| Centre No. | | | | | | Paper Reference | | | | | | | Surname | Initial(s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Candidate No. | | | | | | 7 | 5 | 4 | 0 | / | 0 | 1 | Signature | |

Paper Reference(s)

**7540/01**

# London Examinations GCE

## Physics

## Ordinary Level

Paper 1

Wednesday 12 May 2010 – Afternoon

Time: 1 hour 15 minutes

**Materials required for examination**
Nil

**Items included with question papers**
Nil

Examiner's use only

| | | |
|---|---|---|

Team Leader's use only

| | | |
|---|---|---|

| Question Number | Leave Blank |
|---|---|
| 1 | |
| 2 | |
| 3 | |
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### Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initial(s) and signature.
Check that you have the correct question paper.
Answer ALL the questions. Write your answers in the spaces provided in this question paper.
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 (☒).

### Information for Candidates

Calculators may be used.
Where necessary, assume the acceleration of free fall, $g = 10\ m/s^2$.
The total mark for this paper is 70. The marks for parts of questions are shown in round brackets: e.g. **(2)**.
This paper has 11 questions. All blank pages are indicated.

### Advice to Candidates

Write your answers neatly and in good English.
In calculations, show **all** the steps in your working.



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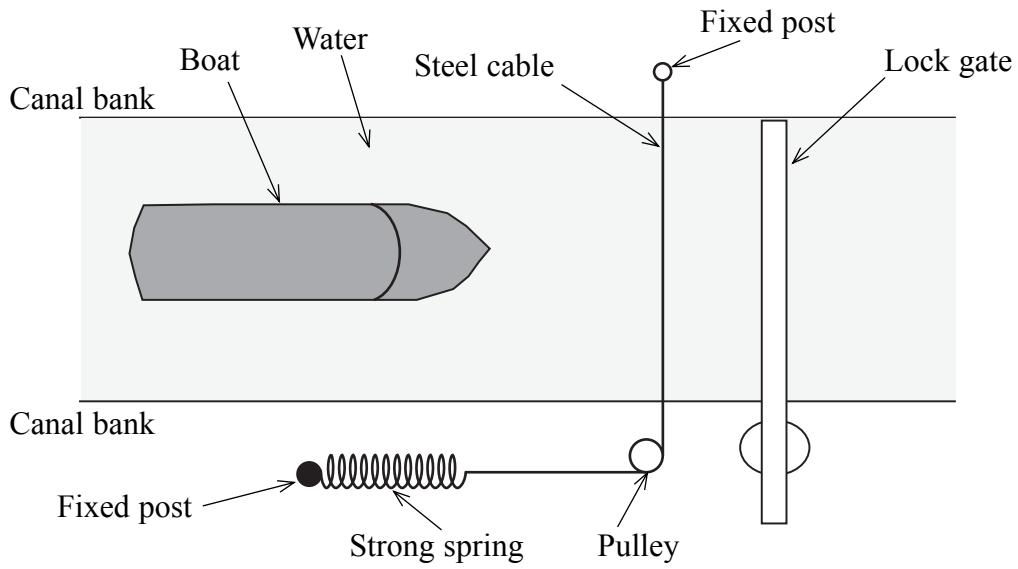
**Answer ALL the questions.**

**1.** Some canals are divided into sections by watertight lock gates. A method for preventing boats from hitting a lock gate uses a steel cable placed across the canal as shown in the diagram. The cable passes round a pulley and is then connected to a strong spring.




(a) Calculate the mass of a boat of weight 60 000 N.

.....

.....

**(1)**

(b) This boat is brought to rest by the steel cable. The steel spring stretches elastically and exerts a maximum force of 8 000 N on the boat.

(i) Calculate the maximum deceleration of the boat.

.....

.....

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**(2)**

(ii) State a reason why the spring needs to stretch elastically.

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**(1)**

Leave blank

(c) Why would more damage be done to the lock gate if the boat hit it directly?

