# 3.2 Electricity: 30-minute Pack

Calculator allowed · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

**Answer ALL questions. Show all your working.**

**1** A torch uses a 3.0 V cell. The torch bulb draws a current of 0.20 A while switched on.

**(a)** Calculate the charge that flows through the bulb in 10 seconds. Use Q = I x t. **(2)**

.....

**(b)** Calculate the energy transferred to the bulb in that 10 seconds. Use E = V x Q. **(1)**

.....

**(Total for Question 1 is 3 marks)**

---

**2** A 13 A fuse is fitted in a plug to protect a small immersion heater. The heater normally draws 11 A. Explain why a 13 A fuse is used rather than a 5 A fuse and why the fuse protects the circuit.

**(a)** Explain why a 13 A fuse is used rather than a 5 A fuse for this heater. **(1)**

.....

**(b)** Explain how the fuse protects the circuit when a fault causes a large current. **(1)**

.....

**(Total for Question 2 is 2 marks)**

---

**3** State the unit of electrical resistance and give its symbol. Include the name of the unit and the common symbol used in equations and on instruments.

**(Total for Question 3 is 1 mark)**


© Revision Library | revisionlibrary.co.uk

**4** Fuel tankers can become charged with static electricity as fuel flows through the delivery pipe during refuelling. If enough charge builds up, a spark could occur and ignite flammable fuel vapour, causing an explosion. Explain how the tanker becomes charged, and describe two methods used to reduce the risk of a spark occurring during refuelling.

**(Total for Question 4 is 6 marks)**

**5** A negatively charged sphere is isolated in space. A second, much smaller object with a positive charge is placed near the sphere.

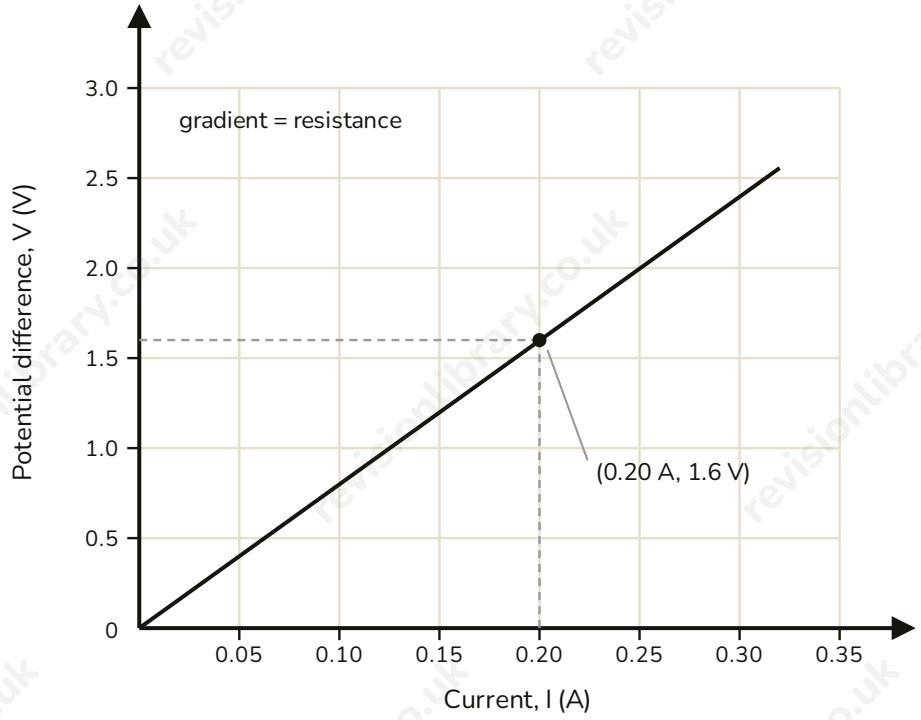
**(a)** Describe the shape of the electric field around the isolated charged sphere. **(2)**

**(b)** Explain, in terms of electric fields, why the positively charged object experiences a force towards the sphere. **(2)**

**(Total for Question 5 is 4 marks)**


© Revision Library | revisionlibrary.co.uk

**6** A student investigates how the length of a wire affects its resistance. For a 50 cm length of the wire, the graph of potential difference against current is a straight line through the origin. At one point on the line, the current is 0.20 A when the potential difference is 1.6 V.




