Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						4	4	3	7	/	6	H	Signature	

Paper Reference(s)

4437/6H

Examiner's use only

Team Leader's use only

London Examinations IGCSE

Science (Double Award)

Physics

Paper 6H

Higher Tier

Tuesday 4 November 2008 – Morning

Time: 1 hour 30 minutes

Materials required for examination
Nil

Items included with question papers
Nil

Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
Total	

Instructions to Candidates

In the boxes above, write your centre number, 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. Write your answers 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 90. The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**. There are 11 questions in this question paper.
Any blank pages are indicated.
Useful formulae are given on page 2.

Advice to Candidates

Write your answers neatly and in good English.

Printer's Log. No.
N32421A
W850/U4437/57570 5/7/5/4/200

N 3 2 4 2 1 A 0 1 2 4

Turn over

edexcel
advancing learning, changing lives

FORMULAE

You may find the following formulae useful.

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

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

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

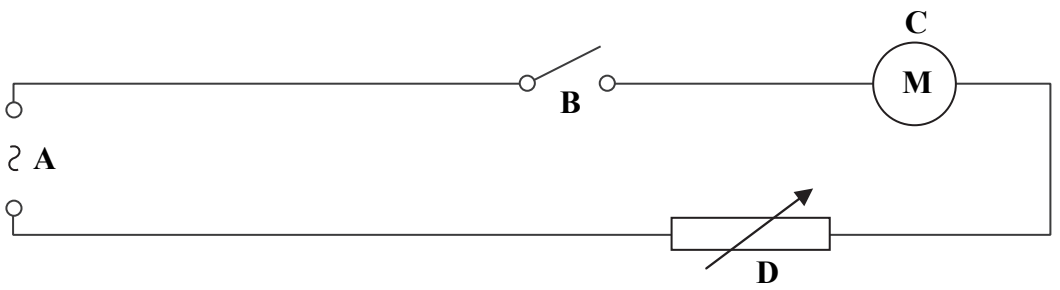
$$\text{power} = \frac{\text{work done}}{\text{time taken}} \qquad P = \frac{W}{t}$$

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

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

Leave blank

1. The diagram shows an electric circuit.



(a) What do the symbols, **A**, **B**, **C** and **D**, represent?

A .....

(1)

B .....

(1)

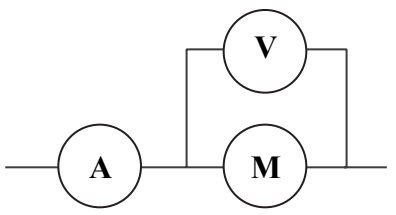
C .....

(1)

D .....

(1)

(b) A student connects two meters to (**M**) as shown.



Complete the table to name each meter and what it measures.

Meter	Name	What it measures
(**V**)	.....	This meter measures the ..... across (**M**).
(**A**)	.....	This meter measures the ..... in (**M**).

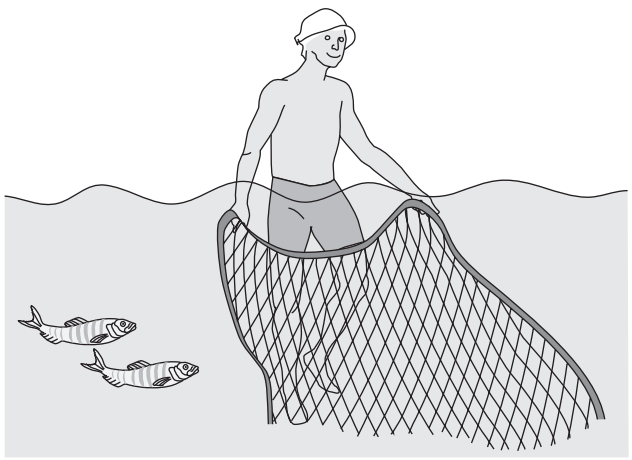
(2) **Q1**

(Total 6 marks)

Turn over

Leave blank

2. The diagram shows a fisherman standing in water.



(a) In 8 seconds, 4 complete waves pass the fisherman.

Calculate the frequency of the waves and give the unit.

.....

Frequency =.....

(2)

(b) These water waves are transverse waves.

Name **one** other example of a transverse wave.

.....

(1)

(c) Complete the sentence.