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**(3)** **Q1**

**(Total 7 marks)**

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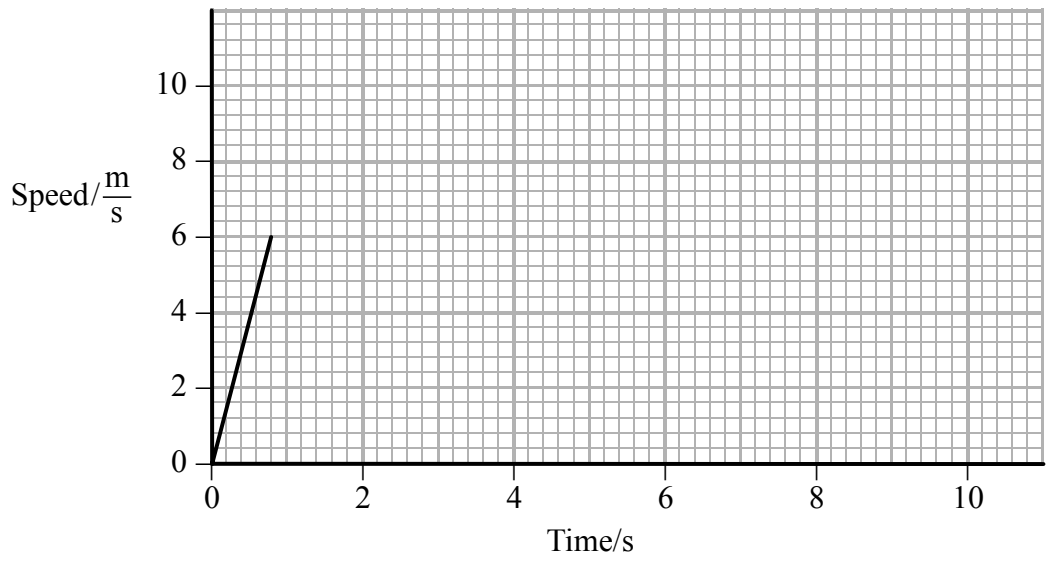
**2.** During the Beijing Olympics, Usain Bolt won the 100 m sprint race in 9.7 s. The graph below shows how his speed increased at the start of the race.




(a) How can you tell that his acceleration during the first 0.80 s was uniform?

.....

.....

**(1)**

(b) Calculate his acceleration during the first 0.80 s.

.....

.....

.....

**(2)**

(c) The table shows how his motion changed during the race. Use the information to complete the speed-time graph for the race.

| Time/s | Motion |
|---|---|
| 0–0.80 | Uniform acceleration |
| 0.80–2.40 | Decreasing acceleration |
| 2.40 | Maximum speed of 11.50 m/s reached |
| 2.40–9.70 | Uniform speed of 11.50 m/s |

**(3)**

**Q2**

**(Total 6 marks)**

Leave blank

**3.** A new device for extracting blood works by making a tiny hole in the skin through which blood can rise. A small square of skin, 0.0050 cm by 0.0050 cm, is removed using a tiny heater.

(a) This layer of skin is 0.030 cm thick. Show that the volume of skin removed by the heater is 0.00000075 $cm^3$ ($7.5 \times 10^{-7}$ $cm^3$).

.....

.....

**(1)**

(b) Calculate the mass of skin removed. [Density of skin = 1.1 $g/cm^3$]

.....

.....

.....

**(2)**

(c) Calculate the heat energy transferred to this mass of skin if its temperature is increased by 90 °C. [Specific heat capacity of skin = 2.10 J/ (g K)]

.....

.....

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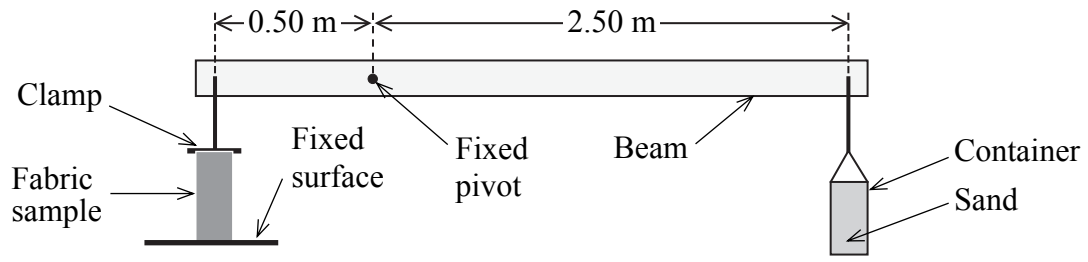
**(2)** **Q3**

**(Total 5 marks)**

Leave blank

**4.** The diagram shows an arrangement which can be used to test the strength of a fabric. A sample of the fabric is placed between a fixed surface and a clamp. The clamp is attached to a pivoted beam. By adding sand to the container a stretching force is applied by the clamp to the fabric.




