Montsaye ACADEMY
Excellence Resilience Aspiration

KS4 Year 11 Physics Homework Booklet

Term 3

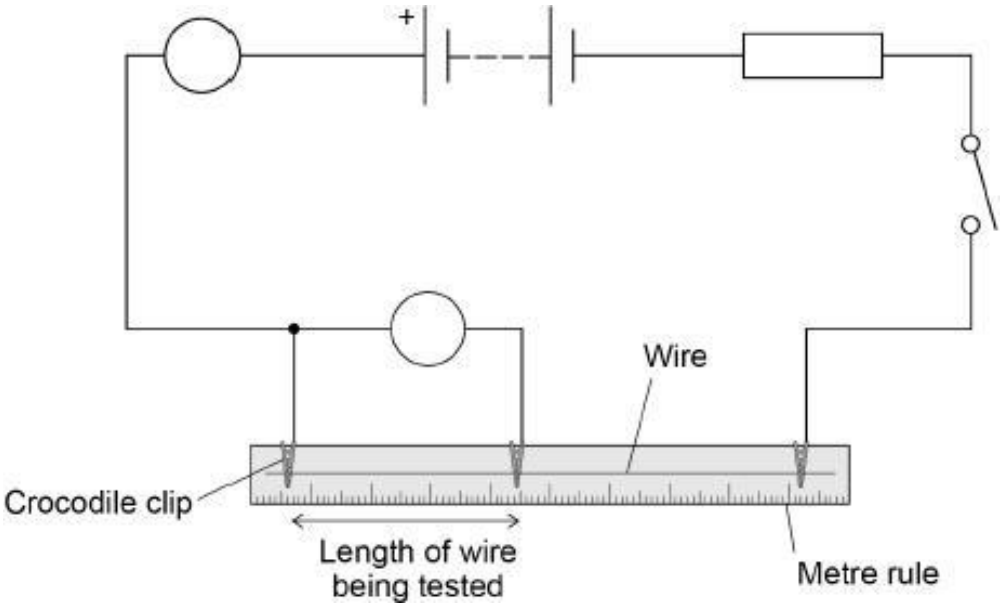
Homework 1	**Q1 and Q2** exam question - complete at home bring to class to be self/peer marked
Homework 2	**Q3** exam question - prepare answer at home, **complete in class, marked by teacher**
Homework 3	**Q4 and Q5 -** exam question – complete at home bring to class to be self/peer marked
Homework 4	**Q6 and Q7 -** exam question - complete at home bring to class to be self/peer marked
Homework 5	**Q8 and Q9 -** exam question - prepare answer at home, **complete in class, marked by teacher**

Homework 1

Q1. A student investigated how the resistance of a wire varies with the length of the wire.

Figure 1 shows the circuit used.

Figure 1



(a) The symbols for the voltmeter and ammeter in **Figure 1** are **not** complete.

Complete the symbols for the voltmeter and ammeter in **Figure 1**.

(1)

(b) Which variable is the independent variable?

Tick (✓) **one** box.

- The current in the wire ☐
- The length of the wire being tested ☐
- The resistance of the wire ☐
- The thickness of the wire ☐

(1)

(c) Which variable is the dependent variable?

Tick (✓) **one** box.

- The current in the wire ☐
- The length of the wire being tested ☐
- The resistance of the wire ☐
- The thickness of the wire ☐

(1)

(d) The student took repeat readings of potential difference for a 30 cm length of the wire.

The readings were:

0.16 V 0.17 V 0.15 V

Calculate the mean potential difference.

(2)

The length of the wire was increased to 60 cm

The current in the wire was 0.50 A

The mean potential difference across the wire was 0.32 V

(e) Calculate the resistance of the 60 cm length of wire. Use the equation:

$$\text{resistance} = \frac{\text{potential difference}}{\text{current}}$$

(2)

(f) Calculate the power dissipated in the 60 cm length of wire.

Use the equation:

power = potential difference × current

(2)

(g) Calculate the charge flow when there is a current of 0.50 A in the wire for 17 s

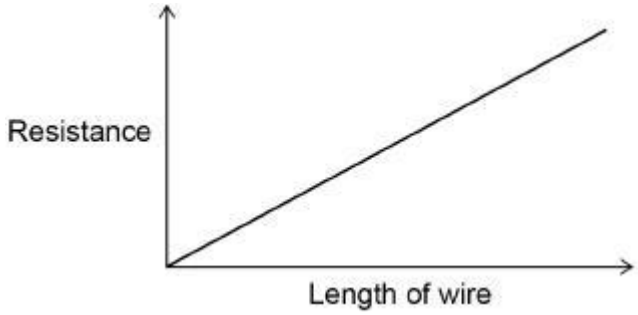
Use the equation:

charge flow = current × time

(2)

(h) **Figure 2** is a sketch graph of the results.

Figure 2



The student repeated the investigation using a thicker wire made from the same metal. For the same length, the thicker wire has a lower resistance.

Draw a line on **Figure 2** to show how the resistance of the thicker wire varies with length.