Waves can transfer energy and ..... without transferring matter.

(1)

(d) What is meant by the time period of a wave?

.....

.....

.....

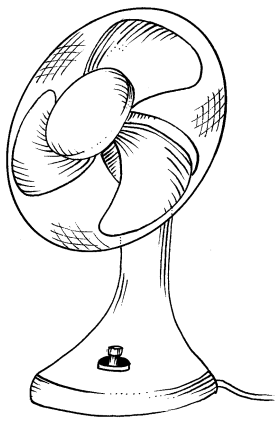
(2)

Q2

(Total 6 marks)

Leave blank

3. The diagram shows an electric fan.



(a) Complete the sentences.

The useful energy output of the fan is ..... energy.

Energy is wasted as ..... energy and as

..... energy.

(2)

(b) State the equation for efficiency.

Efficiency =

(1)

(c) The useful power output of the fan is 50 watts.

Use the equation

power × time taken = work done

to calculate the useful work done by the fan in 15 minutes and give the unit.

.....

.....

Useful work = ...

(3)

Q3

(Total 6 marks)

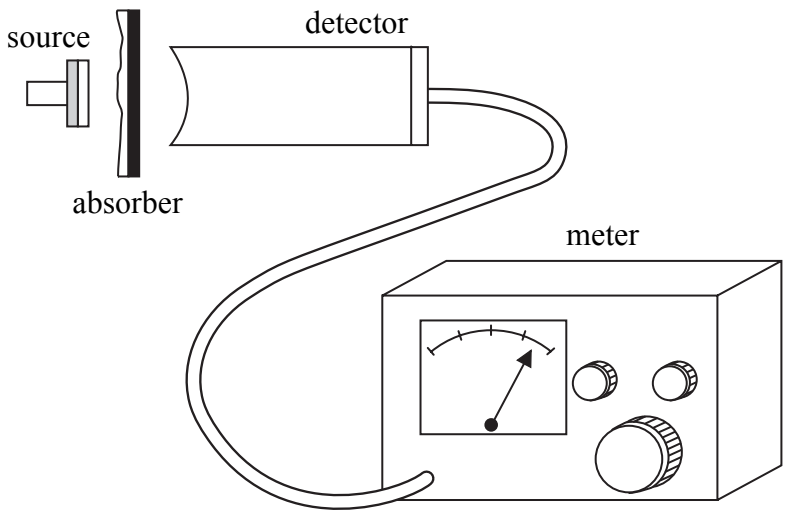
Leave blank

4. (a) Name **one** source of background radiation.

.....

(1)

(b) The diagram shows a Geiger-Muller detector connected to a count rate meter.
The count rate from a radioactive source is measured with different absorbers present.



The table shows the results.

Absorber	**Average count rate (counts per second) [after allowing for background radiation]**
no absorber [apart from 10 mm of air]	41
card 1 mm thick	24
metal 3 mm thick	0

Leave blank

Explain how the results show that the source

(i) emits alpha (α) radiation,

.....

.....

(1)

(ii) emits beta (β) radiation,

.....

.....

(1)

(iii) does **not** emit gamma (γ) radiation.

.....

.....

(1)

(c) A source has a half-life of 15 minutes. When the activity of the source is measured it is 400 megabecquerels (MBq).

Estimate the activity in MBq of the source after one hour.
Show your working.

.....

.....

Activity = ... MBq

(2)

Q4

(Total 6 marks)

BLANK PAGE

Leave blank

5. (a) Explain why it may be dangerous to switch on a light when your hands are wet.

.....

.....

.....

(2)

(b) Many electrical appliances have a metal casing.

A live wire comes into contact with the metal casing.
Explain how an earth wire and a fuse prevent the user receiving an electric shock.

Earth wire .....

.....

Fuse .....

.....

(2)

(c) The resistance of a person's body is 10 000 ohms.
A current of 0.020 amps will give the person a serious electric shock.

Use the equation

voltage = current × resistance

to calculate the minimum voltage in volts which will cause this.

.....

.....

