Mark schemes

Q1.

(a) 50 (Hz)

1

230 (V)

this order only

1

(b) 340 mW = 0.34 W

1

$0.34 = 0.75^2 \times R$

allow a correct substitution of an incorrectly / not converted value of P

1

$R = \frac{0.34}{0.75^2}$

allow a correct rearrangement of an incorrectly / not converted value of P

1

$R = 0.60\ (\Omega)$

allow an answer consistent with an incorrectly / not converted value of P

allow a correct answer given to more than 2 sf

1

(c) the dirt changes the (measured) resistance of the coin

or

the (measured) resistance is different from the expected resistance (of the coin)

allow the measured resistance does not match the resistance of a known coin

allow dirt stops charge flow (through the coin)

allow dirt stops the current (in the coin)

1

(d)

1

(e) R_{Total} = 400 + 80 (= 480 Ω)

1

12 = I × 480

or

$I = \frac{12}{480}$

allow a correct substitution / rearrangement with R_{Total} in range 470 - 490 Ω

1

I = 0.025 (A)

allow a correct calculation using R_{Total} in range 470 - 490 Ω

1

V = 0.025 × 80

allow a correct substitution using their calculated value of I (using V = IR) and R_{Th} in range 70 - 90 Ω

1

V = 2.0 (V)

allow a correct calculation using their calculated value of I (using V = IR) and R_{Th} in range 70 - 90 Ω

OR

total R = 400 + 80 (= 480) (1)

ratio (Th:R) = 80:480 (1)

ratio = 1:6 (1)

$V = \frac{1}{6} \times 12$ (1)

V = 2.0 (V) (1)

allow a range of R_{Th} between 70 and 90 Ω

allow a correct ratio using a value of R_{Th} between 70 and 90 Ω

allow a correct substitution using a value of R_{Th} between 70 and 90 Ω

allow an answer in the range 1.8 (V) to 2.2 (V)

1

[13]

Q2.

(a)

1

(b) t = 0.400 (s)

1

2.0 = I × 0.400

allow a correct substitution of an incorrectly / not converted value of t

1

$$I = \frac{2.0}{0.400}$$

allow a correct rearrangement using an incorrectly / not converted value of t

1

I = 5.0 (A)

allow an answer consistent with an incorrectly / not converted value of t

1

[5]

Q3.

(a) **Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.

5-6

Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.

3-4

Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.

1-2

No relevant content

0

Indicative content

- ammeter in series with filament lamp
- current measured with an ammeter
- voltmeter in parallel with filament lamp
- p.d. measured with a voltmeter
- variable resistor (or variable power pack or variable number of cells) used to vary current in and p.d. across filament lamp
- range of p.d. of 0 to 6 V
- interval of p.d. of 1 V
- reverse connections to power supply to obtain negative values
- take repeat readings and calculate a mean
- discard anomalies

Indicative content may be seen in a circuit diagram.

Level 3 answer: needs to include a circuit which would work (if included) and a method to obtain negative values.

(b) $3.0 = 0.16 \times R$

allow a correct substitution of an incorrect value of I in the range 0.15 (A) to 0.17 (A)

1

$R = \frac{3.0}{0.16}$

allow a correct rearrangement of an incorrect value of I in the range 0.15 (A) to 0.17 (A)

1

$R = 18.75\ (\Omega)$

allow 19 (Ω)

allow 18.8

1

(c) $t = 1800$ (s)

1

$Q = 0.21 \times 1800$

all subsequent marks can score if an incorrectly / not converted value of t is used

1

$Q = 378$ (C)

1

$E = 378 \times 6.0$

1

$E = 2268$ (J)

allow an answer to 2 or 3 s.f.

OR

$P = 0.21 \times 6.0$ (1)

$P = 1.26$ (W) (1)

$t = 1800$ (s) (1)

all subsequent marks can score if an incorrectly / not converted value of t is used

$E = 1.26 \times 1800$ (1)

$E = 2268$ (J) (1)

allow an answer to 2 or 3 s.f.

1

(d) (for the power to quadruple) the current and the p.d. would both need to double

1

(but the current doesn't double) because the resistance of the filament lamp increases
or
(but the current doesn't double because the graph shows that) current is not proportional to p.d.

allow the graph does not show direct proportionality

ignore the graph is not a straight line

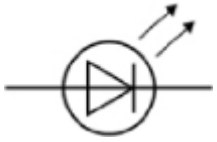
ignore the graph is not linear

1

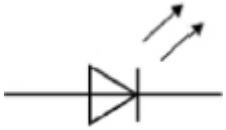
[16]

Q4.

(a)



allow:



1

[1]