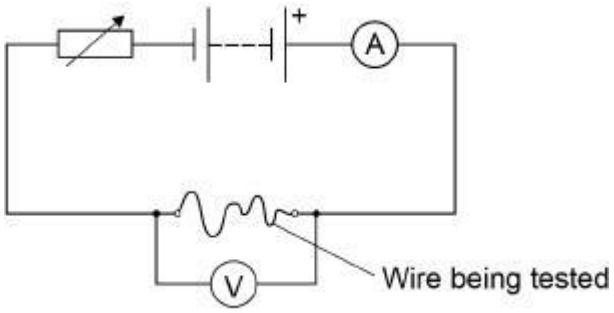
(1)

(Total 12 marks)

Homework 1 Q2.

A student investigated how the resistance of a piece of wire varies with its length.

(a) The diagram below shows the circuit used.



Explain why the student needed to adjust the variable resistor each time she changed the length of the wire.

(3)

(b) The student recorded three measurements of the potential difference across a 0.10 m length of wire.

The table below shows the results.

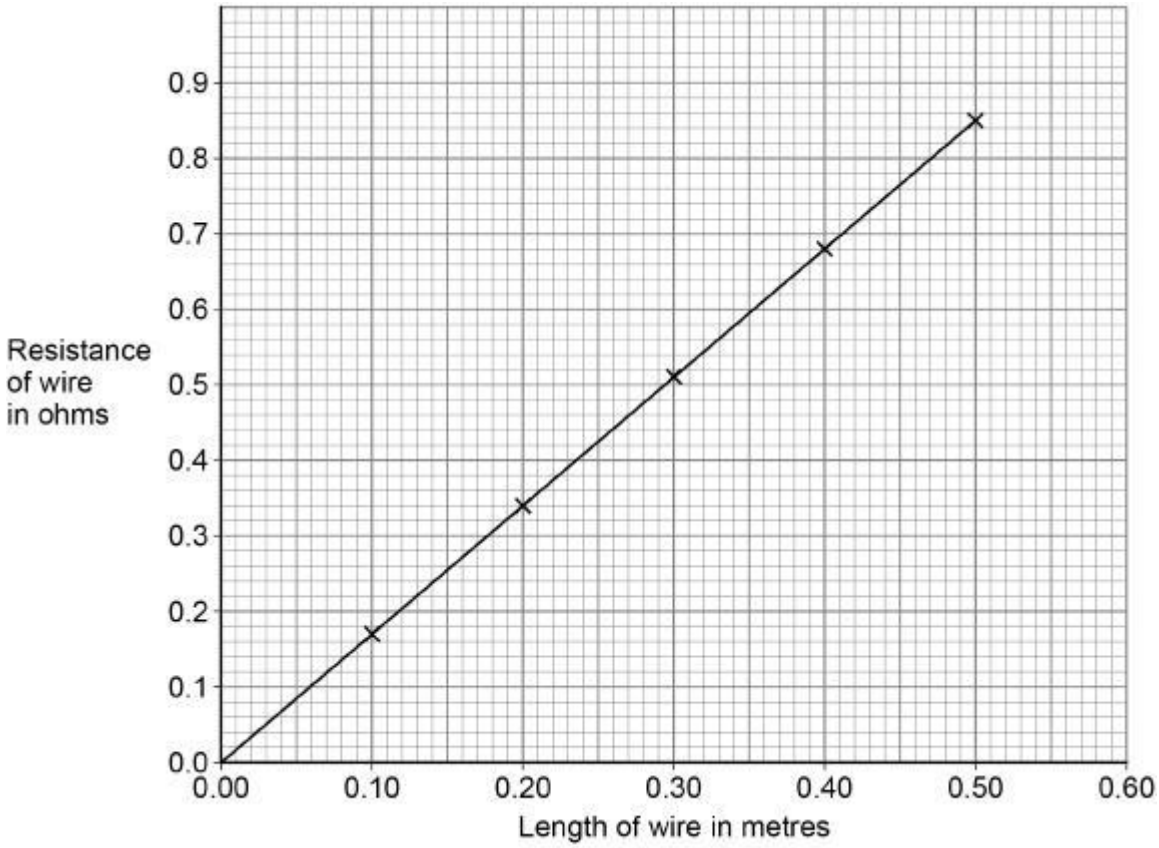
Length in m	**Potential difference in V**			
	1	2	3	Mean
0.10	**X**	0.18	0.15	0.17

Calculate **X** in table above.

(2)

(c) **Figure 1** shows the results for five different lengths of the wire.

Figure 1



Describe the relationship between the length of the wire and the resistance of the wire.

