

535/1
PHYSICS
Paper 1
Jul/Aug.2026
2½ hours



UGANDA TEACHERS' EDUCATION CONSULT (UTEC)

Uganda Certificate of Education

PHYSICS

Paper 1

Theory

2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES:

This paper consists of two Sections A and B. It has seven examinations items

Section A has three compulsory items.

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

Answer five items in all

All responses must be written in the booklets provided

SECTION A (COMPULSORY)

Item 1

During the enforcement of a Uganda trade order, an L.C.1 defense personnel was instructed to inform traders that street vendors and buildings located at least 0.025 km away were to be demolished. The personnel used a hired megaphone and a motorcycle equipped with a side mirror that continuously located distant objects as he moved. While on the tarmac road, the personnel observed that the surface appeared to be a glittering pool of water which kept disappearing as he approached it, which made him wonder greatly. While communicating, he bypassed a large workshop building and began hearing his own spoken words repeated at intervals of 0.175 seconds. The personnel stopped the megaphone using a remote control, but upon switching it back on and communicating, the sound repeated again and only cleared when he moved away from the structure. Consequently, he felt the megaphone had mechanical issues. The owner of the building heard the announcement, although he could not clearly see distant objects, and was in fear of the demolition of his structure.

Hint:

- Speed of sound in air is 320 ms^{-1}
- Ultraviolet radiation is characterized by high frequency.

Task:

Help:

- a) Clear the personnel's wonder regarding the glittering pool of water on the road.
- *b) Using sketch ray diagrams, explain to the owner of the workshop his particular eye defect and its correction.
- c) Explain the side effects of prolonged exposure to the rays used by the remote-control device that the personnel used to switch off the megaphone.
- d) Inform the owner of the structure regarding whether his building meets the demolition criteria.
- *e) Using a clear ray diagram, explain why the motorcycle mirrors located those distant objects and discuss the challenges of using them.
- *f) Give more applications of such mirrors in daily life.

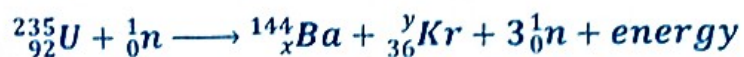
Item 2

A nearby mine in a certain region of Uganda was suspected of discharging dangerous radioactive materials into the nearby swamp water that supports community activities. A study was carried out, and the results are presented below:

Count rate (per hour)	625	575	500	450	400	300	250
Time (hours)	0	10	30	46	60	90	118

The study also showed that the swamp should remain out of reach to the community until the count rate drops to 220 counts per hour; this finding was not received in good faith by the community. It was further suggested that the whole community should undergo individual medical check-ups if the half-life of the substance is above four (4) days.

The community also alleged that the mine consumes too much electricity, which affected their local supply. However, the miners defended themselves by stating that they have a plan to produce more reliable electricity through the nuclear fission of uranium, as represented by the following equation, though the community still doubted it:



Task:

- Help the community members to:
 - Determine the estimated number of days the community members need to keep away.
 - Know whether they will be subjected to further individual medical tests.
- Kindly inform the community members to help them appreciate the resolution to stay away for the determined duration.
- Using a well-labeled diagram, explain the possibility of producing electricity from the nuclear fission process described above.
- Present a balanced nuclear equation by finding the values of x and y.
- Explain the uses and international regulations regarding the use and control of such radioactive materials today.

Item 3

In February 2026, the USA and Israel engaged in a military conflict with Iran in the Middle East, during which Iran's Supreme Leader was assassinated at around 9:30 AM local time in Iran. The attack was closely monitored by the White House in the USA using space-based satellites, which asserted that the incident occurred at around midnight USA Standard Time. The Islamic Republic of Iran retaliated by launching sophisticated missiles at the State of Israel that penetrated the Israeli defense system, since the missiles traveled for almost 9 minutes at a hypersonic speed of Mach 13. As the war escalated, the entire planet Earth within the Solar System was affected, particularly as fuel prices skyrocketed.

Support Material:

- One Mach speed is equal to the speed of sound in air.
- Speed of sound in air is 330 ms^{-1} .

Task:

- * a) Explain the cause for the difference in the recorded time of occurrence of the attack that claimed the life of the Supreme Leader.
- ✓ b) How was the White House able to observe and follow the attacks in such a distant country?
- c) Estimate the distance between Iran and Israel based on the missile flight data.
- ✓ d) Discuss other components of the Solar System.
- ✗ e) Give several other applications of the satellite device setup that enabled the White House to follow up on the attack.

SECTION B

Part I

Respond to one item from this part

Item 4

John hired a special car to travel to school, which charged Ugsh 5,000 per kilometer on board. While loading luggage, John placed his bags on the top rack, but the driver changed the arrangement and put them in the lower cabin, which John did not like. As they started the journey, John hit his head hard against the seat when the car suddenly moved. He alarmed the driver, who stopped the car immediately, causing John to hit the forward seat. The driver then started slowly from rest and accelerated at a rate of 0.1 m/s^2 for 4 minutes. The driver continued at this steady speed for 10 minutes and bypassed an automatic penalty billing machine that fines every driver who exceeds a speed of 90 km/h for over speeding, and then decelerated uniformly to arrive at the

school in 3 minutes. The candidate offboarded and was charged Ugsh 155,520, which he doubted, claiming the driver had overcharged him beyond the agreed tariff. The candidate also developed a severe headache; when taken to the sickbay, the nurse attributed it to either fatigue or malaria. She checked his temperature, which read 310.6 K . The nurse required that they pay for a further malaria test if the temperature exceeded $37.8\text{ }^{\circ}\text{C}$.