(a) The force applied by the sand and container is 60 N. Calculate the moment of this force about the pivot.

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**(2)**

(b) Calculate the stretching force applied by the clamp to the fabric. (Assume that the weight of the beam and clamp is negligible.)

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**(2)**

(c) State and explain how your answer to (b) would be affected if the weight of the beam was not negligible.

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**(2)**

(d) Give two ways in which the stretching force applied to the fabric could be increased using the same amount of sand.

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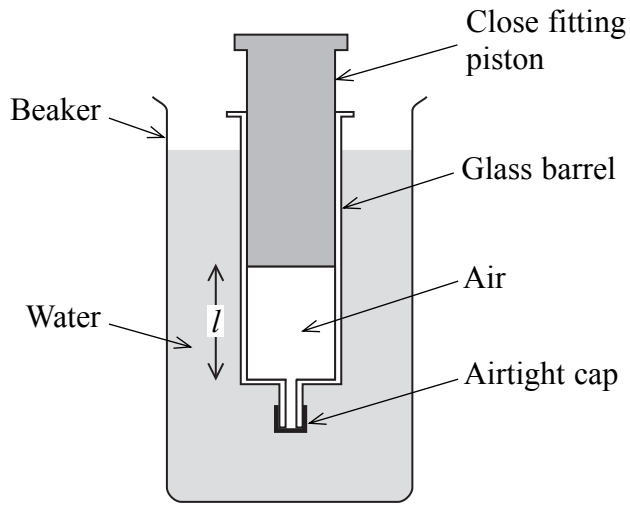
**(2)**

**Q4**

**(Total 8 marks)**

Leave blank

**5.** The diagram shows an arrangement, using a gas syringe, that can be used to investigate how the volume of air depends on temperature. The initial temperature of the water in the beaker and the initial length, *l*, of the air are measured. The beaker is heated and a number of sets of measurements made.




(a) When making calculations from these measurements certain assumptions are made. State the assumption made about:

(i) the cross-sectional area of the glass barrel

.....

**(1)**

(ii) the pressure of the air in the gas syringe

.....

**(1)**

(iii) the mass of air in the gas syringe

.....

**(1)**

(b) The initial temperature of the air is 27 °C and the initial length of the air, *l*, is 5.0 cm. Calculate the length *l*, when the temperature is 97 °C.

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**(3)** **Q5**

**(Total 6 marks)**

Leave blank

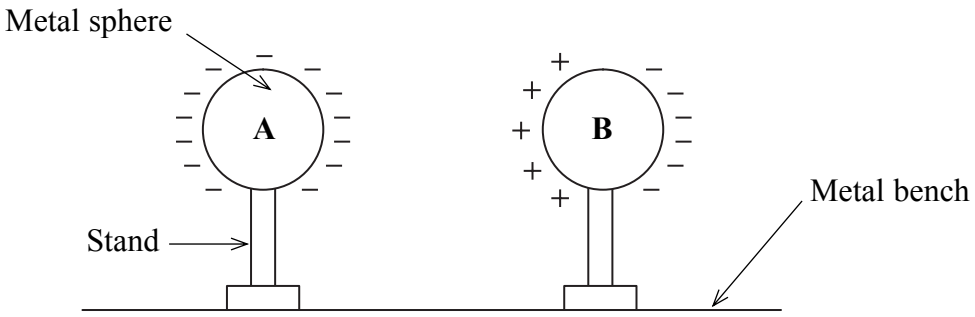
**6.** (a) A charged particle is able to move through metal.
Name this particle and the type of charge that it carries.

Name .....

Type of charge .....

