

# 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  $10\text{m/s}^2$ .

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)

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**(10 marks)**

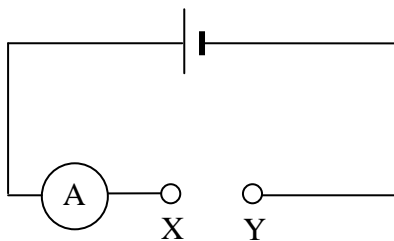
2. This question is about electric circuits.

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.



Wire A	
Wire B	
Wire C	

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?

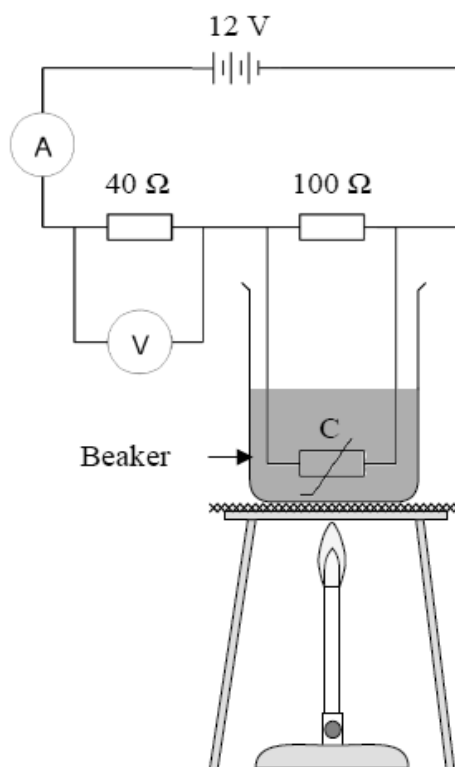
\_\_\_\_\_ (1)

- c) **Tick (✓)** the correct answer:-

The voltmeter in the diagram is measuring:

- ☐ the current through the  $40\Omega$  resistor,  
☐ the p.d. across all the components in the circuit,  
☐ the p.d across the  $40\Omega$  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)

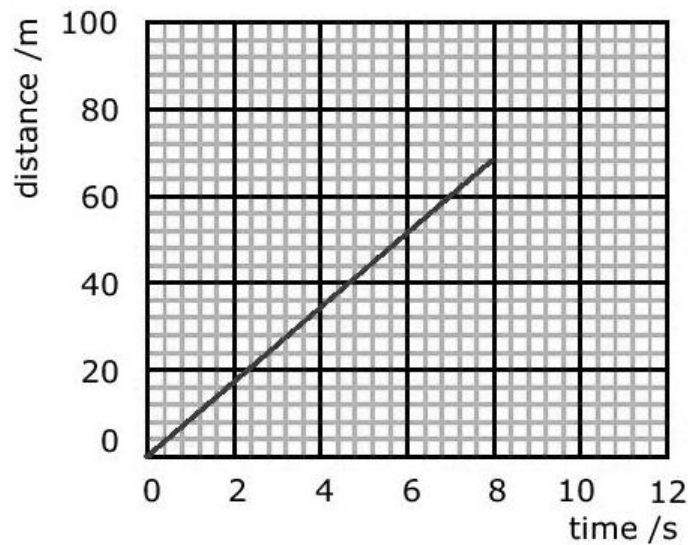
- f) **Explain** what would happen to the current read by ammeter A if the water is left to cool down.

\_\_\_\_\_  
\_\_\_\_\_ (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.



