

Name of the Student: _____

Max. Marks : 19 Marks

Time : 19 Minutes

Mark Schemes

Q1.

(a) **Method 1:**

Attempts to determine area under curve / by counting squares ₁✓

Multiplies their (total) area (or charge) by 24 (V) ₂✓

240 (J) ₃✓

Allow POT error on area of square in ₁✓ and ₂✓

*Evidence seen by calculations **or** from counting squares **or** from division of area into **at least two** recognisable geometrical shapes (triangles, rectangles, trapezia)*

answer in range 220 J to 264 J

Method 2:

Attempt to determine average current (over first 200 ms in range 45 A to 55 A) ₁✓

Use of $E = I \times V \times t$ ₂✓

240 (J) ₃✓

Substitutes current value (or Δ current) with $t = 200$ ms and $V = 24$ V.

Condone POT

Allow as two stage $Q=It$ and $E=QV$

*Or $P = VI$ **and** $E = Pt$*

answer in range 220 J to 264 J

3

(b) (KE (gained) =) 65(.0) (J) **or**

(PE (gained) =) 58(.3) (J) ₁✓

Use of efficiency = $\frac{\text{an output energy}}{\text{ans from part 04.1}}$

Allow output energy = 65 /58/ 120 /123 or candidate ke + pe

or (total output = 65 + 58 =) 123 (J) ₂✓

Allow ecf from (a) for all 3 marks.

(Efficiency =) 0.51 or 51% ₃✓

Answer to at least 2 sf. Range is 0.467 to 0.56 (46.7 % to 56 %)

3

- (c) Heating occurs / temperature increases when there is a current (in the thermistor) (due to I^2R) ₁ ✓

(When the temperature increases) the resistance of thermistor decreases (whereas fixed resistor remains high) ₂ ✓

(Lower resistance from thermistor means) less wasted power ₃ ✓

OR

(Lower resistance from thermistor means) more pd dropped across the motor (less wasted voltage) ₃ ✓

Alternatively: (Lower resistance from the thermistor means) less voltage drop across thermistor ₃ ✓

3

[9]

Q2.

- (a) resistance of lamp B and D = $3.5^2/4.1 = 3.0$ (2.98)(Ω) ✓
resistance of lamp A and C = $6.0^2/6.0 = 6.0$ (Ω) ✓
pd across lamp B and lamp D = $3/9 \times 9.0 = 3.0$ (V) OR pd across lamp A and C = 6.0 (V) ✓
hence A and C normal brightness ✓

Can justify in terms of current i.e. current needed by A and C is 1 A provided resistance values calculated

Must have some correct working for conclusion mark

1
1
1
1

- (b) the pd across new lamp = 0 / E does not light ✓
no current in E ✓
other lamps are not affected ✓
because the current in the lamps/pd across lamps does not change ✓

2nd and 3rd marks conditional on 1st mark

1
1
1
(MAX 3)

- (c) in first circuit current in battery = $9.0/4.5 = 2.0$ A ✓
in second circuit current in battery = $9.0/7 = 1.2857$ A ✓
hence current in battery decreases ✓

Allow ecf from (a)

Original current = 2A can come from (a) and score here

If say circuit resistance increases so current decreases and no other marks awarded score 1 mark

1
1
1

[10]