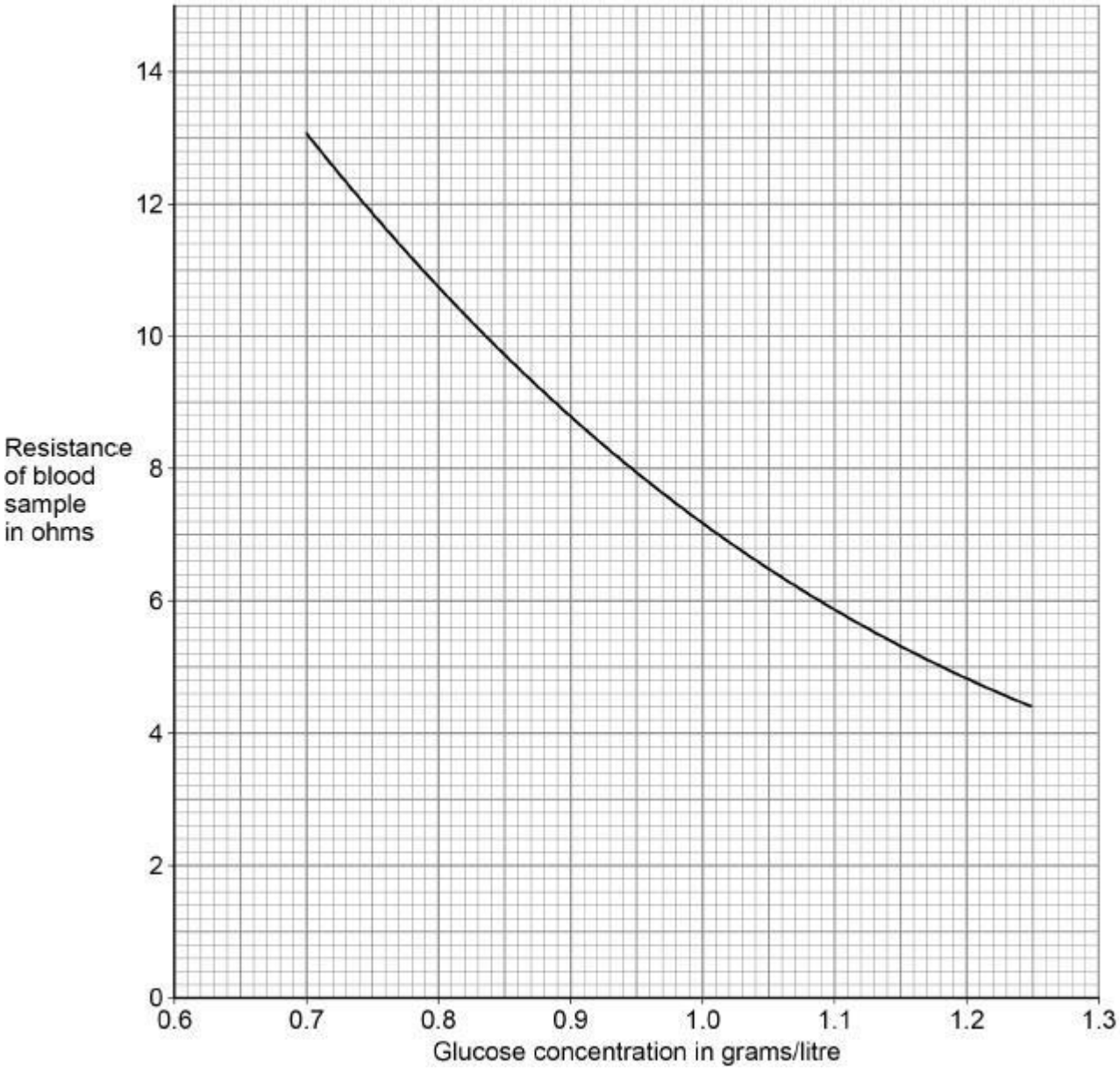
(2)

A glucometer uses the resistance of a blood sample to calculate the glucose concentration in a person's blood.

A blood sample is put into a small tube, which is put inside the glucometer. The blood then acts like a resistance wire.

Figure 2 shows the relationship between the resistance of a blood sample and the glucose concentration.

Figure 2



(d) The glucometer applies a potential difference of 0.90 volts across a blood sample.

The glucose concentration of the blood sample is 0.98 grams/litre.

Determine the current in the blood sample.

(4)

(e) A new tube is used each time a blood sample is tested.

Explain why valid results are only obtained if each tube is identical.

(2)

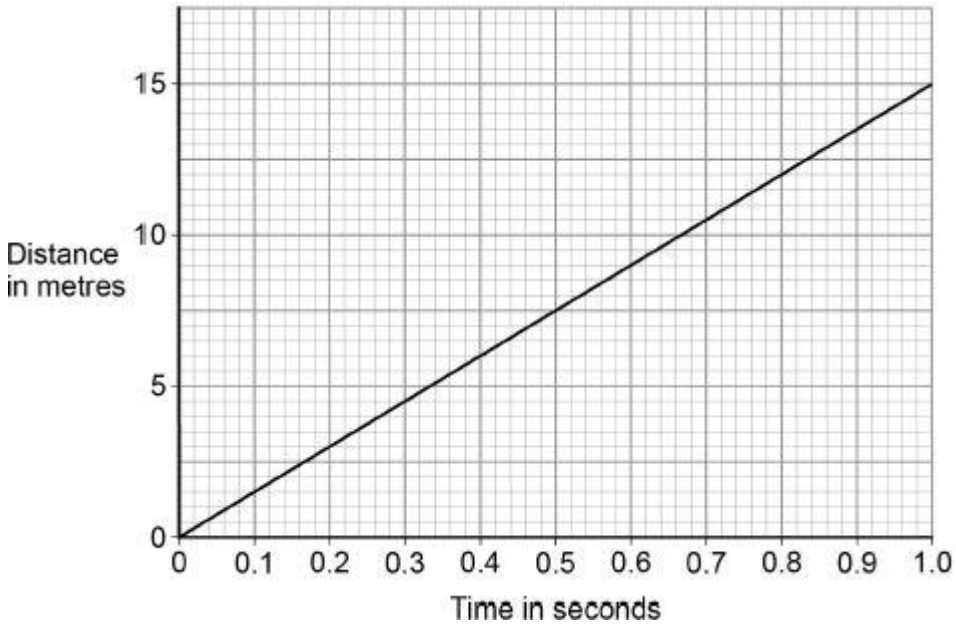
(Total 13 marks)

Homework 2

Q3.