**(2)**

(b) The diagram shows two metal spheres **A** and **B**. **A** is negatively charged and **B** is uncharged.




(i) The stand of each sphere is made from the same material. Is the material a conductor or an insulator? Put a cross (☒) in the correct box.

Conductor ☒ Insulator ☒

**(1)**

(ii) Explain your answer.

.....

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**(2)**

(c) Explain the distribution of charges on sphere **B**.

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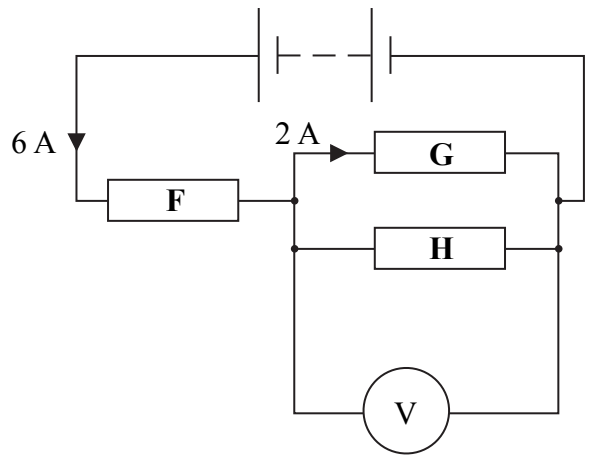
**(2)**

**Q6**

**(Total 7 marks)**

Leave blank

**7.** The circuit shows a battery connected in a circuit with three resistors **F**, **G** and **H** and a voltmeter. The resistance of **G** is 9 Ω. The current in **F** is 6 A and the current in **G** is 2 A.




(a) (i) What is the current in **H**?

.....

**(1)**

(ii) What assumption have you made about the resistance of the voltmeter?

.....

**(1)**

(iii) Calculate the reading on the voltmeter.

.....

.....

**(1)**

(b) A student states that resistors **G** and **H** will get equally hot in the circuit above.

(i) Is the student correct?

.....

**(1)**

(ii) Explain your answer.

.....

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.....

.....

**(2)**

**(Total 6 marks)**

**Q7**

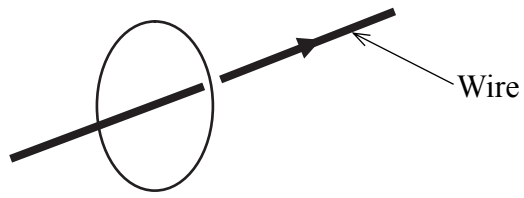




**Turn over**

Leave blank

**8.** The diagram shows the shape of the magnetic flux pattern for a current-carrying straight wire.




(a) Is the direction of the magnetic flux pattern clockwise or anticlockwise?

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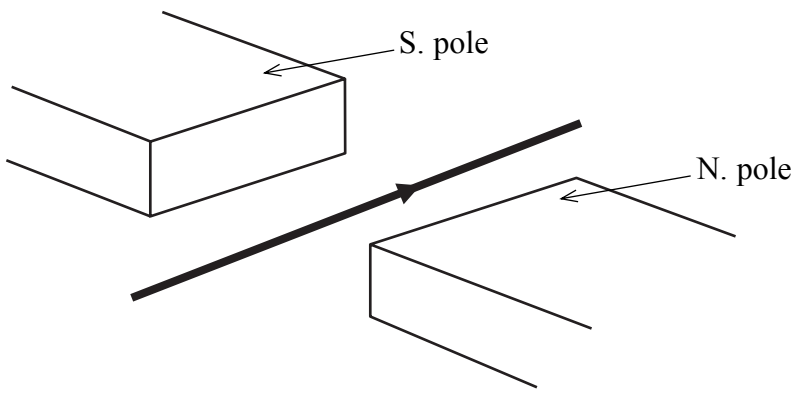
**(1)**

(b) When the current-carrying wire is placed in a magnetic field the wire experiences an electromagnetic force.




(i) State the direction of this force.

