a) A student sings into a microphone.



Complete the sentence.

The useful energy transfer made by the microphone is from sound energy to ..... energy. **(1)**

(b) The amplitude, the frequency and the wavelength of a sound wave can be changed.

(i) What change could be made to make the sound lower in pitch?  
..... **(1)**

(ii) What change could be made to make the sound louder?  
..... **(1)**

(c) A sound wave, wavelength  $\lambda$ , approaches a gap in a wall.

(i) Name the effect which occurs as the sound wave passes through the gap.  
..... **(1)**

(ii) Complete the sentence.  
The greatest effect occurs when ..... is equal to  $\lambda$ . **(1)**



Leave  
blank

(d) Describe how you could measure the speed of sound in air by a simple direct method.  
You may draw a diagram to illustrate your answer.

.....

.....

.....

.....

.....

(4)

(Total 9 marks)

Q10



Leave blank

11. A torch uses three cells to light a bulb. The voltage across the bulb is 4.5 V and the current in it is 1.5 A.

(a) Calculate the power input, in watts, to the torch bulb.

.....  
.....

Power = ..... W  
(2)

(b) Use the equation

$$\text{energy transferred} = \text{current} \times \text{voltage} \times \text{time}$$

to calculate the energy, in joules, transferred to the bulb when the torch is used for ten minutes.

.....  
.....

Energy = ..... J  
(2)

(c) The filament in the torch bulb is made of tungsten which is a metal.

(i) Describe the nature and direction of the current in the filament.

.....  
.....  
.....  
(2)

(ii) The filament has a high resistance. What is the effect of the current in the filament? Explain this.

.....  
.....  
.....  
(2)

(Total 8 marks)

Q11





Leave  
blank

**12.** A lump of rock falls from a cliff. The kinetic energy of the rock just before it hits the ground is 4375 joules. The mass of the rock is 3.5 kg.

- (a) Calculate the speed of the rock just before it hits the ground.  
State the unit.

.....  
.....  
.....

Speed = .....  
**(4)**

- (b) As the rock falls its gravitational potential energy is transferred to kinetic energy.

- (i) How much gravitational potential energy does the rock have to start with?

.....  
**(1)**

- (ii) What assumption have you made?

.....  
.....  
**(1)**

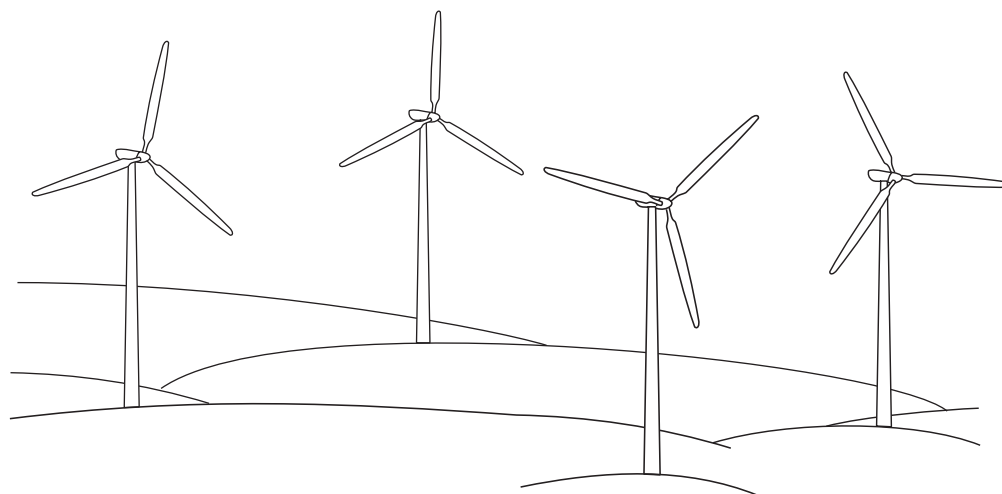
**(Total 6 marks)**

**Q12**



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13. Electricity may be produced on a large scale by using tall wind turbines connected to generators.



Without referring to the costs involved, state and explain

(a) one advantage of generating electricity by this method

.....  
.....  
.....

(2)

(b) one disadvantage.

.....  
.....  
.....

(2)

(Total 4 marks)

Q13



14. (a) In the 17th century a scientist called Robert Boyle carried out experiments on gases. He found that the relationship

$$p_1V_1 = p_2V_2$$

is true when  $p_1$  and  $V_1$  are the initial pressure and volume of the gas and  $p_2$  and  $V_2$  are the final pressure and volume of the gas.

(i) What two things must remain constant for this relationship to be true?

1 .....

2 .....

(2)

(ii) Some gas has a volume of  $1.2 \text{ m}^3$  at a pressure of 120 kPa. Calculate its volume, in  $\text{m}^3$ , when the pressure is increased to 250 kPa.

.....  
.....

Volume = .....  $\text{m}^3$

(2)

(b) (i) Convert a temperature of  $-273 \text{ }^\circ\text{C}$  into kelvin.

.....

Temperature = ..... K

(1)

(ii) What is special about this temperature?

.....  
.....

(1)

(c) Some gas is trapped in a metal cylinder. The temperature outside the metal cylinder increases.