(a) **Figure 1** shows the distance-time graph for a car travelling at 15 m/s

Figure 1



When the driver is tired, his reaction time increases from 0.50 seconds to 0.82 seconds.

Determine the **extra** distance the car would travel before the driver starts braking.

(2)

(b) When the brakes are used, the temperature of the brakes increases.

Explain why. Use ideas about energy in your explanation.

(2)

(c) A lorry travels 84 m with a constant acceleration of 2.0 m/s^2 to reach a velocity of 19 m/s

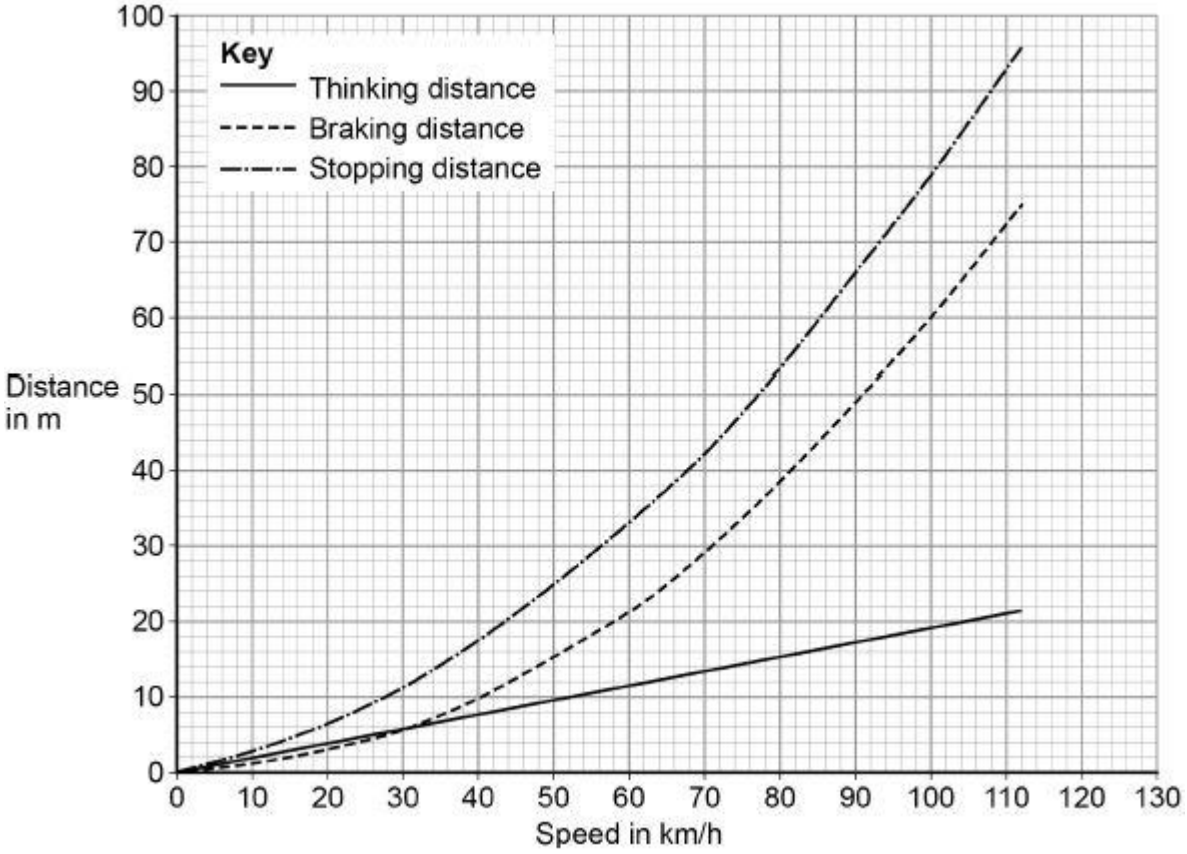
Calculate the initial velocity of the lorry.

Use the Physics Equations Sheet.

(3)

(d) **Figure 2** shows how the thinking distance, braking distance and stopping distance for a car vary with the speed of the car.

Figure 2



Describe the relationships shown in **Figure 2**

You should include factors that would affect the gradient of the lines.

(6)

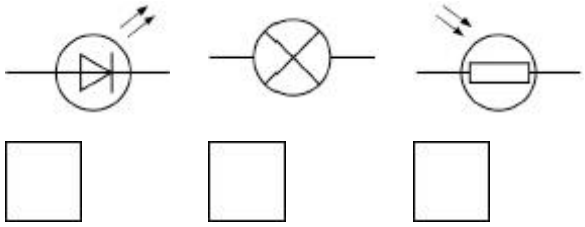
(Total 13 marks)

Homework 3

Q4. A filament lamp breaks if the electric current in the filament becomes too big.

(a) What is the correct symbol for a filament lamp?

Tick (✓) **one** box.



(1)

(b) What is meant by an electric current?

