

P510/1

PHYSICS

Paper 1

(Theory)

2026

$2\frac{1}{4}$ hours

Uganda Advanced Certificate of Education

PHYSICS

Paper 1

2 hours 15 minutes

Instructions:

*This examination paper consists of two sections; **A** and **B**. it has **three** items*

*Section **A** has **one compulsory** item.*

*Section **B** has two parts: **I** and **II**. Respond to **all** items in both parts*

*Respond to **three** items*

*Response to **each** item should start on a fresh page*

Silent non-programmable scientific calculators may be used.

SECTION A

Respond to **all** items in this section

Item 1

Netball in schools is a popular, fast-paced team sport. It emphasizes teamwork, positional discipline and quick passing, with strict rules against moving with the ball, contact, or obstruction. Janet is a senior net baller in one of the secondary schools in Uganda. Janet starts her run on a horizontal surface of the pitch at velocity of 3.6kmh^{-1} at a rate of 6ms^{-2} . After running 2m, she decided to make a shot towards the goal/ring.

She throws the shot forwards with a velocity 12ms^{-1} with respect to her hand, in a direction 54° to the horizontal at a time when her body is moving forward horizontally with a velocity $V\text{ms}^{-1}$.

The school netball coach was amazed at her skills and he got concerned to study Janet's motion to model equations for future training drills. He decided to contact you and requested you help him to know if such a shot can enter the ring with in 5s which is 50m from the point of throw and determine the speed Janet was running with by the time she threw the ball.

Hint:

Acceleration due to gravity is 9.81ms^{-2}

Task:

Address the concerns and requests made by the coach.

SECTION B

Part I

Respond to **all** items from this part

Item 2

A school carpenter fixed a dressing mirror in one of the dormitories in a school. Irean the tallest girl among all who reside in that dormitory complained of not being able to see the whole of herself in the mirror while all others could comfortably see themselves. The carpenter has been advised to change the size of the mirror. Irean is 1.8m tall and her eyes are 10cm below the top of her head.

When irean had holidays was picked from school by the mother and as she was driving the car back home, it developed a problem. There was a lot of steam coming from the bonnet and the engine stopped working. The mechanic she invited told them that the engine had overheated because there was little water in the radiator. After filling the radiator with water, the car started working.

When Irean reached home came to your home and narrated all that happened when she was at school and told you also that the head teacher of the school also had a newly purchased 2.352kW power Kettle made of a material of heat capacity of 420JK^{-1} and he was assured by the shop owner that the kettle was so genuine and can boil water within 6 minutes. The head teacher gave it to Irean's group of discussion to test whether it was truly genuine. They heated 2 litres of water initially at 20°C until it boiled at 100°C .

Hint:

$$1 \text{ litre} = 1 \text{ kg}$$

$$\text{specific heat capacity} = 4200 \text{ J kg}^{-1} \text{ K}^{-1}$$

TASK.

As a physics student, help Irean to understand;

- a. How the carpenter will be able to determine the height of the mirror where she can view the whole of her image and address the head teacher's request to Ireans group.
- b. Why the mechanic in all liquids recommended water for filling in the radiator.

Part II

Respond to **all** items in this part

Item 3

A commercial battery manufacturing company has recently received consumer complaints regarding the operational lifespans and internal power drops of a specific batch of heavy-duty DC blocks. The quality assurance director establishes a rigorous two-tier experimental check to verify the validity of these complaints.

In the first quality check, a test battery from the line is connected in series with two standard load resistors of values $25 \, \Omega$ and $10 \, \Omega$ and the secondary ammeter which must registered a current of 0.34 A

In the second quality check, the two standard load resistors were arranged in parallel and the secondary ammeter which must registered a current of 1.68 A

The director further guided that for their type of battery to be pronounced to be good, it should have an internal resistance not exceeding $1.0 \, \Omega$ and *e.m.f* should be in a range of $11.0 - 13.0 \text{ V}$.

The same company supplied a small Van de Graff generator to a certain school, the generator uses a motor driven insulating belt to transfer charge to a spherical metal dome. The school laboratory did not know how the system works and what to check for. Alexa a s.6 physics student suggested that they can test for charge distribution. At some time, the parks were observed around the dome. This surprised both Alexa and the technician. Before the two completed the test. Alexa was called for his next lesson.

Task:

- a) Analyze the quantitative metrics, determine whether the consumer complaints are justified based on company standards.
- b) Help the laboratory technician to understand the working principle of the system, the cause of the sparks around the dome with clear details to convince Alexa.

END