PHYSICS

Paper 1

(Theory)

Feb./Mar.2025

$2\frac{1}{2}$ hours

Uganda Certificate of Education

Beginning of term exams, 2025

PHYSICS

Paper 1

2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

*This paper consists of two sections; **A** and **B***

It has seven examination items.

*Section **A** has **three** compulsory items.*

*Section **B** has **two** parts; **I** and **II**. Answer **one** item from **each** part.*

*Answer **5** items in all.*

Any additional item(s) answered will not be scored.

All answers must be written on the answer sheet provided.

FOR SCORER'S USE ONLY

Item	1		2		3		4		5		6		7		Total Weight
Code	IR_1	MC_1	IR_2	MC_2	IR_3	MC_3	IR_4	MC_4	IR_4	MC_4	IR_5	MC_5	IR_5	MC_5	
EP															
Weight															

SECTION A

Answer **all** *the items from this section*

Item 1.

On his way to the beach, a holiday maker noticed a pool of water at a spot along a tarmacked road. The pool suddenly disappeared as the holiday maker approached the spot.

- While at the beach, the water crests at the shallow area behaved different from those at the far deep water areas. It is not safe for the holiday maker to boat cruise if the speed of the waves at the shallow and deep water areas exceed $30ms^{-1}$ and $65ms^{-1}$ respectively.
- The number of water crests made per second is 50.

Hint

Distance between two consecutive crests is 70cm and 40cm in deep water and shallow water respectively.

Task

As a student of Physics;

a) Help the holiday maker understand the formation of the pool of water he noticed.

b) Determine whether it was safe for the holiday maker to boat cruise from the beach to the far deep water area.

Item 2.

Road accidents have been so rampant on Uganda's roads. One morning an accident occurred between a fuso truck and a passenger taxi. Fortunately enough none of the passengers passed on. However some passengers sustained scratches on their bodies with one case of suspected fracture on the arm. You learnt that

there is some electromagnetic radiation that can be used to detect a fracture. The relatives of the casualty do not understand how the radiations will be used to reveal the fracture.

Task

As a student Physics, help the relatives understand the electromagnetic radiation and how it would be used to reveal the fracture.

Item 3.

A girl makes a video call to her parents who are currently in Brazil. In their conversation, the girl reported;

- How it was dry season and windy in Uganda
- That it was day in Uganda
- An occurrence that happened a day before in which case darkness engulfed her location for a short while during day time.

The parents responded as follows;

- "It is wet and very cold out here"
- "It is night here in Brazil"

Task

As a learner of Physics, help;

a) The girl understand the cause of;
   i) being day in Uganda while it was night in Brazil.
   ii) difference in seasons

b) The parents understand the occurrence of darkness that engulfed the location of the girl.

SECTION B

PART I

*Answer **one** item from this part*

Item 4.

Students who visited a port were told ships were made of steel whose density is 7750 kgm^{-3}. This surprised the students as they thought such a material could not float on water. They started a voyage of 60 km at midday for an island where they were to arrive in 80 minutes. They started from rest and attained a velocity of 80 kmh^{-1} in 30 minutes. The ship stopped for 15 minutes for sightseeing. Some of the students wearing black clothes complained about them feeling so hot which surprised those wearing white. The time-conscious students started to wonder what speed the ship would have to move in order to get to their destination in time.

Task

Use your knowledge of physics to;

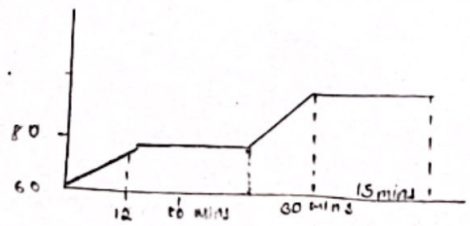
a) Explain to the students how the ship is able to float on water.

b) Determine the minimum average speed that the ship has to move with to get to its destination in time.

c) Explain to the students why the students in black were feeling hotter than those in white.

Item 5.

A village in a hilly area depends on water pumped by National Water and Sewerage Cooperation (NWSC) from a distant lake. Being distant, the residents complain that the water comes at a low pressure. One learned resident mobilizes fellows that the low pressure can be rectified if a reservoir tank is positioned midway the source and the village so that the water could flow through an



outlet pipe positioned at a point on the tank from the top of the tank so that the water comes out at a pressure of about 302kPa.