Minimum voltage = ... V

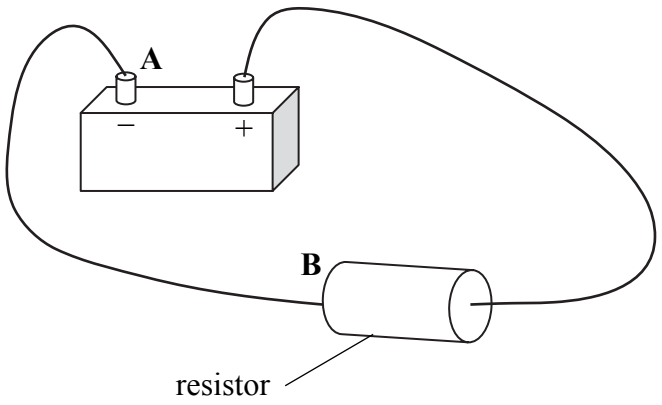
(2)

(Total 6 marks)

Q5

Leave blank

6. (a) A student connects a 12 V battery to a resistor as shown.



(i) Draw an arrow in the resistor to show the direction of electron flow.

(1)

(ii) Explain your answer.

.....

.....

(2)

(b) The potential difference across the wire **AB** is 0.20 V when the current in the circuit is 3.0 A.

The student leaves the circuit connected for 4 minutes.

(i) How much energy in joules is transferred from the battery to the wire **AB** in this time?

.....

.....

Energy transferred = ... J

(2)

(ii) Into what form is this energy transformed?

.....

(1)

Leave blank

(c) The 12 V battery is now replaced by a 6 V battery.

(i) How much energy in joules is transferred from the 6 V battery to the wire **AB** in 4 minutes?

.....

.....

Energy transferred = ... J

(2)

(ii) Explain your answer.

.....

.....

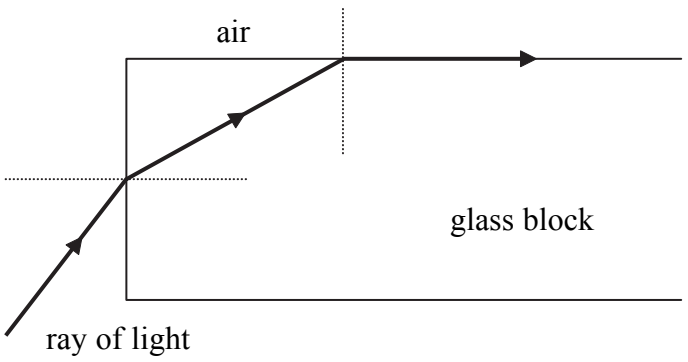
(1)

Q6

(Total 9 marks)

Leave blank

7. (a) A student shines a ray of light at a glass block as shown below. The refractive index of the glass is 1.6.



Show on the diagram for this ray of light

(i) the angle of incidence from air to glass and label it **I**,

(1)

(ii) the angle of refraction inside the glass and label it **R**,

(1)

(iii) the critical angle and label it **C**.

(1)

(b) (i) What does the term **critical angle** mean?

.....

.....

(1)

(ii) State the relationship between critical angle and refractive index.

.....

(1)

(iii) Calculate the critical angle in degrees for this block of glass.

.....

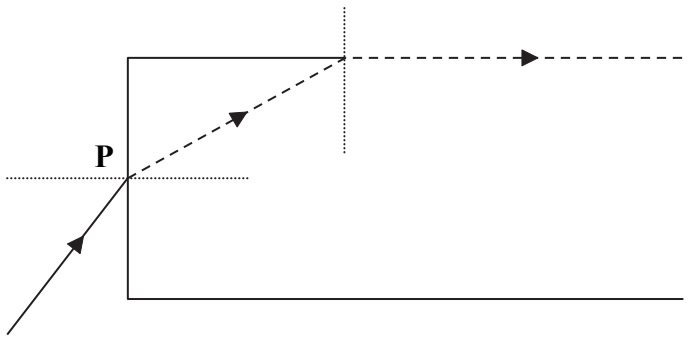
.....

Critical angle = ... °

(1)

Leave blank

(c) The diagram below shows the ray of light entering the glass block at point **P**. The dashed path is for glass of refractive index 1.6.



(i) Draw the path of the ray from **P** if the refractive index of the glass is greater than 1.6.

(2)

(ii) Explain the path that you have drawn.

.....

.....

.....

.....

.....

