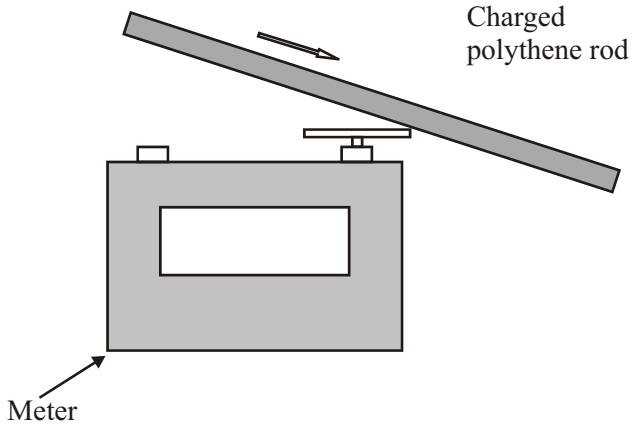
7. Exam Questions: Edexcel AS Level

7.1. A polythene rod was negatively charged by rubbing it with a cloth. The rod was then stroked several times across the metal cap of a meter used for measuring charge.



The initial reading on the meter was zero.

After 3.8 s the final reading was -6.4×10^{-8} C.

Calculate the number of electrons that were transferred to the metal cap.

……..……..……
…

……..……
….

Number of electrons = ……..……

(3)

Calculate the average rate in C s^{-1} at which charge was transferred to the metal cap.

……..……
….

……..……
….

Rate = ……..…… C s^{-1}

(2)

State the base unit for the rate of flow of charge.

…….

(1)

(Total 6 marks)

7.2. Io is one of Jupiter's moons. Some of the electrons released from the volcanic surface of Io have an average velocity of 2.9×10^{7}m s^{-1} towards Jupiter. The distance between Jupiter and Io is 4.2×10^{5} km.

(a) Show that the time taken for these electrons to reach Jupiter is about 14 s.

……..

.....

(2)

(b) In this way a current of 3.0×10^6 A is created between Io and Jupiter. Calculate the number of electrons that arrive at Jupiter every second.

.....

.....

.....

Number of electrons =…….....

(2)

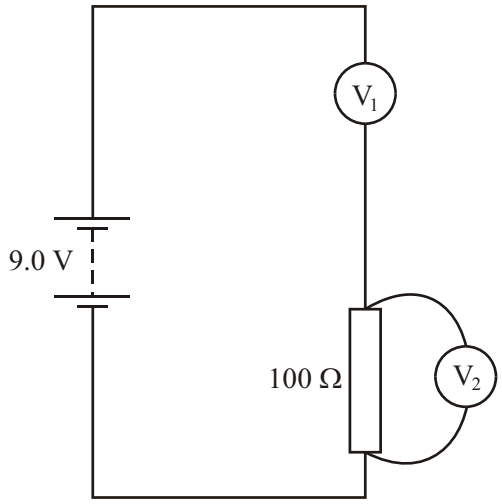
(c) State the direction of the current.

.....

(1)

(Total 5 marks)

7.3. A student sets up a circuit and accidentally uses two voltmeters V_1 and V_2 instead of an ammeter and a voltmeter. The circuit is shown below.



(i) Circle the voltmeter which should be an ammeter.

(1)

(ii) Both voltmeters have a resistance of 10 MΩ. The student sees that the reading on V_2 is 0 V. Explain why the potential difference across the 100 Ω resistor is effectively zero.

.....

.....

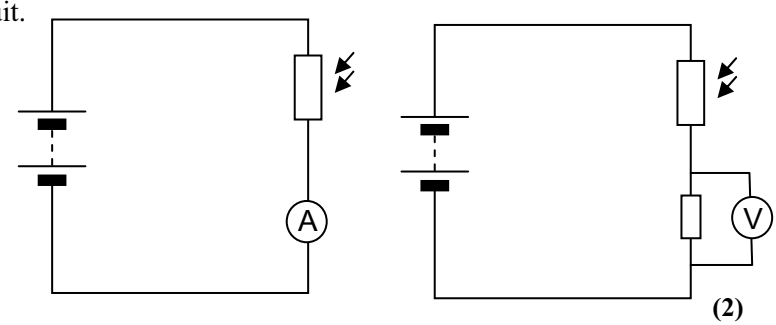
.....

.....

(2)

(Total 3 marks)

7.4. A light-dependent resistor may be used with additional components to make a light meter. Sketch a diagram for a suitable circuit.