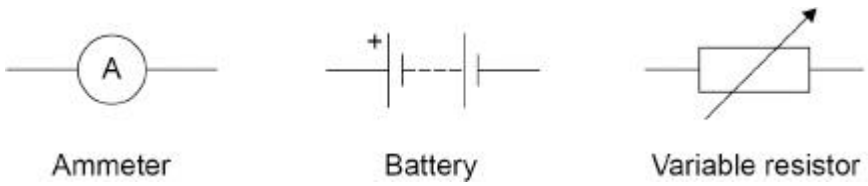
Tick (✓) **one** box.

The energy carried by each unit of charge	☐
The flow of electrical charge	☐
The number of electrons in a circuit	☐
The speed at which charge moves	☐

(1)

A manufacturer investigated the maximum current value of some filament lamps.

(c) The figure below shows the symbols for an ammeter, a battery and a variable resistor.



The manufacturer connected an ammeter, battery, filament lamp and variable resistor in series.

Draw a circuit diagram to show the manufacturer's circuit.

Include the symbol for a filament lamp from part (a)

(1)

(d) How could the manufacturer increase the current in the filament lamp?

Tick (✓) **one** box.

Add an extra ammeter to the circuit.	☐
Decrease the resistance of the variable resistor.	☐
Use a battery with a smaller potential difference.	☐

(1)

(e) When the potential difference across a filament lamp was 0.75 V, the current in the filament lamp was 0.16 A.

Calculate the power of the filament lamp.

Use the equation:

power = potential difference × current

(2)

(f) Write down the equation which links charge flow (*Q*), current (*I*) and time (*t*).

(1)

(g) The manufacturer increased the current in the filament lamp to 200 mA.

Calculate the charge flow through the filament lamp in 15 s.

(3)

(h) The manufacturer increased the current in the filament lamp from 200 mA.

The filament in the lamp broke when the current reached 320 mA.

How many times greater than 200 mA was the current at which the filament broke?

(1)

(i) The manufacturer tested lots of filament lamps.

The current at which the filament lamps broke was 320 ± 60 mA.

What is the range of currents at which the filament lamps broke?

Tick (✓) **one** box.

60 mA to 320 mA	☐
260 mA to 320 mA	☐

320 mA to 380 mA ☐

260 mA to 380 mA ☐

(1)

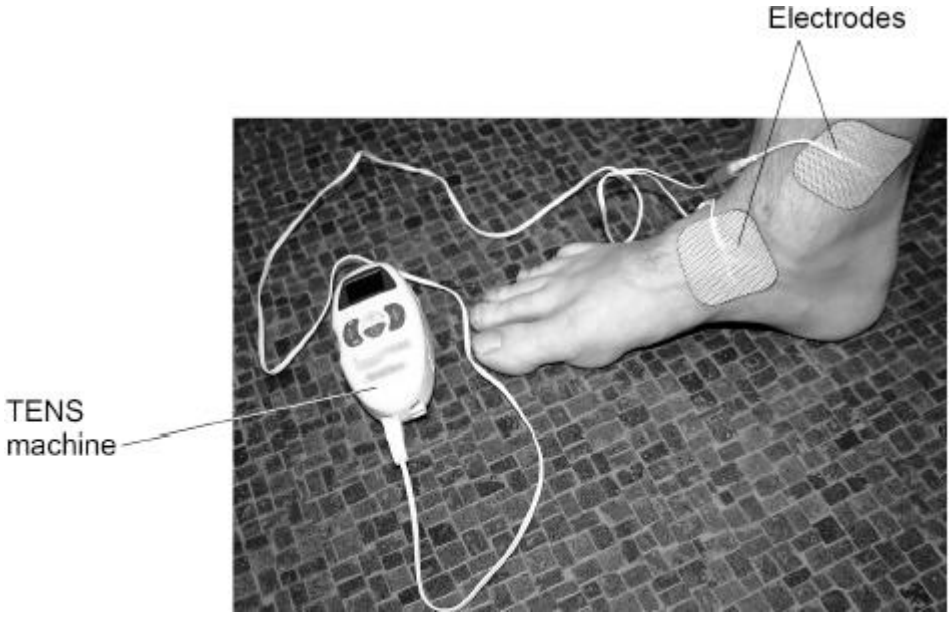
(Total 12 marks)

Homework 3

Q5. A TENS machine uses an electrical current to relieve pain.

Figure 1 shows the electrodes of a TENS machine connected across an ankle.

Figure 1



(a) The maximum power of the TENS machine is 240 mW.