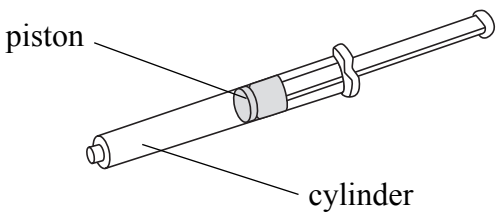
(2)

(Total 10 marks)

Q7

Leave blank

8. The diagram shows a syringe. The volume of the air in the cylinder is 150 cm^3 at a pressure of 100 kPa.



A student places a finger over the open end of the syringe and then pushes the piston down. He reduces the volume of the air in the syringe by 30 cm^3.

(a) Calculate the new pressure in kilopascals of the air in the syringe.

.....

.....

Pressure = ... kPa

(2)

(b) One assumption that is made in this calculation is that the temperature of the air does not change. State **one** other assumption.

.....

(1)

(c) If some of the energy used in moving the piston is transferred to heat energy, the pressure of the gas would not be the same as that calculated in (a).

(i) Would it be bigger or smaller?

.....

(1)

(ii) Explain your answer.

.....

.....

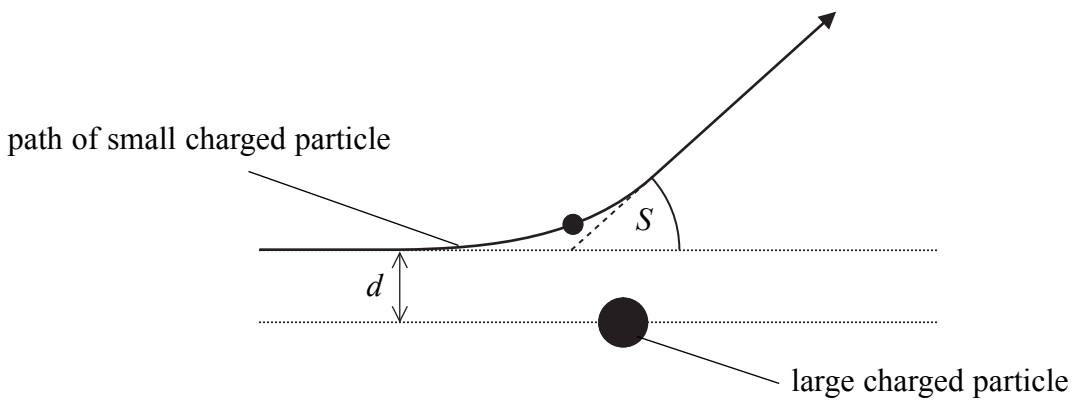
(2)

Q8

(Total 6 marks)

Leave blank

9. The diagram shows the path of a small charged particle being deflected as it passes a large charged particle. The angle of deflection *S* depends on the distance *d*.



(a) Geiger and Marsden's experiment, from which the structure of the atom was determined, involved a small particle being deflected by a large particle.

(i) Name the small particle.

.....

(1)

(ii) Name the large particle.

.....

.....

(1)

(b) (i) What can you conclude about the type of charge on the two particles?

.....

.....

(1)

(ii) Explain your conclusion.

.....

.....