- The water pipes often burst during cold seasons of the year causing water shortage. However the residents think it is due to malicious neighbors that damage the pipes.
- One beneficiary from the water supply system receives $20l$ of water at a temperature of 23°C. He mixes this water with a certain amount of water at 95°C to help him maintain the temperature of his brewery plant at 80°C.

Hint

Specific heat capacity of water = $4200Jkg^{-1}K^{-1}$

Mass of $1m^3$ of water = 1000kg,

Acceleration due to gravity g= $10ms^{-2}$

Task

As a student of Physics;

a) Help the residents know what position on the tank would be suitable for positioning the delivery pipe.

b) Help the residents understand why the water pipes burst during cold seasons of the year.

c) How much water is required for the brewery owner so as to maintain the brewery temperatures at 80°C?

PART II

Answer **one** *item from this part.*

Item 6.

A factory dealing in the manufacture of metallic sheets employs a mechanism of elevating the metal sheets into loading trucks so as to minimize likely injuries. The mechanism requires a 12V DC-source that it can be disconnected whenever the metal sheets have been raised to a desired position.

A security officer at the factory uses the DC-source to charge his emergency lighting gadget whose capacity is 900C when fully charged. The gadget gets fully charged when left connected for some time in the circuit through which a current of 0.25A is flowing.

Task

As a student of Physics;

a) Describe the mechanism used to raise metal sheets in the factory.

b) Determine whether the gadget gets fully charged after staying in the circuit for 0.75hours

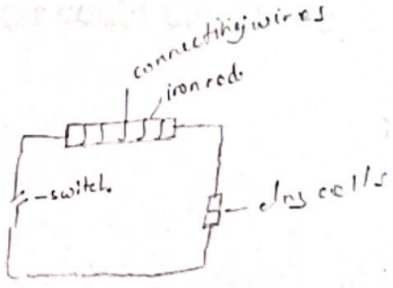
Item 7.

You have gone for a tour to a forested park and all of a sudden you got lost. You are aware that your school is located North of the park. Fortunately enough one of your friends possess connecting wires, 2 dry cells each of EMF 1.50V, a switch, a piece of thread and an iron rod in their bag.

Task.

A learner of Physics, help your team on how they can be able to find the direction back to school.

END



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PHYSICS PAPER 1

SCORING SCHEME, 2025

Item	Expected response	E.R.P		
		iR	MC	Weight
1.		07	07	12
a)	The pool of water was a mirage caused by total internal reflection of light			5-7 = 5
	Air layers near the surface are warm and less dense than the air above it.			0-4 = 0
	Light rays from a denser medium (cooler air) to a less dense medium (hotter air),			
	are refracted away from the normal.			MC_1
	The rays undergo total internal reflection			4-7 = 6
	Hence the holiday maker sees an image of the sun which appears as a pool of water.			0-3 = 0
b)	Deep water			
	$v = f\lambda$			
	$= 50\ x\ 0.70$			
	$= 35ms^{-1}$			
	Shallow water			
	$v = 50\ x\ 0.40$			
	$= 20ms^{-1}$			
	Since $20ms^{-1}$ *and* $35ms^{-1}$ *are less than* $30ms^{-1}$ and $65ms^{-1}$ in shallow and deep water respectively, it is safe for the holiday maker to boat cruise.			

2.	The radiations are (soft) x-rays Soft x-rays have long wavelength, less penetrative Produced when cathode rays are stopped by matter The limb is positioned/placed/put against a photographic plate Soft x-rays are directed to the plate through the limb The soft x-rays penetrate the fracture and affect the plate but are absorbed by the bone. The fracture appears dark on the plate hence the fracture is revealed.	09	09	IR_2 6-9 = 6 3-5 = 3 0-2 = 0 MC_2 4-9 = 5 0-3 = 0
3.a)	Day and night are due to the rotation of the Earth about its axis As the Earth rotates, the hemisphere facing the sun receives sunlight and experiences day The hemisphere away from the sun receives no light, experiencing darkness (night). One complete rotation takes 24 hours, this is equal to one day Hence at some point, Uganda was directly facing the sun while Brazil not facing	20	—	IR_3 13-20 = 6 6-12 = 2 0-5 = 0

