

KULLEGG SAN BENEDITTU

Secondary School, Kirkop

Mark

HALF YEARLY EXAMINATION – 2015/2016

Track 2

FORM 4

PHYSICS

TIME: 1h 30min

Name: _____

Class: _____

Answer ALL questions in the spaces provided on the exam paper.

All working must be shown. The use of a calculator is allowed.

Where necessary take acceleration due to gravity, g to be 10m/s².

You may find some of these equations useful.

| | | |
|--------------------|---|---|
| Motion | $v = \frac{\text{distance}}{\text{time}}$ | $a = \frac{v - u}{t}$ |
| | Average speed = $\frac{\text{Total distance}}{\text{Total time}}$ | Area of trapezium = $\frac{1}{2} (a+b)h$ |
| Electricity | $Q = I t$ | $V = I R$ |
| | $E = Q V$ | $E = I V t$ |
| | $R_T = R_1 + R_2 + R_3$ | $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$ |
| | $R \propto \frac{L}{A}$ | $P = I V$ |

| Question | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Theory Mark | Practical Mark | Global Mark |
|-----------|----|----|----|----|----|----|----|-------------|----------------|-------------|
| Max. Mark | 10 | 10 | 10 | 10 | 15 | 15 | 15 | 85 | 15 | 100 |
| Mark | | | | | | | | | | |

Section A - This section carries 40 marks.

1. This question is about static electricity.

- a) Emma's hair tends to stand up when her hat is removed.
The hat has become negatively charged.



- i. What is the charge on Emma's hair?

_____ (1)

- ii. **Explain** why Emma's hair stands on her head as shown in the diagram.

_____ (2)

- b) Michael rubs a balloon against his hair. The balloon becomes negatively charged.
Explain, **in terms of charges**, how the balloon becomes negatively charged.

_____ (2)

- c) i. What are electrical conductors?

_____ (1)

- ii. Give **one** example of an electrical conductor.

_____ (1)

- iii. What are electrical insulators?

_____ (1)

- iv. Give **one** example of an electrical insulator.

_____ (1)

- v. Give **one** example of a semiconducting material.

_____ (1)

(10 marks)

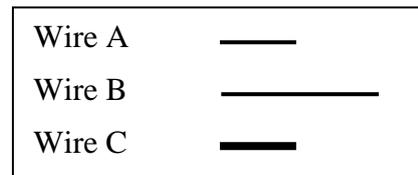
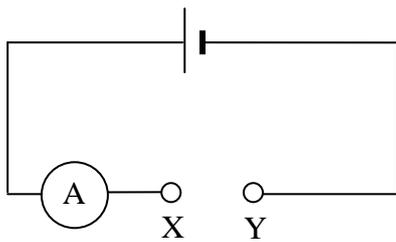
2. This question is about electric circuits.

a) Give the name of the electrical components A to E, represented by the following symbols.

| | CIRCUIT SYMBOL | COMPONENT |
|----|----------------|-----------|
| A. | | |
| B. | | |
| C. | | |
| D. | | |
| E. | | |

(5)

b) Thelma and Louise set up an electrical circuit as shown below. They have three resistance wires A, B and C, made of the same material.



i. What happens to the ammeter when wire A is placed across XY?

_____ (1)

ii. **Wire B is double the length of wire A. State what happens to the ammeter reading when wire B is connected across XY. Give one reason for your answer.**

 _____ (2)

iii. **Wire C is of equal length as wire A, but twice as thick. State what happens to the ammeter reading when wire C is connected across XY. Give one reason for your answer.**

 _____ (2)

(10 marks)

3. This question is about electrical circuits.

The diagram shows a circuit that may be used to measure the temperature of boiling water.

a) **Name** the component labelled C shown in the diagram.
_____ (1)

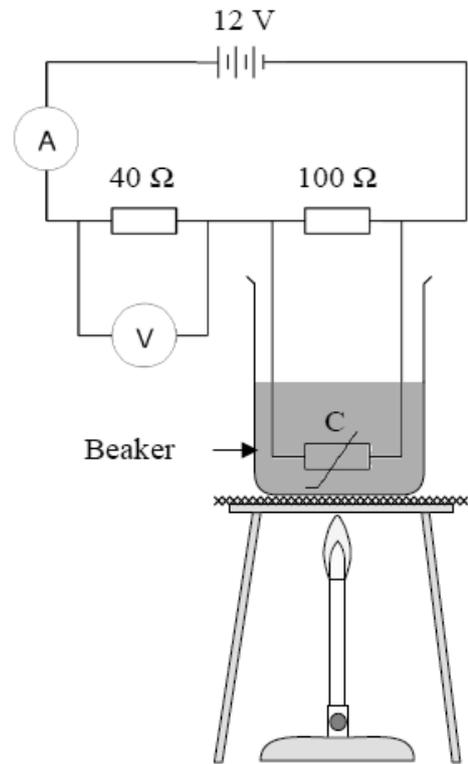
b) Should an ammeter have a low or a high resistance?
_____ (1)

c) **Tick** (✓) the correct answer:-

The voltmeter in the diagram is measuring:

- the current through the 40Ω resistor,
- the p.d. across all the components in the circuit,
- the p.d across the 40Ω resistor.