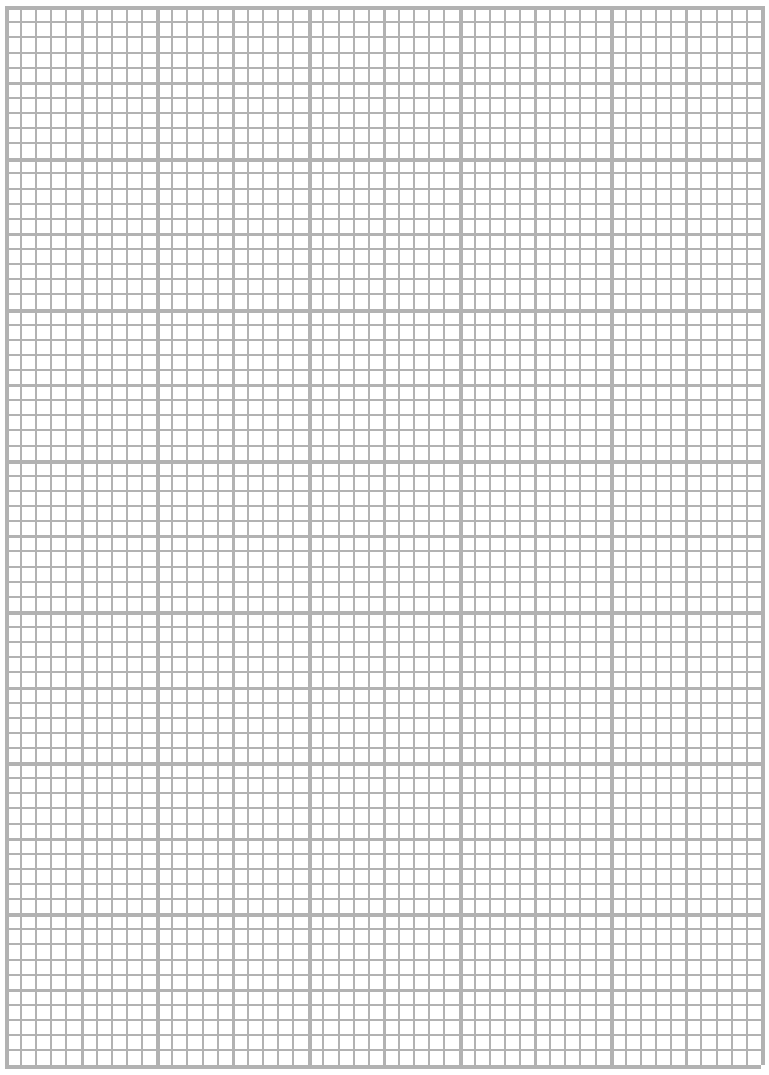
(1)

Leave blank

(c) The table shows some results for Geiger and Marsden's experiment.
The distances are very small and measured in femtometres (fm).

Distance d (fm)	27	32	39	51	72	100
Angle of deflection S (°)	70	60	50	40	30	22

(i) Plot a graph of angle of deflection (y-axis) against distance (x-axis). Draw a smooth curve through your points.



(5)

(ii) Use your graph to find the angle of deflection in degrees for a distance of 60 fm.

Angle = ... °

(1)

Leave blank

(d) Use values and ranges from the box to complete the sentences.

0°	**0° to 45°**	**45° to 90°**	**90°**	**above 90°**

In Geiger and Marsden's experiment, when the distance, *d*, was very much larger than the radius of the large particle, the angle of deflection was .....

When the distance, *d*, was very much less than the radius of the large particle the angle of deflection was .....

(2)

(e) (i) State the property of the smaller particle, apart from its charge, that must be kept constant.

.....

(1)

(ii) Why did Geiger and Marsden's experiment take place in a vacuum?

.....

.....

(1)

(f) State the name of the model of the atom proposed by Rutherford as a result of this experiment.

.....

(1)

Q9

(Total 15 marks)

Leave blank

10. Elements with a higher atomic number than uranium can be formed artificially.
The table shows details of some of these elements.

Element	Symbol	Atomic number
neptunium	Np	93
plutonium	Pu	94
americium	Am	95
curium	Cm	96

(a) It is possible to form a nucleus of plutonium by bombarding a nucleus of uranium with an alpha particle.

(i) Complete the nuclear equation for this reaction

$$^{238}_{92}\mathrm{U} \quad + \quad ^{4}_{2}\alpha \quad \rightarrow \quad ^{241}_{94}\mathrm{Pu} \quad + \quad ^{\cdots\cdots}_{\cdots\cdots}\mathrm{X}$$

(2)

(ii) Identify particle X.

.....

(1)

(b) Plutonium-241 formed in the reaction above then undergoes beta decay.

(i) Complete the nuclear equation for the beta decay of plutonium-241.

$$^{241}_{94}\mathrm{Pu} \longrightarrow ^{\cdots\cdots}_{\cdots\cdots}\mathrm{Y} + ^{\cdots\cdots}_{\cdots\cdots}\beta$$

(3)

(ii) Use the table to identify element Y.