(2)

Explain how your circuit works

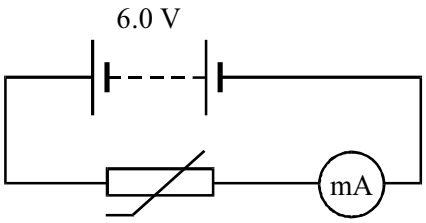
.....

.....

.....

(2)

A negative temperature coefficient thermistor is used in the following circuit to make a temperature sensor.



Explain how the circuit works.

.....

.....

.....

(2)

(Total 6 marks)

TOTAL marks = / 20

MARK SCHEME

7.1. Number of electrons

$(-64 \times 10^{-9}\ C) / (-1.6 \times 10^{-19}\ C) = 4.0 \times 10^{11}$ electrons
Use of $n = Q/e$ **(1)**
Seeing 1.6×10^{-19} C **(1)**
Answer of 4.0×10^{11} (electrons) **(1)** 3

[Use of a unit is a ue]

[–ve answer: 2/3]

Rate of flow

$(6.4 \times 10^{-8}\ C)/3.8\ s = 16.8/17$ [nC s^{-1}] OR $16.8/17 \times 10^{-9}$ [C s^{-1}]

(6.4) / 3.8 s i.e. use of $I = Q/t$ [Ignore powers of 10] **(1)**

Correct answer [No e.c.f.] [1.7 or 1.68 x 10^{-8} or 1.6×10^{-8}] **(1)** 2

Unit

Amp(ere)/A **(1)** 1

[Total 6 marks]

7.2. (a) Io and Jupiter: Time taken for electrons to reach Jupiter

$t = s/\upsilon = (4.2 \times 10^{8}\ m)/(2.9 \times 10^{7}\ m\ s^{-1}) = 14.48\ s$

Correct substitution in $\upsilon = s/t$ (ignore powers of ten) **(1)**

Answer: 14.48 s, 14.5 s [no ue] **(1)** 2

(b) Estimate of number of electrons

$Q = ne = It$

$n = It/e$

$n = (3.0 \times 10^{6}\ A)\ (1s)/(1.6 \times 10^{-19}\ C)$

Use of $ne = It$ **(1)**

$(1.8 - 2.0) \times 10^{25}$ **(1)** 2

(c) Current direction

From Jupiter (to Io) / to Io / to the moon **(1)** 1

[Total 5 marks]

7.3. (a) (i) Replacement

V_1 **(1)** 1

(ii) Explanation

[**ONE** pair of marks]

Resistance: resistance of V_1 [not just the voltmeter] is much larger than 100 Ω
OR combined resistance of parallel combination is approximately 100 Ω **(1)**
Voltage: p.d. across V_1 is much greater than p.d. across 100 Ω OR **(1)**
all 9 V is across V_1

OR

Current: no current is flowing in the circuit / very small current **(1)**
Resistance: because V_1 has infinite/very large resistance **(1)**

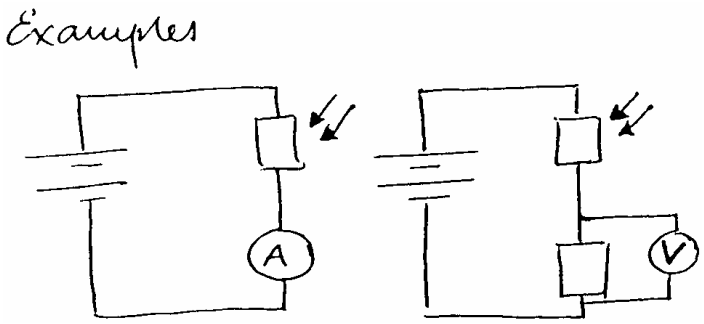
OR

(Correct current calculation 0.9 x 10^{-6} A and) correct pd calculation
90 x 10^{-6} A **(1)**
This is a very small/negligible pd **(1)** 2

[Total 3 marks]

7.4. A light-dependent resistor may be used with additional components to make a light meter. Sketch a diagram for a suitable circuit.

Examples



(–1) for each error in the diagram. Correct working circuit (2)

(2 marks)

Explain how your circuit works

***R*$_L$ decreases with increasing incident light intensity (1)**

***W*hence increase in A or V reading (1)**

(2 marks)

Explanation:
As the temperature rises, the resistance decreases **(1)**
As the resistance decreases, so the ammeter reading/current increases **(1)**
[No mention of resistance 0/2]
[Current controls temperature → controls *R* is wrong physics – 0/2]
[If *T* changes so *R* changes OR vice versa so *I* changes 1 mark only]
[Correct static relationship (extremes) 1 mark only]

(2 marks)

[Total 6 marks]