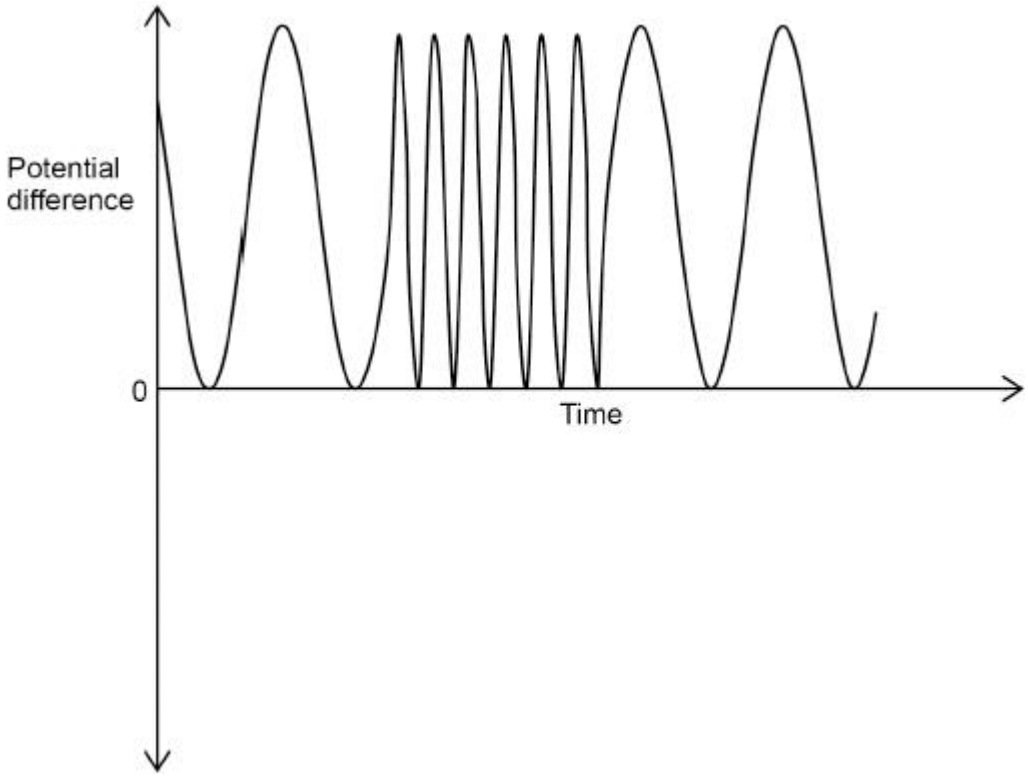
The potential difference across the battery in the TENS machine is 2.5 V.

Calculate the maximum current from the battery.

(4)

(b) **Figure 2** is a sketch graph showing how the potential difference across the electrodes varies with time.

Figure 2



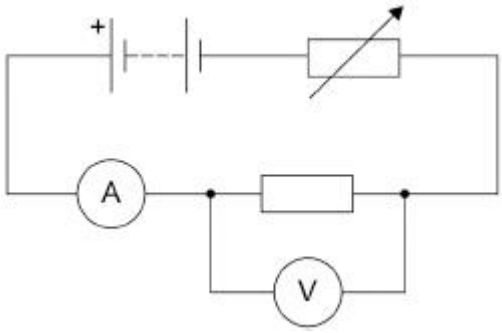
A student concluded that there was an alternating potential difference across the electrodes.

How does **Figure 2** show that the student was **not** correct?

(1)

Figure 3 shows a circuit the student built using the battery from the TENS machine.

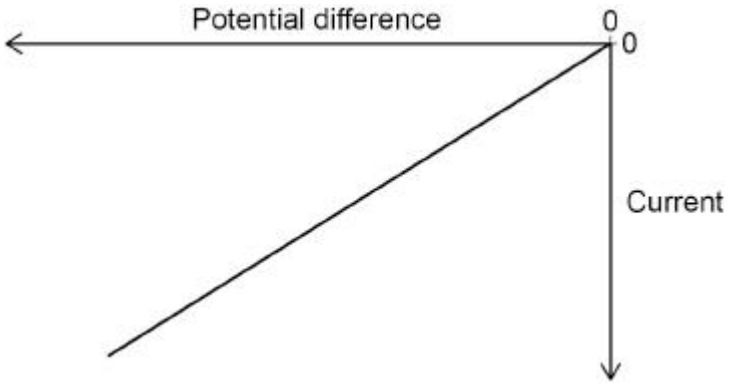
Figure 3



The student recorded how the current in the resistor varied with the potential difference across the resistor.

Figure 4 shows a sketch graph of the results.

Figure 4

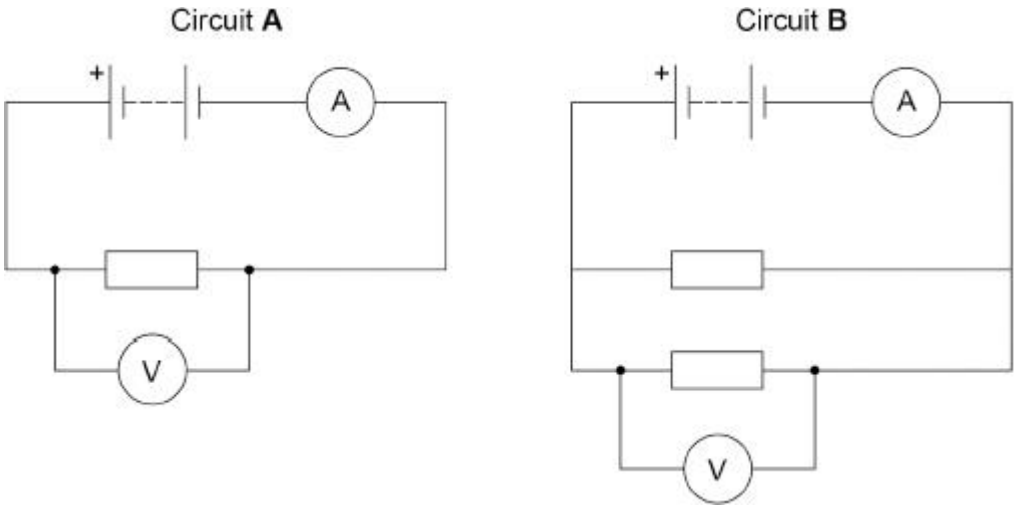


(c) What relationship does **Figure 4** show?