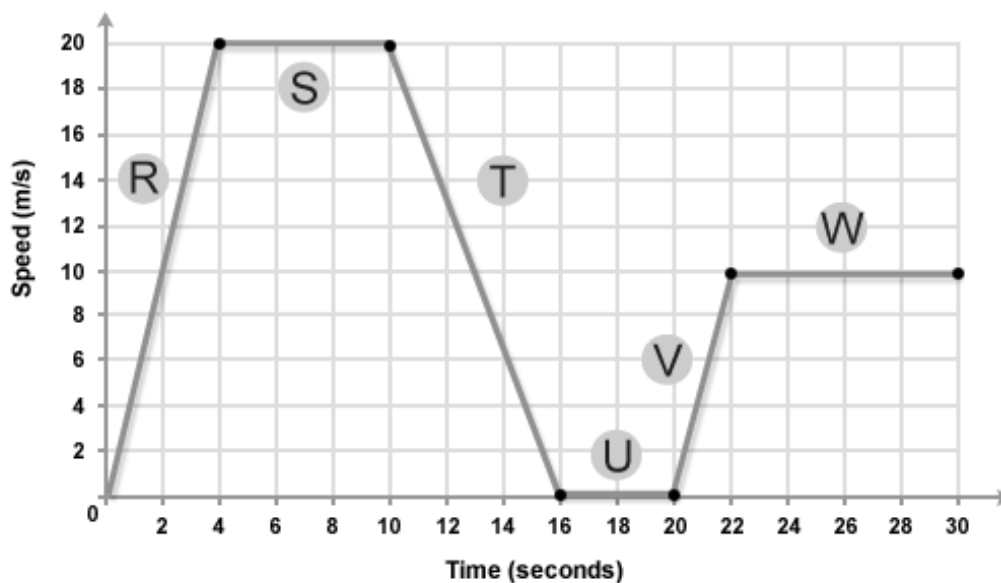
- a) From the graph find the **distance covered** during the race. \_\_\_\_\_ (1)
- b) How **long** did Jurgen take to cover this distance? \_\_\_\_\_ (1)
- c) What **distance** did Jurgen cover after 6 seconds? \_\_\_\_\_ (1)
- d) How can we conclude from the graph that Jurgen ran at a steady speed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

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(4)

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

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(2)

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

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(1)

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*(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.

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(2)

- c) The engineer obtained the following results:

<b>I (Amps)</b>	0.1	0.2	0.3	0.4	0.5	0.6	0.75
<b>V(Volts)</b>	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)

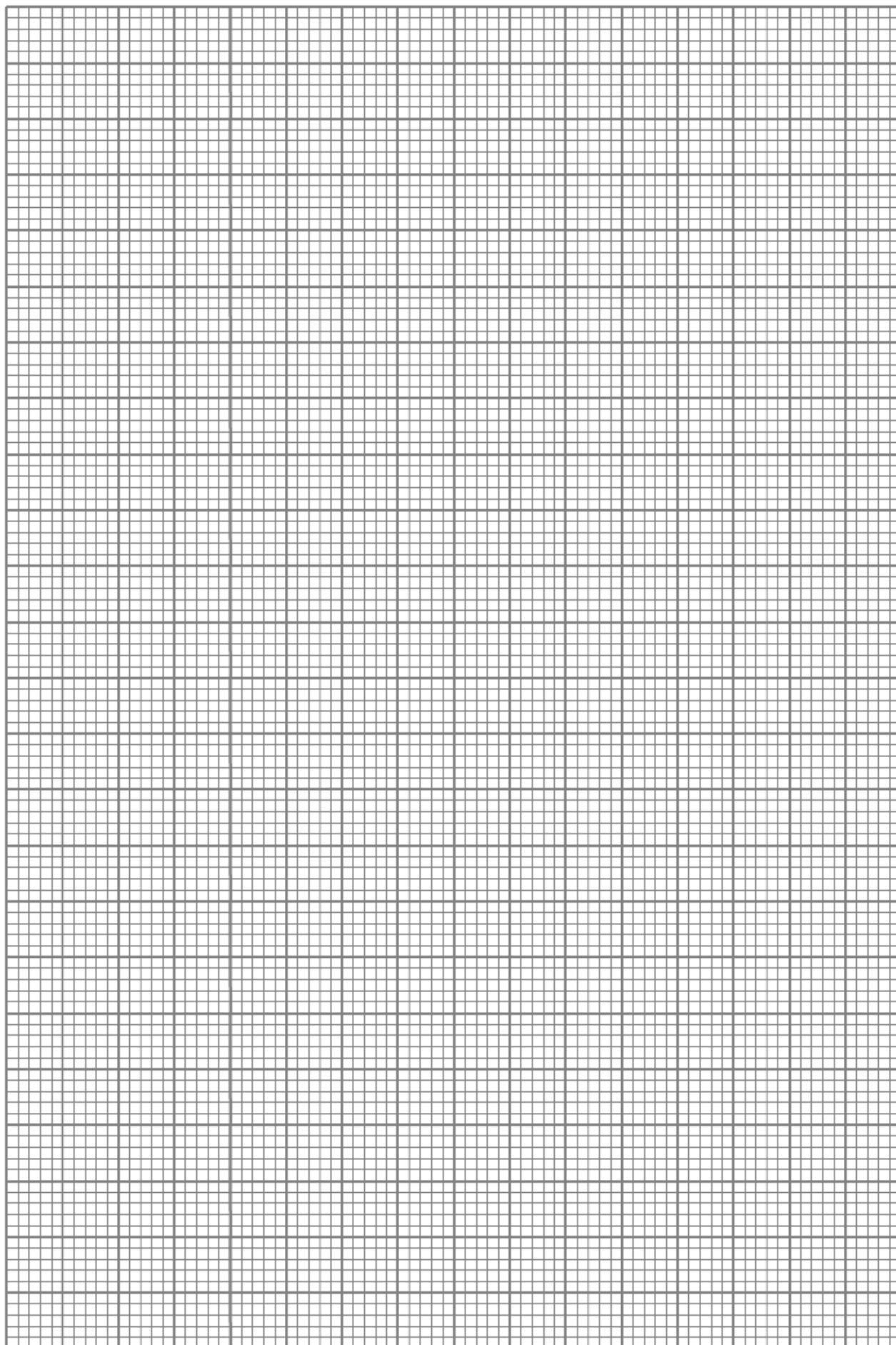
- g) What would you expect to happen if the engineer accidentally leaves the circuit switched on for a long time?