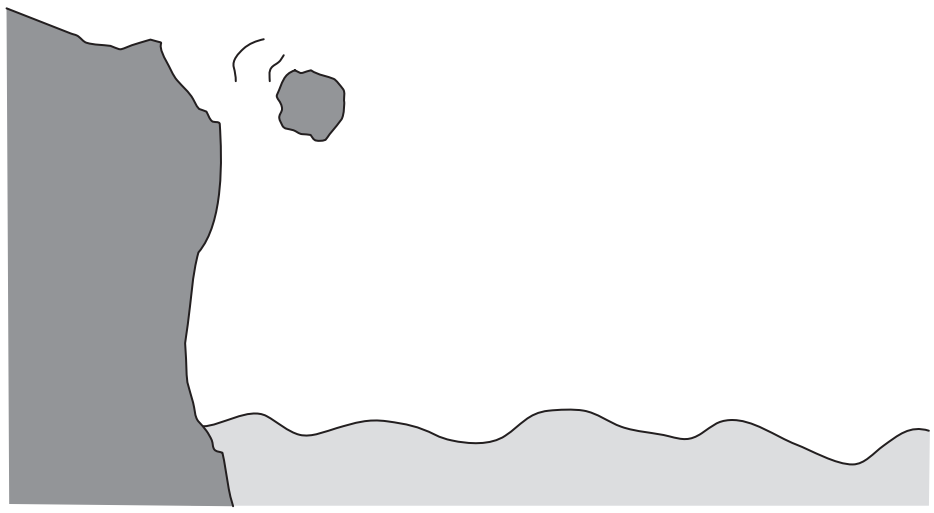
.....

(1) **Q10**

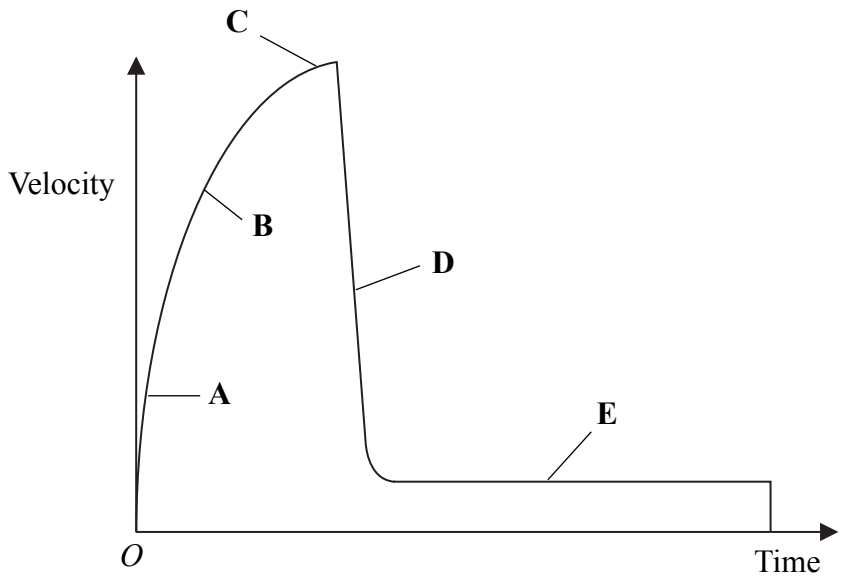
(Total 7 marks)

Leave blank

11. During a storm, a large rock falls from a high cliff into the sea.



The graph shows the velocity of the rock as it falls from the cliff until it reaches the bottom of the sea. **A**, **B** and **C** are stages in its fall before it hits the sea.



(a) State the property of the graph that can be used to determine

(i) acceleration,

.....

(1)

(ii) distance travelled.

.....

(1)

Leave blank

(b) (i) Does the rock reach terminal velocity in air?

.....

(1)

(ii) Explain your answer.

.....

.....

(1)

(c) **A**, **B**, **C**, **D** and **E** represent stages in the fall of the rock.
At which of these stages does the rock have

(i) greatest acceleration, ...

(1)

(ii) greatest deceleration, ...

(1)

(iii) the greatest force acting on it due to air resistance? .....

(1)

(d) Describe and explain the motion of the rock when it is in the sea at stage **E**. Use the concepts of drag, weight, acceleration and velocity in your answer.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(4)

Leave blank

(e) Explain how the graph shows that the height of the cliff is greater than the depth of the sea.

.....

.....

(2)

Q11

(Total 13 marks)

TOTAL FOR PAPER: 90 MARKS

END

BLANK PAGE

BLANK PAGE

BLANK PAGE