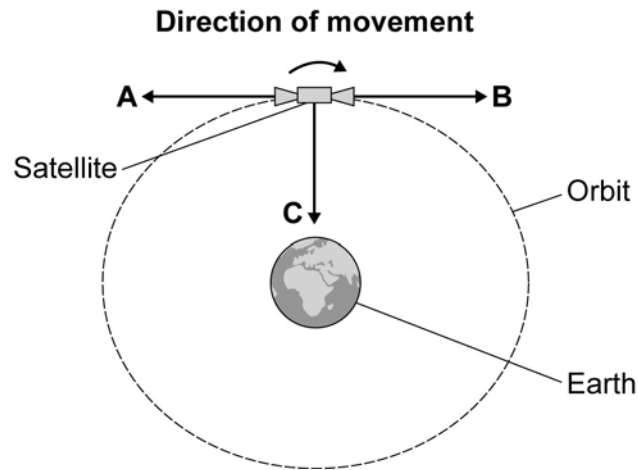Answer **all** questions in the spaces provided.

1 (a) The diagram shows a satellite moving in a circular orbit above the Earth.

A centripetal force acts on the satellite, causing it to accelerate.

1 (a) (i) Use a word from the box to complete the sentence.

friction	gravity	tension

The centripetal force on the satellite is provided by ....

(1 mark)

1 (a) (ii) In what direction does the satellite accelerate, **A**, **B** or **C**?

....

(1 mark)

1 (a) (iii) When the satellite accelerates in a circular orbit its speed does not change.

Draw a ring around the correct answer in the box to complete the sentence.

When the satellite accelerates there is a change in its

| direction. |
| distance from the Earth. |
| kinetic energy. |

(1 mark)

1 (b) The electrical systems on the satellite can be powered by rechargeable batteries.

One fully charged 4 volt battery stores 216 000 coulombs of charge.

Calculate the energy, in joules, available from one fully charged battery.

....

....

....

Energy available = ... J
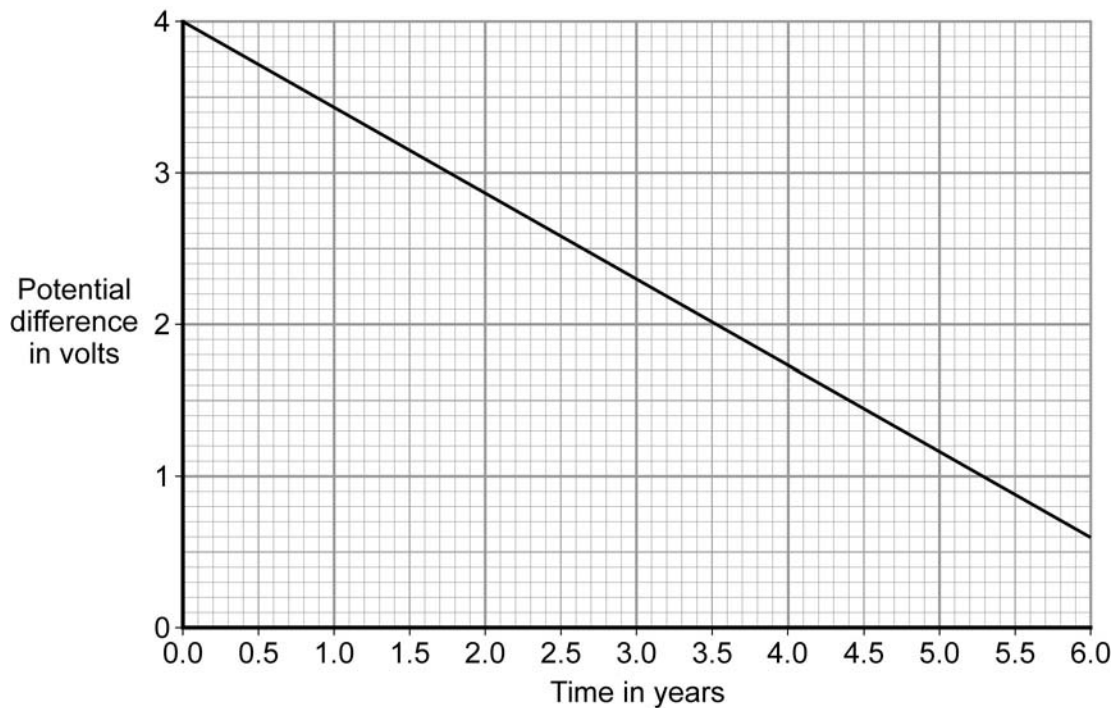
(2 marks)

Question 1 continues on the next page

Turn over ▶

1 (c) Batteries to be used on a satellite must not discharge by more than 15 % when left unused for three years.