(1)



d) The voltmeter reads a voltage of 4 V when the water is boiling. Calculate the **current** flowing through the circuit at this time.

_____ (2)

d) Calculate the **total resistance** of the circuit.

_____ (2)

e) If the current flowing through component C is 0.02 A, calculate its **resistance**.

_____ (2)

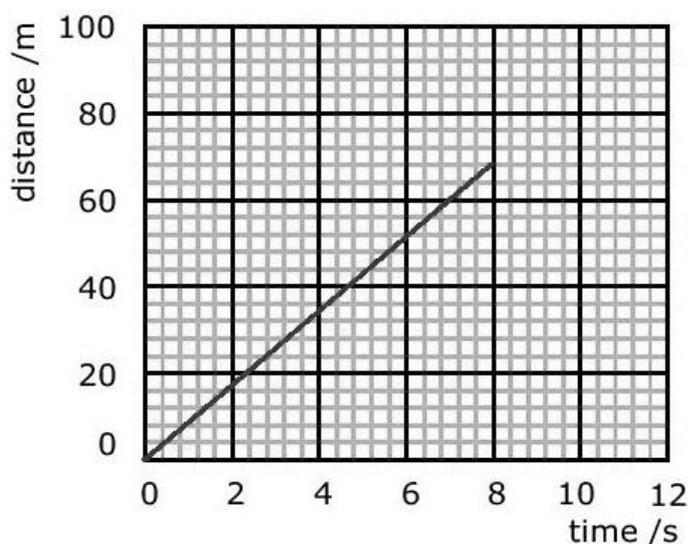
f) **Explain** what would happen to the current read by ammeter A if the water is left to cool down.

_____ (1)

(10 marks)

4. This question is about linear motion.

Jurgen runs a race at a steady speed. A graph of distance against time was plotted.



- a) From the graph find the **distance covered** during the race. _____ (1)
- b) How **long** did Jurgen take to cover this distance? _____ (1)
- c) What **distance** did Jurgen cover after 6 seconds? _____ (1)
- d) How can we conclude from the graph that Jurgen ran at a steady speed during the race?
 _____ (1)
- e) Calculate Jurgen's **speed** during the race.

 _____ (2)
- f) Janet also ran the same race at a steady speed. She finished the race in 12 seconds. **On the same axes, sketch a graph** to show her race. (1)
- g) Calculate **Janet's speed**.

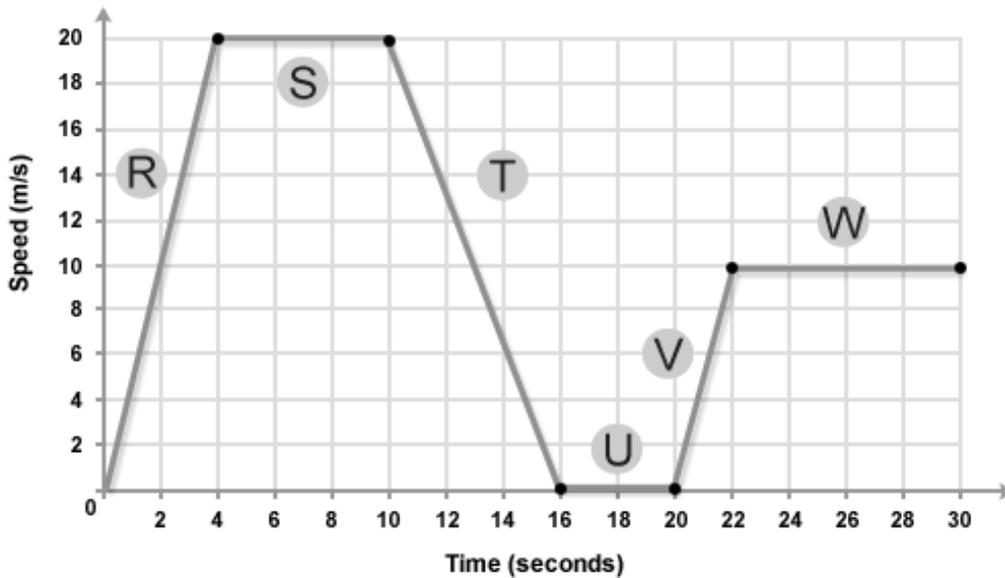
 _____ (2)
- h) Who won the race? _____ (1)

(10 marks)

Section B : This section carries 45 marks.