Explain how this affects the particles in the gas and what effect this has.

.....  
.....  
.....  
.....  
.....

(3)

(Total 9 marks)

Q14



Leave blank

15. (a) Transformers are used in the large scale transmission and distribution of electricity.

(i) How are they used?

.....  
.....  
.....  
.....

(2)

(ii) Why are they used?

.....  
.....  
.....  
.....  
.....  
.....

(3)

(b) A small transformer for a radio has an input voltage of 230 V and an output voltage of 6.0 V.

Calculate the input current in mA when the output current is 575 mA.  
Assume that the transformer is 100% efficient.

.....  
.....  
.....

Input current = ..... mA

(3)

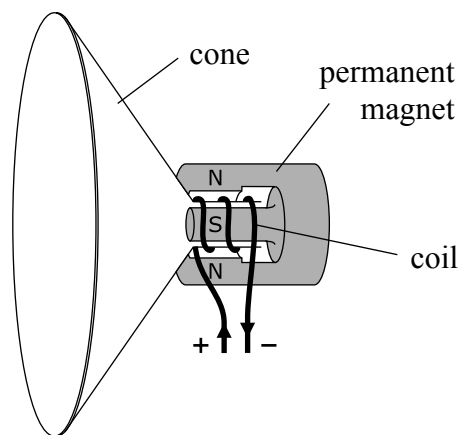
(Total 8 marks)

Q15



16. The diagram shows the inside of a loudspeaker. It contains a cone attached to a coil of insulated wire.

The coil is in the gap between the cylindrical poles of a permanent magnet. When there is a current in the coil, both the coil and the cone are forced to move.



(a) Why is the coil made of insulated wire?

.....  
 .....  
 (1)

(b) (i) In which direction will the coil move?

.....  
 (1)

(ii) State two changes you could make to increase the force acting on the coil.

1 .....  
 2 .....  
 (2)

(c) When the current in the coil changes direction the cone vibrates.

(i) When the cone vibrates at a frequency of 3.6 kHz, what is the frequency in kHz of the sound which is produced?

Frequency = ..... kHz  
 (1)

(ii) Name the unit represented by the symbol kHz.

.....  
 (1)

(Total 6 marks)

Q16



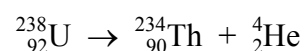
17. About 99% of natural uranium is uranium-238. The remaining 1% is uranium-235.

(a) Complete the sentences.

Uranium-238 and uranium-235 are ..... of uranium. In their nuclei there are the same number of ..... and different numbers of .....

(2)

(b) The equation shows the decay of uranium-238.



(i) What type of ionising radiation is emitted during this decay?

.....  
(1)

(ii) How can you tell this from the equation?

.....  
.....  
(1)

(c) (i) Which sub-atomic particle can collide with a uranium-235 nucleus and cause it to split?

.....  
(1)

(ii) Name this process.

.....  
(1)

(iii) Complete the sentences.

The products of the process are two daughter ..... and a small number of ..... The process releases energy in the form of ..... energy of these products.

(3)



Leave  
blank

(iv) What must happen for uranium-235 nuclei to be involved in a chain reaction?

.....  
.....  
.....

(2)

Q17

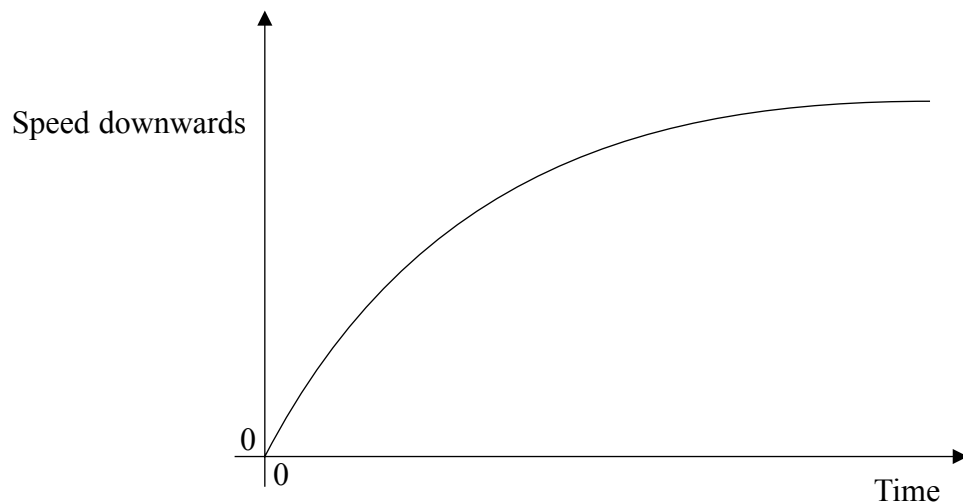
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**TURN OVER FOR QUESTION 18**



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18. An object falls down a very deep, vertical mine shaft. The sketch graph shows how the object's speed downwards varies with time.



(a) Show on the graph how you can find the object's terminal velocity. (1)

(b) Explain the shape of the graph. Use the concepts of force and acceleration in your answer.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(6) **Q18**

(Total 7 marks)

**TOTAL FOR PAPER: 120 MARKS**

**END**

