

**EXTERNAL EXAMINATIONS**

**Uganda Certificate of Education**

**NAME:**  **RATING: UCE 3-4**

**INSTRUCTIONS TO CANDIDATES (IN EXAMINATIONS)**

- Write your name, signature, centre and index number clearly.
- Answer any five questions.
- Any additional questions(s) answered will not be marked.
- Mathematical tables and silent non-programmable calculators may be used.

*These values of physical quantities may be useful to you:*

- Acceleration due to gravity, $g$	=	$10 \text{ ms}^{-2}$
- Density of water	=	$1000 \text{ kgm}^{-3}$
- Specific heat capacity of water	=	$4200 \text{ Jkg}^{-1} \text{ K}^{-1}$
- Specific heat capacity of copper	=	$400 \text{ Jkg}^{-1} \text{ K}^{-1}$
- Speed of electromagnetic waves	=	$3.0 \times 10^8 \text{ ms}^{-1}$
- Speed of sound in air	=	$340 \text{ ms}^{-1}$

**NUMBER ONE**

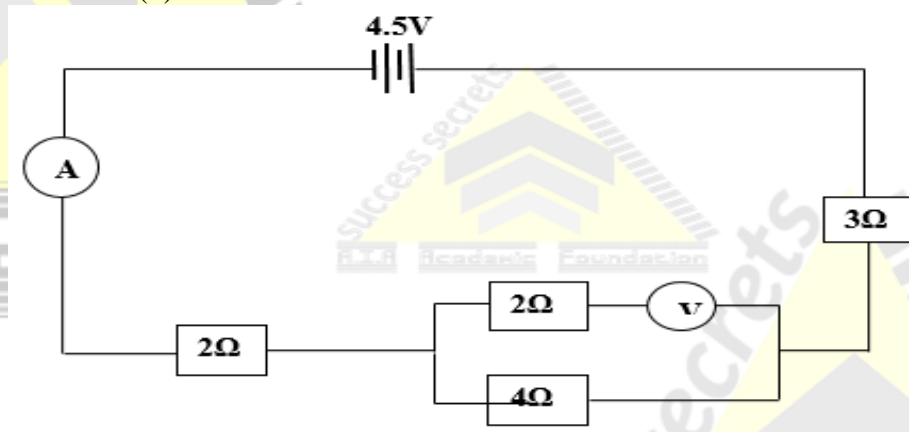
- (a) What is meant by **uniformly accelerated motion**? (01 mark)
- (b) A driver of a racing car moving at  $20 \text{ ms}^{-1}$  notices that he is about to be overtaken by his competitor. He then decides to accelerate at  $4 \text{ ms}^{-2}$  for 6 minutes. He maintains this velocity for a further 10 minutes before his car develops a flat tyre. He then decelerates to a halt in 10 seconds.
- (i) Represent the motion of the motorist on a velocity time graph (04 marks)
- (ii) Find the total distance travelled by the motorist before developing a flat tyre (03 marks)
- (iii) Calculate his deceleration (01 mark)
- (c) (i) Define the term acceleration due to gravity (01 mark)
- (ii) Describe a simple experiment to determine the acceleration due to gravity using a simple pendulum (06 marks)

**NUMBER TWO**

- (a) Define the term **refractive index** (01 mark)
- (b) A ray of yellow light is incident on water - glass interface at an angle of  $48^\circ$
- (i) Sketch a ray diagram to show the path of light between the two media (01 mark)
- (ii) Determine the refractive index of the water if the refractive index of the glass block is  $\frac{3}{2}$  and the angle of refraction is  $31^\circ$ . (02 marks)
- (c) (i) Describe a simple experiment to determine the focal length of a converging lens using an illuminated object (05 marks)
- (ii) A convex lens has a focal length of 250mm. What is the power of this lens? ( $1\frac{1}{2}$  marks)
- (d) (i) Using a diagram, explain how a glass prism produces a spectrum of white light ( $3\frac{1}{2}$  marks)
- (ii) Give any four differences between the human eye and the lens camera (02 marks)

**NUMBER THREE**

- (a) Distinguish between **electromotive force (emf)** and **potential difference (p.d)** (02 marks)
- (b)



A battery of e.m.f  $4.5V$  and negligible internal resistance is connected to resistances of  $2\Omega$ ,  $2\Omega$ ,  $4\Omega$  and  $3\Omega$  as shown in the figure above.