5. This question is about linear motion.

The diagram below shows the velocity-time graph for a bus.



a) Use the graph to **describe the motion** of the bus:

- i) during the first 4 seconds (**R**) _____ (1)
- ii) between the 4th and the 10th second (**S**) _____ (1)
- iii) between the 10th and the 16th second (**T**) _____ (1)
- iv) between the 16th and the 20th second (**U**) _____ (1)

b) What is the **maximum speed** of the bus during its journey? _____ (1)

c) Calculate the **acceleration** in region V.

 _____ (2)

d) **How** can you find the distance from a speed-time graph?

_____ (1)

e) Calculate the **distance covered** by the bus during the **first 16 seconds**.

(4)

f) Work out the **distance covered** by the bus in the **last 10 seconds**.

(2)

g) Hence find the **total distance** covered by the bus.

(1)

(15 marks)

6. This question is about Ohm's Law.

An electrical engineer measures the potential difference across a length of metal wire and the current flowing through the wire. He repeats the procedure for different current values.

a) Use the apparatus in the list, draw a labelled diagram of a circuit that enables the engineer to do this.

List of apparatus:

- d.c supply,
- ammeter,
- voltmeter,
- variable resistor,
- length of metal wire,
- connecting wires

(3)

b) **Describe** how the engineer could use the above circuit in order to carry out the experiment.

(2)

c) The engineer obtained the following results:

| | | | | | | | |
|-----------------|-----|-----|-----|-----|------|------|------|
| I (Amps) | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.75 |
| V(Volts) | 2.0 | 4.0 | 6.0 | 8.0 | 10.0 | 12.0 | 15.0 |

Use the graph paper (on page 9) to **plot a graph of Voltage V** on the y-axis **against Current I** on the x-axis.

(5)

d) From your graph, **find** the voltmeter reading when the current flowing through the resistor is 0.25A. _____

(1)

e) **Fill in:**

Ohm's Law states that the _____ across an electrical conductor is directly _____ to the _____ flowing through it, provided that the _____ remains constant.

(2)

f) The metal wire used in the experiment obeys Ohm's Law. How would you expect the resistance of the wire to change during the experiment?

Tick (✓) the correct answer:

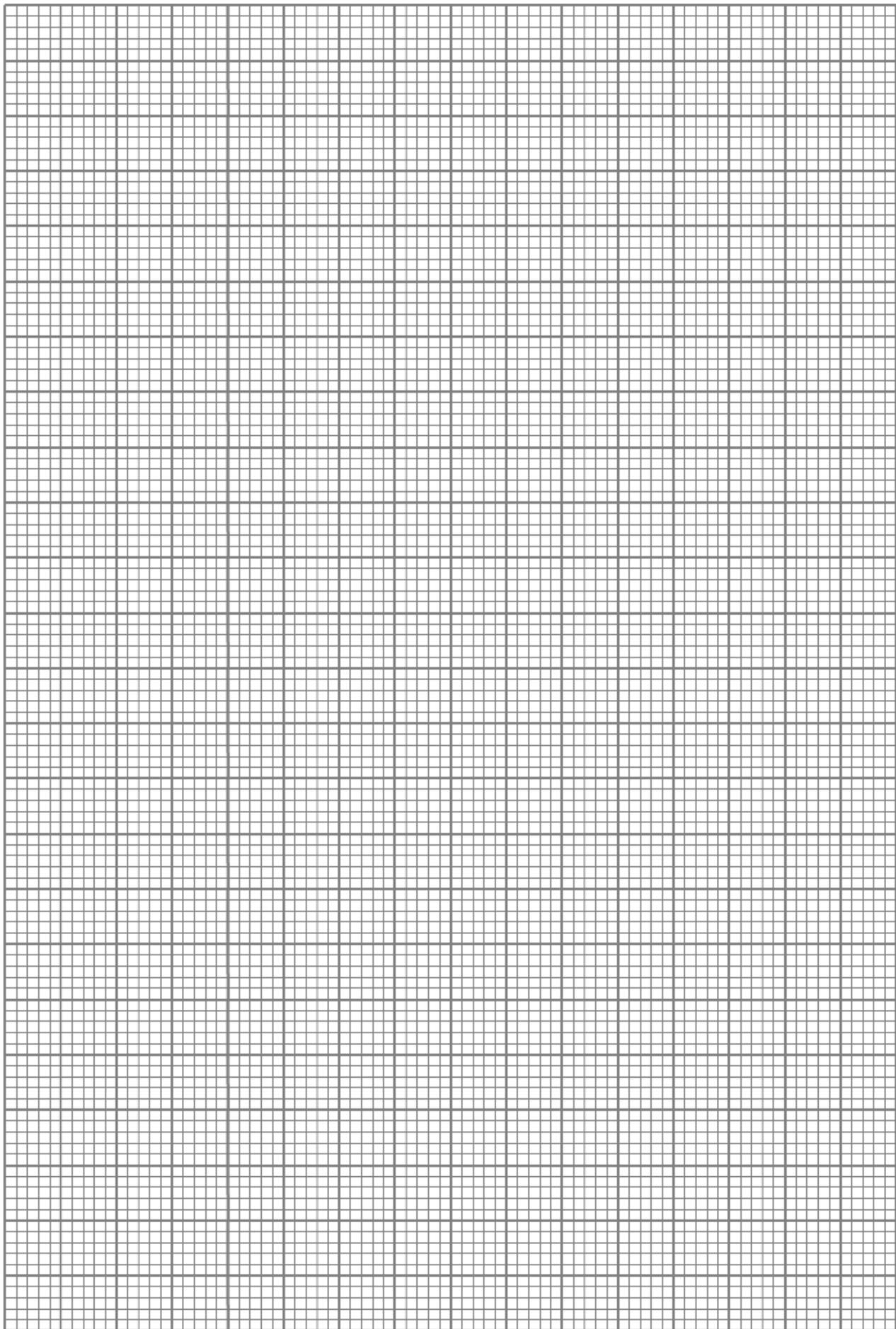
- The resistance of the wire decreases,
- The resistance of the wire increases,
- The resistance of the wire remains the same.