**(a)** In this investigation, identify the independent variable and the dependent variable. **(2)**

**(b)** The gradient of a potential difference against current graph is equal to resistance. Show that the resistance of the 50 cm wire is 8.0 ohm. **(3)**


© Revision Library | revisionlibrary.co.uk

**(c)** The student repeats the experiment using a wire of the same material and cross-sectional area but double the length. Predict, with a reason, how the resistance of this wire compares with the 50 cm wire. **(3)**

**(Total for Question 6 is 8 marks)**


© Revision Library | revisionlibrary.co.uk

# Mark scheme · 3.2 Electricity: 30-minute Pack

## Question 1

(a) substitutes: Q = 0.20 x 10 **M1**

(a) 2.0 C cao **A1**

**(a) Answer: 2.0 C**

(b) 6.0 J cao **A1**

**(b) Answer: 6.0 J**

## Question 2

(a) 13 A is higher than the normal current 11 A so it will not blow during normal use; 5 A would blow because it is lower than the normal current, oe **B1**

**(a) Answer: Because the heater draws 11 A normally, a 13 A fuse will not blow during normal use while a 5 A fuse would blow.**

(b) the fuse contains a thin wire that melts if the current is too large, breaking the circuit and stopping current flow, oe **B1**

**(b) Answer: If a fault causes a very large current the thin wire in the fuse melts, breaking the circuit and stopping the dangerous current.**

## Question 3

ohm, with symbol capital ω (accept the symbol written out as ohm or ω where the Greek letter cannot be typed) (oe) **B1**

**Answer: ohm (symbol: capital Greek letter ω)**

## Question 4

**Level 1** Basic statement that friction/movement of fuel causes charging, or a brief mention of one risk-reduction idea, with little or no explanation. Answer may be a simple list. **1-2**

**Level 2** Describes the charging mechanism with some detail (e.g. friction/electron transfer as fuel moves through the pipe) and describes at least one risk-reduction method, with some linking to the danger of sparks. **3-4**

**Level 3** Clear, logically structured explanation of how friction between the moving fuel and the pipe transfers electrons and builds up static charge on the tanker, why this is dangerous (a spark could ionise the air and ignite flammable vapour), and describes two valid risk-reduction methods with clear reasoning for how each works. **5-6**

**Indicative content:**

- friction between the flowing fuel and the inside of the pipe transfers electrons
- this causes a build-up of (static) charge on the tanker/fuel
- if the charge (potential difference) becomes large enough, it can ionise the air and cause a spark
- fuel vapour is flammable, so a spark risks igniting it and causing an explosion
- an earthing/bonding strap or cable connects the tanker to the ground, allowing charge to flow away safely rather than building up
- using conducting materials for hoses/pipes allows charge to disperse gradually instead of building up to a dangerous level
- reducing the flow rate of the fuel reduces the rate at which charge builds up, keeping the potential difference lower

## Question 5

(a) a radial field, with field lines pointing towards the sphere (since it is negative) **B1**

(a) field lines are more spread out further from the sphere, showing the field gets weaker with distance oe **B1**

**(a) Answer: A radial field pointing towards the sphere, weakening (lines spreading out) with distance from the sphere.**

(b) the positive object lies within the electric field of the sphere, so a force acts on it **B1**

(b) unlike charges attract, and the force increases the closer the object gets (field is stronger nearer the sphere) oe **B1**

**(b) Answer: The object is within the sphere's field, and since unlike charges attract, it experiences an attractive force that grows stronger closer to the sphere.**

## Question 6

(a) independent variable: length of the wire **B1**

(a) dependent variable: resistance of the wire (or current/p.d. measured) **B1**

**(a) Answer: Independent: length of wire. Dependent: resistance of the wire.**

(b) correct method: R = V / I **M1**

(b) substitutes: R = 1.6 / 0.20 **M1**

(b) R = 8.0 ohm cso (answer given) **A1**

**(b) Answer: 8.0 ohm (shown)**

(c) resistance doubles, to 16 ohm ft **B1**

(c) resistance is directly proportional to length oe **B1**

(c) a longer wire gives charge carriers more collisions with the fixed ions, increasing resistance oe **B1**

**(c) Answer: 16 ohm; resistance is directly proportional to length because charge carriers collide with more ions along a longer wire.**


© Revision Library | revisionlibrary.co.uk