(1)

(d) **Figure 5** shows two more circuits that the student built using the battery from the TENS machine.

Figure 5



The resistors all have the same resistance.

Compare the readings on the voltmeter and ammeter in circuit **A** and circuit **B**.

(3)

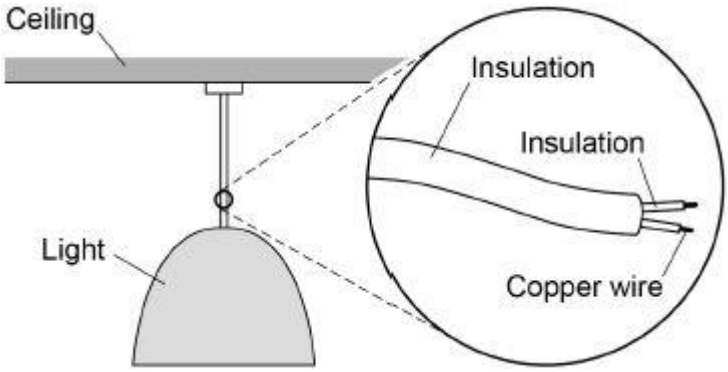
(Total 9 marks)

Homework 4

Q6. Some ceiling lights in the home are connected to the mains by a two-core cable.

Figure 1 shows a ceiling light.

Figure 1



(a) Suggest why some ceiling lights do **not** have an earth wire.

(2)

(b) Write down the equation that links charge flow, current and time.

(1)

(c) There is a current of 2.95 A in one of the copper wires for 60 seconds.

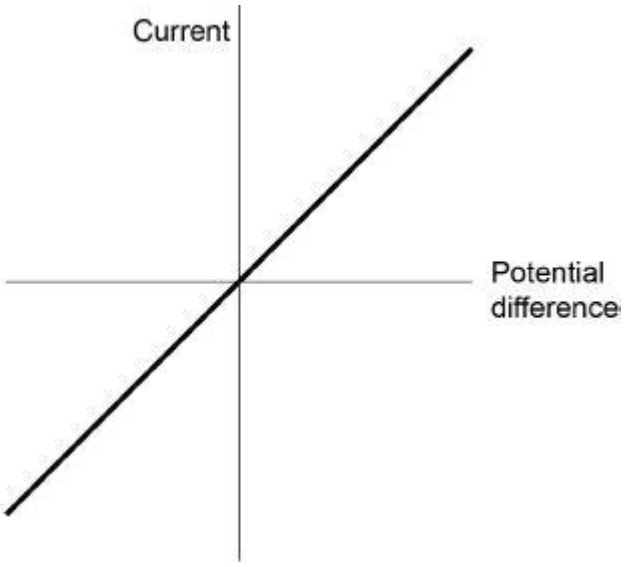
Calculate the charge flow through the wire.

Use your equation from part **(b)**

(2)

(d) **Figure 2** shows a current potential difference graph for a piece of copper wire.

Figure 2



Draw another line on **Figure 2** for a wire with a different resistance.

(2)

Some fuses have a thin piece of copper that melts if the current is too large.

(e) Draw the circuit symbol for a fuse

(1)

(f) Describe how the movement of the copper particles in the wire changes when copper melts.

(2)

(g) Old copper wires are melted when they are recycled.

Calculate the energy needed to melt 500 kg of copper at its melting point.

Specific latent heat of fusion of copper = 200 kJ/kg

Use the Physics Equations Sheet.

(3)

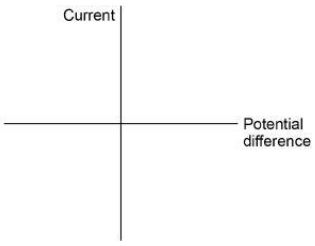
(Total 13 marks)

Homework 4

Q7. A student built a circuit using filament lamps.

(a) Sketch a current potential difference graph for a filament lamp on **Figure 1**

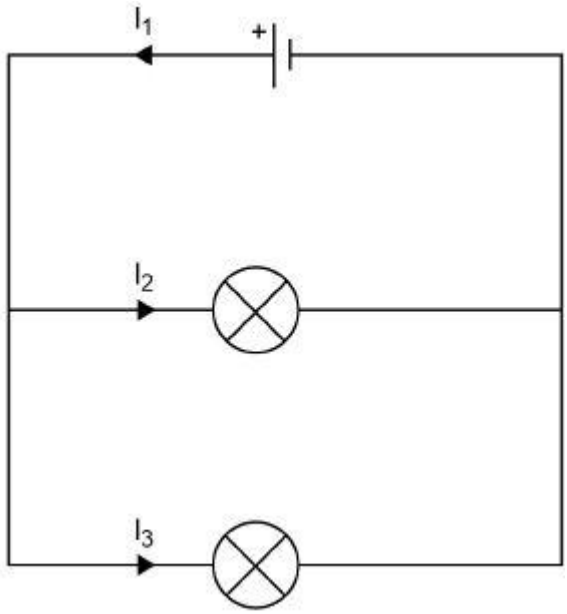
Figure 1



(2)

Figure 2 shows the circuit with two identical filament lamps.

Figure 2



(b) Compare the currents I_1, I_2 and I_3

(2)

(c) Calculate the charge that flows through the cell in 1 minute.

Each filament lamp has a power of 3 W and a resistance of 12 Ω

Write any equations that you use.