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**(1)**

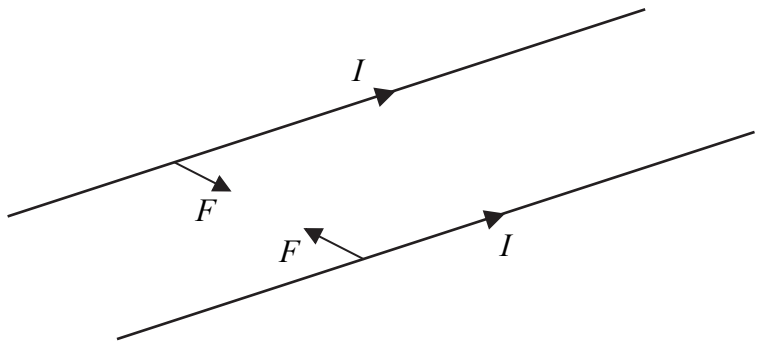
(ii) State the name of the rule that you used to answer (i).

.....

**(1)**

Leave blank

(c) When two parallel wires carry a current *I* there is a force *F* of attraction acting between them as shown below. This is because each wire is in the magnetic field produced by the other wire.




(i) State two ways in which the force *F* could be increased.

1 .....

2 .....

**(2)**

(ii) Put a cross (☒) in the correct box.
If the current in one wire is reversed *F*

remains a force of attraction ☒

becomes zero ☒

becomes a force of repulsion ☒

**(1)**

**Q8**

**(Total 6 marks)**

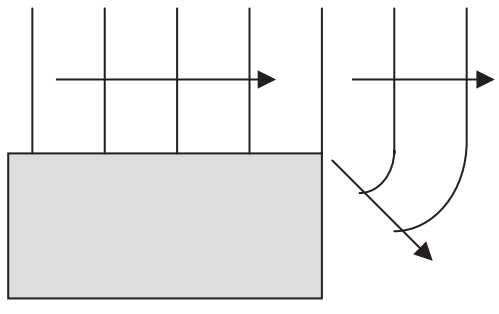


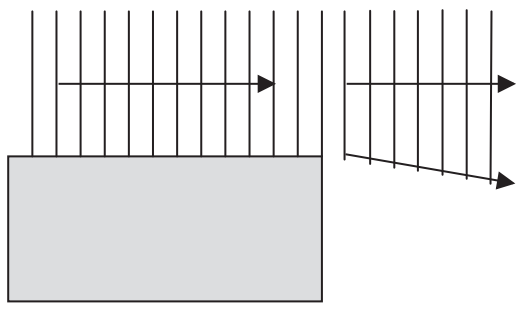


**Turn over**

Leave blank

**9.** (a) The diagrams show the diffraction of two different sets of water waves at an edge in a ripple tank.





(i) Describe the difference in behaviour of the two waves in terms of their wavelength.

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.....

**(2)**

(ii) State how the size of a gap affects the amount of diffraction that occurs when a wave of a particular wavelength passes through the gap.

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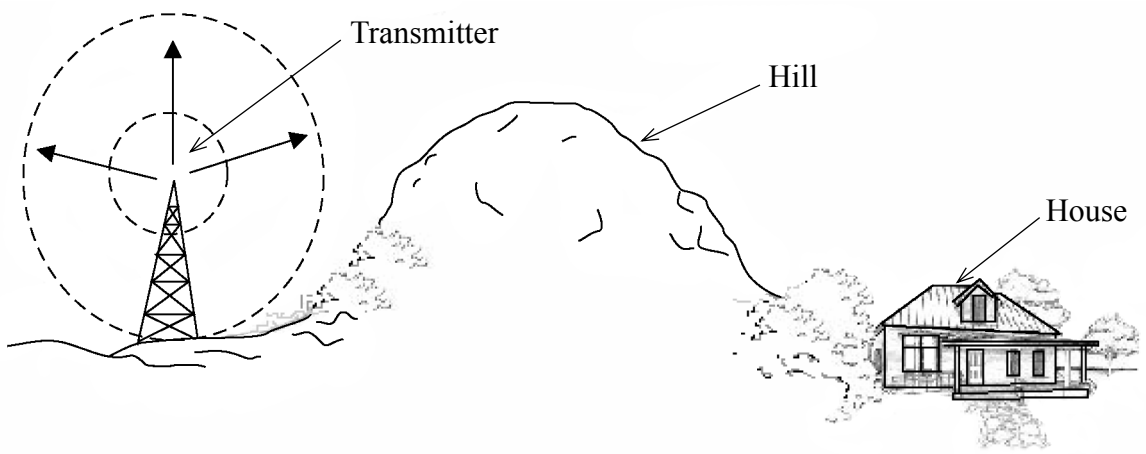
**(2)**

Leave blank

(b) A house receives radio waves from a transmitter on the other side of a hill. The waves are unable to pass through the hill.