Scientists test new types of battery by charging them to 4 volts and then storing them at 37 °C for several years. The potential difference of the battery is measured every month.

The graph shows the data obtained for one type of battery.

1 (c) (i) Use the graph to calculate the time taken, in years, for the potential difference of this battery to drop by 15%.

....

....

....

Time taken = ... years

(2 marks)

1 (c) (ii) Use your answer from **(c)(i)** to explain whether this battery is suitable for use on a satellite.

....

....

(1 mark)

1 (d)   There are now thousands of satellites in orbit around the Earth. A student used the Internet to find information about three of them.

The table shows the information found by the student.

Satellite	Height of the orbit above the Earth in kilometres	Orbital speed in kilometres per hour
K	705	27 500
L	20 200	13 900
M	35 800	11 100

A student concluded that the greater the height of the satellite the slower the orbital speed.

Any conclusion drawn from the data in the table might not be valid for **all** satellites.

Suggest reasons why.

....

....

....

....

....

....
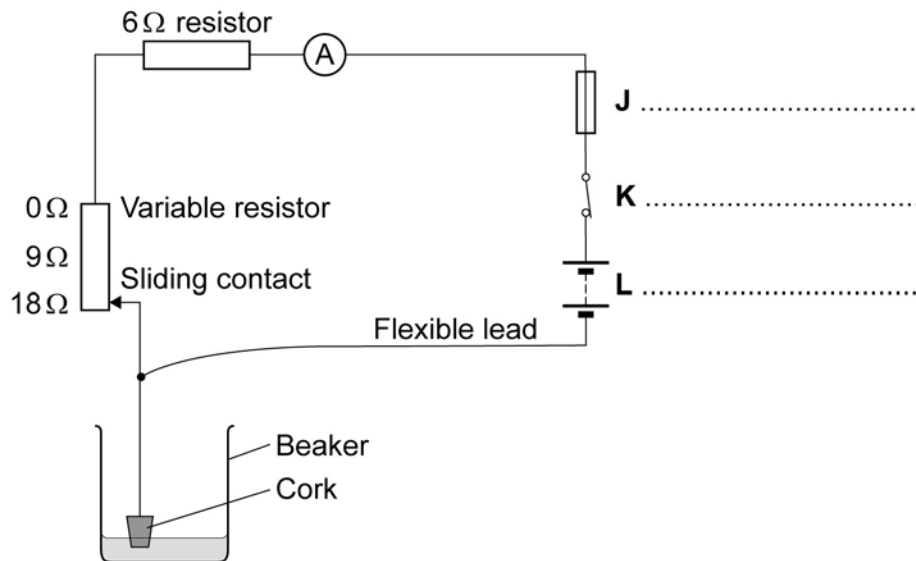
(3 marks)

11

Turn over for the next question

Turn over ▶

3 A student has designed the circuit shown in the diagram to measure the water level in a beaker. The student is going to use the ammeter to indicate the water level.

3 (a) Use words from the box to label the three components, **J**, **K** and **L**, on the diagram.

battery	cell	fuse	lamp	resistor	switch

(3 marks)

3 (b) The resistance of the variable resistor changes as the cork moves up and down inside the beaker. This changes the *electric current* flowing in the circuit.

3 (b) (i) What is meant by the term *electric current*?

....

....
(1 mark)

3 (b) (ii) When a voltmeter was mistakenly added to the circuit in series, the reading on the ammeter was zero.

Suggest why.

....

....
(1 mark)

3 (c) The table gives the variable resistor value and the ammeter readings for different water levels. The table is not complete.

Water level	Variable resistor value in ohms	Ammeter reading in amps
Full	0	2.0
Half full	9	0.8
Empty	18	

Calculate the reading on the ammeter, in amps, when the beaker is empty.

Assume the ammeter, battery, fuse and wires have zero resistance.

....

....

....

Ammeter reading = ... A

(3 marks)

3 (d) A second student copied the design using a 2A fuse, but he forgot to include the 6 Ω resistor.

What will happen to the fuse in this circuit as the water reaches the top of the beaker?

Explain your answer.

....

....

....

....

....

....

....

(5 marks)

13