Determine the

- (i) Reading of the ammeter, A (03 marks)
- (ii) Voltmeter reading, V (02 marks)
- (iii) Power dissipated in the  $4\Omega$  resistor (03 marks)
- (c). (i) Distinguish between an insulator and a conductor (02 marks)
- (ii) Describe how a gold leaf electroscope can be used to test for the presence of charge on a body (04 marks)

**NUMBER FOUR**

- (a) (i) What is meant by an **echo**? (01 mark)
- (ii) Describe an experiment to determine the velocity of sound in air using echo method (05 marks)
- (iii) A student observed the time interval between the lightning flash from a distant storm and the accompanying thunder as 4 beats of her pulse. If her pulse is 72 beats per minute, calculate the distance of the storm from the observer (03 marks)
- (b) (i) Define the term **resonance** (01 mark)
- (ii) In an experiment to determine the speed of sound using a tuning fork and long capillary tube, the shortest length of a resonance tube that produces resonance is  $0.12m$  and the next resonance length is  $0.37m$ . Calculate the velocity of sound in air, if the frequency of the tuning fork is  $680Hz$  (03 marks)
- (iv) Explain why open pipes are preferred to closed pipes as musical instruments (02 marks)

**NUMBER FIVE**

- (a) Define **specific latent heat of vaporization** (01 mark)
- (b) Describe how you can determine the specific latent heat of vaporization of steam (06 marks)
- (c) A copper calorimeter of mass  $0.1kg$  contains  $0.3kg$  of water at  $40^{\circ}C$ . A mass of  $0.005kg$  of steam is vaporized through the water in the calorimeter until a final temperature is attained. Assuming no heat losses to the surrounding, calculate the

final temperature of the calorimeter and its contents  
(*specific latent heat of vaporisation of steam* =  $2.26 \times 10^6 J Kg^{-1}$ ) (04 marks)

- (d) (i) What is **saturated vapour**? (01 mark)
- (ii) Use the kinetic theory of matter to explain how evaporation causes cooling (04 marks)

**NUMBER SIX**

- (a) State the law of magnetism (01 mark)
- (b) Draw the magnetic field pattern for
  - (i) two straight conductors carrying current in opposite directions ( $1\frac{1}{2}$  marks)
  - (ii) a long cylindrical coil carrying current ( $1\frac{1}{2}$  marks)
- (c) (i) Explain how any three energy losses can be minimized in a practical transformer (03 marks)
- (ii) A transformer whose primary and secondary coils have 60 and 1200 turns respectively has its secondary coil connected to a  $3.0\Omega$  resistor. If the primary is connected to a  $240V$  A.C supply and the transformer is 80% efficient, calculate the current flowing in the primary circuit (04 marks)
- (d) Describe how full-wave rectification can be achieved using four diodes (05 marks)

**NUMBER SEVEN**

- (a) (i) Define density (01 mark)
- (ii) Describe an experiment to determine the density of a piece of stone (05 marks)
- (b) (i) State the law of moments (01 mark)
- (ii) A solid body rests with its flat surface on a horizontal ground. State two factors that affect the stability of the body (02 marks)
- (c) A uniform beam AB of length  $5.0m$  and weight  $200N$  is put on a knife edge at a distance of  $2.0m$  from A. If a boy of weight  $500N$  sits at A,

(i) draw a diagram showing the forces acting on the beam  
(1 1/2 marks)

(ii) find the distance from the pivot at which a girl of weight 350N should sit for the beam to balance horizontally  
(2 1/2 marks)

(d) (i) Give one application of moments (01 mark)

(ii) Explain why a person at the top of a mountain feels pain in the ears and may develop nose bleeding (03 marks)

**NUMBER EIGHT**

(a) (i) What are cathode rays? (01 mark)

(ii) State any **four** properties of cathode rays (02 marks)

(b) Describe, with a well labeled diagram, how X – rays are produced in an X-ray tube (06 marks)

(c) Explain the effect of increasing the p.d between the cathode and anode in an X- ray tube (03 marks)

(d) A dead oak tree trunk from Mabira forest is found to contain  $2.5 \times 10^5$  carbon atoms. A fresh sample of the same tree contains  $8.0 \times 10^6$  carbon atoms. How long ago did the tree die, if the half life of carbon is 5600 years? (04 marks)

**A.I.A BONUS**

(i) What is **half-life** as applied to radioactivity? (01 mark)

(ii) State any **one** medical and **one** industrial application of radioactivity. (02 marks)

Medical:.....

Industrial:.....

(b) Two electrically neutral atoms *M* and *N* shown in the table below are isotopes. Fill in the missing gaps in the table. (01 mark)

Atom	Electron Number	Neutron Number	Mass number
<i>M</i>	38	.....	89
<i>N</i>	.....	45	.....

**\*\*\*\*END WITH CONFIDENCE\*\*\*\***