Three types of radio waves are shown below.

| | | |
|---|---|---|
| Long wave | Medium wave | Very high frequency (VHF) |

Explain why VHF waves would be unsuitable.

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**(2)** **Q9**

**(Total 6 marks)**

Leave blank

**10.** (a) State the two laws of reflection.

1 .....

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2 .....

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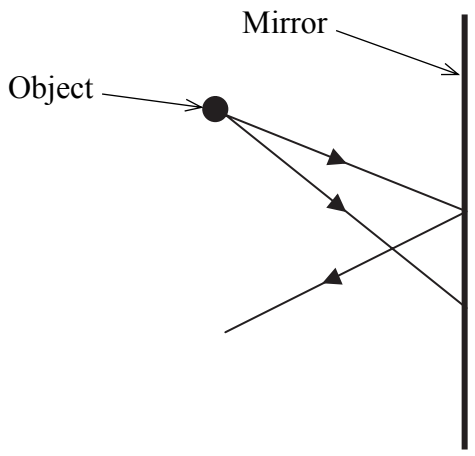
**(2)**

(b) The diagram shows an object in front of a plane mirror.




(i) Draw sufficient construction lines to show the position of the image of the object in the mirror. Label the image **I**.

**(2)**

(ii) Is the image real or virtual? Put a cross (☒) in the correct box.

Real ☒ Virtual ☒

**(1)**

Leave blank

(c) Early scientists had several theories about light. Three of these are shown below.

A. Objects are seen because light travels outward from the eye
B. Light travels at a finite speed
C. Rainbows are caused by reflection of light within raindrops

(i) Which of these sentences is incorrect? Put a cross (☒) in a box.

**A** ☐ **B** ☐ **C** ☐

**(1)**

(ii) Write out the correct version of this statement.

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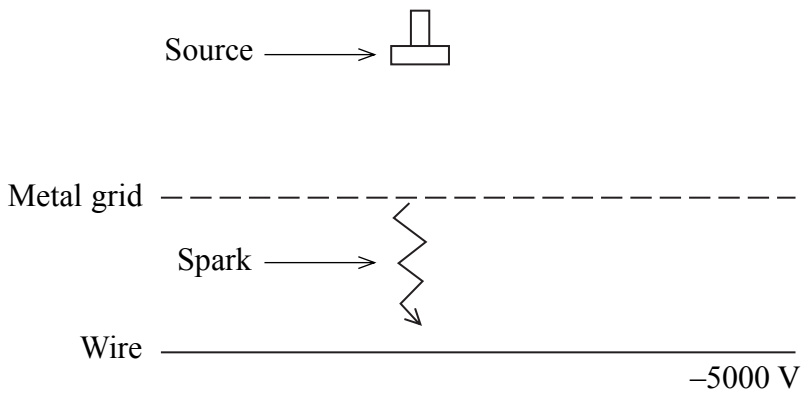
**(1)**

**Q10**

**(Total 7 marks)**

Leave blank

**11.** A spark counter is a type of detector of radiation.




Its action is shown above where a source is held near to an earthed metal grid. A wire is maintained at –5000 V. The air between the grid and the wire is ionised and sparks are seen. This only occurs if the source is a few cm from the grid or nearer.

(a) State two properties of alpha particles that suggest why the source is emitting alpha radiation.

1 .....

.....

2 .....

.....

**(2)**

(b) State two safety hazards associated with this experiment.

1 .....

2 .....

**(2)**

(c) Name two other types of detector which can detect alpha radiation.

1 .....

2 .....

**(2)** **Q11**

**(Total 6 marks)**

**TOTAL FOR PAPER: 70 MARKS**

**END**