(1)

g) What would you expect to happen if the engineer accidentally leaves the circuit switched on for a long time?

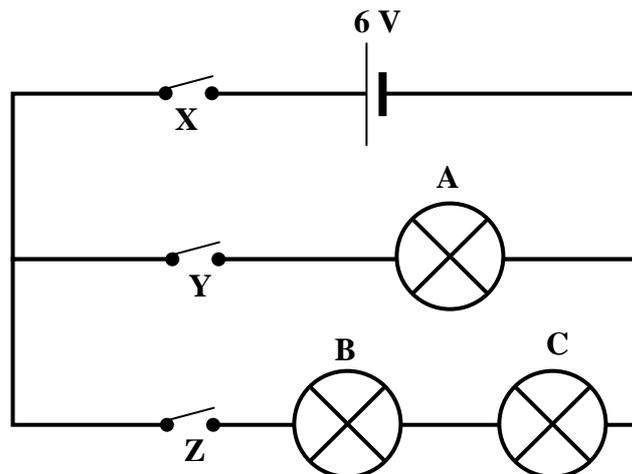
(1)

(15 marks)



7. This question is about electrical circuits.

Three **identical** filament lamps are connected as shown in the figure below.



a) Fill in :

- i) Lamps A and B are connected in _____
- ii) Lamps B and C are connected in _____

(2)

b) State which **switch or switches** need to be closed (switched on), so that only:

- i) Lamp A lights up: _____
- ii) Lamps B and C light up: _____

(2)

c) With **all switches closed**:

- i) calculate the **p.d across B**,

_____ (1)

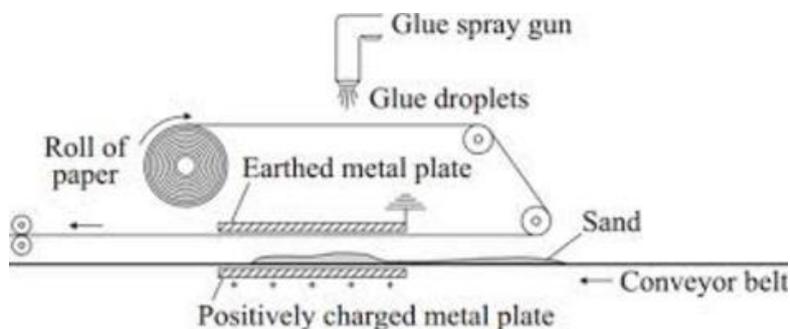
- ii) calculate the **charge** present in lamp A given that a current of 2A flows for 30 seconds.

 _____ (2)

- iii) **explain** why lamp A will light brighter than lamp B.

 _____ (2)

- d) The figure below shows a method of producing sand paper using static electricity. Glue is sprayed from the spray gun onto a moving strip of paper. The glue droplets become negatively charged once they leave the nozzle. The sticky paper passes between two metal plates. Sand moving on a conveyor belt also passes between the metal plates.



- i) **Explain** how the glue droplets become negatively charged.

_____ (2)

- ii) **Explain** the advantage of having all the droplets negatively charged.

_____ (2)

- iii) **Explain** why the sand moves towards the sticky paper.

_____ (2)

(15 marks)

End of Examination