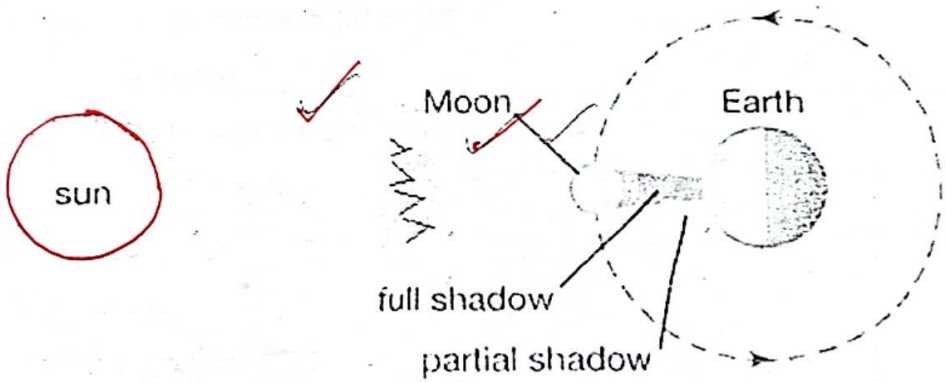
the sun directly.

ii) Seasons are due to Earth's revolution about the sun and the tilt of its axis about the orbit.

The part of Earth's hemisphere close the sun receives more sunlight experiencing high temperatures hence a dry (summer) season.

The Earth's hemisphere facing away from the sun receives less sunlight experiencing low temperatures hence winter (wet) season.

b)



The darkness was due to solar eclipse

The sun, moon and earth were in a straight line

The moon was between the Earth and the sun temporarily blocking the sun's light and casting a shadow on Earth

Hence the darkness

SECTION B (Part I)

4. a)	The ship is hollow, occupied by air. The average density of the ship is less than that of water. The ship displaces a large amount of water, experiencing large up thrust hence it floats.	11	08	IR_4 7-11 = 6 3-6 = 3 0-2 = 0
b)	$Distance = vt$ $= 80\ x\ \frac{30}{60}$ $= 40km$ $Reamaining\ distance = 80 - 40$ $= 20km$ $Time = 80 - (15 + 30) = 35minutes$ $Speed = \frac{Distance}{time}$ $= 20 \div \frac{35}{60}$ $= 34.286kmh^{-1}$ The minimum average speed of the ship is $34.286kmh^{-1}$			MC_4 4-8 = 6 0-3 = 0
c)	White surfaces are bad absorbers of heat radiation, the white shirts reflect radiations, and temperature remains low.			

	Black surfaces are good absorbers, black clothes absorb heat radiations, its temperature riser up Hence the students in black feel hotter			
5.a)	$P = h\rho g$ $302 \times 1000 = h \times 1000 \times 10$ $h = 30.2m$ The tap should be positioned at a point 30.2m from the top of the tank.	03	12	IR_4 2-3 = 6 0-1 = 0 MC_4 6-12 = 6 4-5 = 4 0-3 =0
b)	Water cools during cold seasons It expands abnormally Exerts a lot of pressure on the pipe causing the pipes to burst.			
c)	Let m_2 be the mass of required water $1l = 1kg$ $20l = 20kg$ *Heat lost by hot water = heat gained by in let cold water* $m_1C(\theta_3 - \theta_1) = m_2C(\theta_2 - \theta_3)$ $20(80 - 23) = m_2(95 - 80)$ $m_2 = 76kg$ The amount of water required for the brewery is 76kg			

7.	The students should use a magnet to act as a campass. A wire is wound around an iron rod. The wire is connected to the dry cell Current flows through the coil The iron rod gets magnetized The ends of the iron rod are marked The magnetized iron rod is tied and suspended using a piece of thread and left to swing freely The rod rests pointing in the North-South direction. The team then can be able to locate the direction back to school.	11	11	IR_5 7-11 = 6 0-6 = 0 MC_5 5-11 = 6 0-4 = 0

Key

E.K.P-Expected Key points

IR-Identification with reason

MC-Mathematical computation

W-Weight