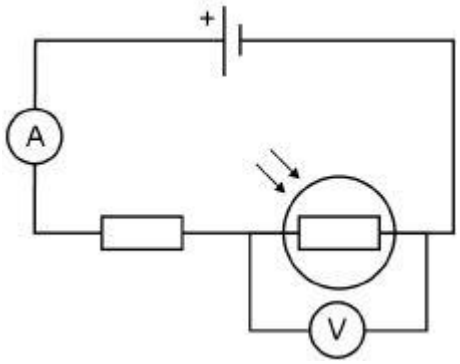
Give the unit.

(6)

(d) The student builds a different circuit.

Figure 3 shows the circuit.

Figure 3



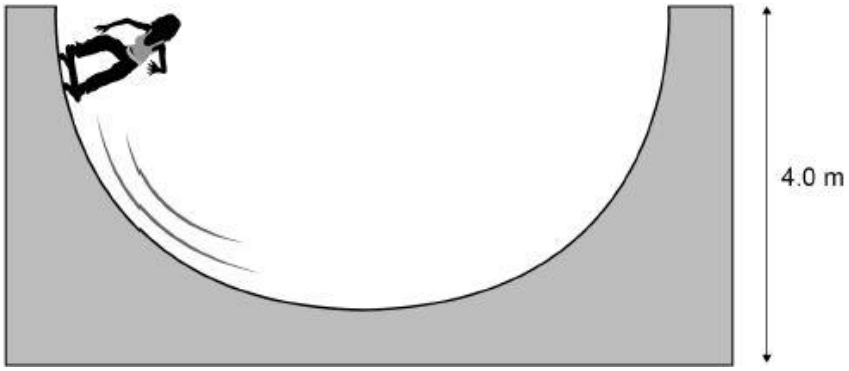
Explain how the readings on both meters change when the environmental conditions change.

(6)

(Total 16 marks)

Homework 5

Q8. The diagram below shows a girl skateboarding on a semi-circular ramp.



The girl has a mass of 50 kg

(a) Calculate the gravitational potential energy (g.p.e.) of the girl at the top of the ramp. Use the equation:

g.p.e. = mass × gravitational field strength × height

gravitational field strength = 9.8 N/kg

(2)

(b) The girl has a speed of 7 m/s at the bottom of the ramp.

Calculate the kinetic energy of the girl at the bottom of the ramp. Use the equation:

kinetic energy = 0.5 × mass × $(\text{speed})^2$

(2)

(c) Not all of the g.p.e. has been transferred to kinetic energy.

Which **two** statements explain why?

Tick **two** boxes.

Some energy is wasted. ☐

The mass of the girl is too low. ☐

The ramp is not high enough. ☐

The g.p.e. of the girl is not zero. ☐

The speed of the girl is too great. ☐

(2)

(d) Explain how lubricating the wheels of the skateboard can increase the speed of the girl.

Use ideas about energy in your explanation.

(3)

(Total 9 marks)

Homework 5

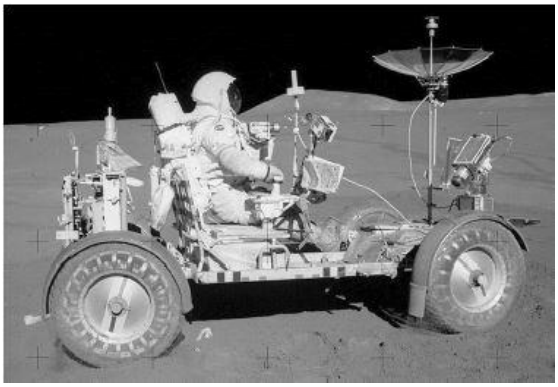
Q9. Astronauts have landed on the Moon on six separate occasions.

(a) The Moon is in a circular orbit around the Earth. The speed of the Moon is constant.

Explain why the Moon is accelerating.

(3)

The astronauts moved around the surface of the Moon in a lunar rover. The photograph below shows a lunar rover.



(b) At one point, the lunar rover accelerated from 1.4 m/s to 2.6 m/s

The acceleration of the lunar rover was 0.31 m/s^2

Which calculation could be used to calculate the distance travelled s during this acceleration?

Tick **one** box.

$s = \sqrt{2.6^2 - 1.4^2 - 2 \times 0.31}$ ☐

$s = \dfrac{1.4^2 - 2.6^2}{2 \times 0.31}$ ☐

$s = \dfrac{2.6^2 - 1.4^2}{2 \times 0.31}$ ☐

$s = \dfrac{2 \times (2.6^2 - 1.4^2)}{0.31}$ ☐

(1)

(c) The lunar rover used four electric motors connected in parallel to a 36 V battery.

The maximum output power of one motor was 190 W

The efficiency of each motor was 72%

Calculate the current drawn from the battery when all four motors were operating at maximum power.

(6)

(d) Scientists once thought that the Moon formed elsewhere in the solar system and later came to orbit the Earth.

Studies of Moon rocks brought back by the astronauts showed that the rocks were extremely similar to those found on Earth.

This led to a new theory about how the Moon formed called the 'Giant Impact Hypothesis'.

According to the Giant Impact Hypothesis, a small planet collided with the Earth. Molten rock thrown up by the collision then formed the Moon.

Suggest why a new theory was developed.

(2)

(Total 12 marks)