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(1)

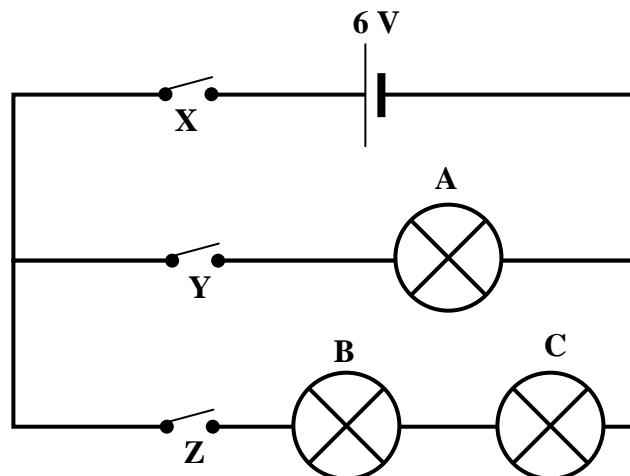
**(15 marks)**





**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)

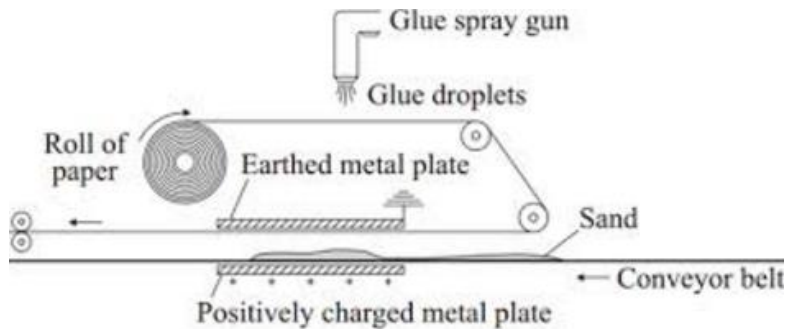
- ii) calculate the **charge** present in lamp A given that a current of 2A flows for 30 seconds.

\_\_\_\_\_  
 \_\_\_\_\_ (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)

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(15 marks)

***End of Examination***