Task:

Help;

- a) (i) Explain the physical effect experienced by John when the car started and stopped, and how it could be limited.
- (ii) Give applications of this effect in daily life.
- b) Inform the driver whether he was billed for over speeding by the automated machine.
- c) Help John appreciate the driver's decision regarding the position of the luggage.
- d) Determine whether the candidate was required to pay for the further malaria test based on his temperature.
- e) With reference to a sketch velocity-time graph, determine if the fare charged by the driver was ideal based on the distance covered.

✓ Item 5

Senior 1 learners set off for a study tour to the source of a certain river. While traveling in a saloon car to the site, a speeding Sinotruk bypassed them, and they experienced a force pulling them towards the truck, which made them fear greatly for their lives. On reaching the site, two girls, A and B, rushed to a seesaw where Girl A, of mass 46 kg, was seated at 2.5 m from the center pivot. Girl B, who weighed 600 N, wanted to balance the seesaw on the other end but did not know the exact distance where she should sit. They then witnessed some ice floating on water and also noticed that the river was flowing fastest at narrow sections compared to wider sections, which puzzled them. They continued to a dam where their teacher cautioned them that swimming in a dam is only safe if the depth does not exceed 4 m. The tour guide informed them that the dam had thicker walls at the bottom to counteract a hydrostatic pressure of around $6.5 \times 10^4\text{ N/m}^2$, and advised that they should not risk moving near the water because the dam appeared shallower than its actual depth.

Hint:

- Density of water is 1000 kgm^{-3}
- Acceleration due to gravity is 10 ms^{-2}

Task:*Help*

- a) Explain to the learners the cause of the force that caused their fear while on board next to the moving truck.
- b) Determine the distance Girl B should sit from the pivot to balance the seesaw, and state the conditions necessary for it to remain in this equilibrium state.
- c) Explain the anomalous behavior of ice to the girls and explain any of its applications in daily life.
- d) Inform them whether they will be safely allowed to swim based on the maximum depth rule and the given pressure threshold.
- e) Explain any other applications of the knowledge of fluid pressure acting normally on surfaces (such as the bottom of a dam) in daily life.

Part II

Respond to one item from this part

✓ Item 6

A poultry farmer in Mityana is required to connect four brooder infrared bulbs, each labeled 250W, 240V, to warm chicks, and a security bulb to be used on the compound. These are connected to the mains electricity supply that charges Ugsh 760 per unit, with a fixed service fee of Ug.sh 3,500 per week. He has two switches and a junction box to connect the bulbs, as well as a socket for a speaker used for advertising. The farmer needs to limit electricity consumption by minimizing the hours of use of the security bulb and the brooder bulbs as much as possible since they are highly energy-consuming. The farmer has been using a local heating charcoal stove at a cost of Ugsh 65,000 per bag of charcoal per week, and is not sure whether he will be saving money by switching to the brooder bulbs. He plans to use the brooder bulbs for 10 hours daily and strictly use the security light during the hours of darkness daily (assumed to be 12 hours).

Task:

As a learner of physics, help the farmer to:

- a) make an informed decision between using the infrared bulbs and the charcoal stove by comparing costs.
- b) make a safe and efficient circuit diagram layout for the above appliances in reference to costs, safety, and efficiency.
- ★c) explain how the advertising speaker device works.
- d) automatically switch on and off a compound bulb effectively in response to darkness.
- e) give more applications of the rays used by brooder bulbs in daily life.

Item 7

In an effort to connect the Karamoja region to the national electricity grid from the River Nile, local residents were told to clear and vacate a stretch of land which was a minimum of 10 feet from the grid path. The transmission line is expected to carry a voltage of around 40 kV, which would later be stepped down to 14 kV using a transformer with 400 turns in its primary coil. The locals disagreed, claiming that all that land could not be left unutilized just because of a mere electric grid pathway. The officials then requested the Chairman L.C.1 of one of the villages to call for an awareness meeting. The chairman used a bicycle to ride around the village mobilizing residents. He tried turning on the headlight, but it did not work; he was told by a mechanic that the dynamo had internal technical issues, which was the source of light. The Chairman wondered greatly how the bicycle dynamo works to produce light without any dry cell battery.

Task:

- a) Help convince the locals to appreciate the safety need to leave the demarcated grid space unutilized.
- b) Kindly clear the chairman's wonder by explaining how a bicycle dynamo generates electricity.
- c) With reference to calculations, advise on the exact specifications (number of turns in the secondary coil) of the transformer required to step down the voltage as specified.
- d) Using a well-labeled diagram, explain to the locals the path of grid transmission from the River Nile power station to their region.
- e) Help locals understand why electric power is transmitted along the grid at such a very high voltage.
- f) Discuss more applications of the device used to step down or step-up voltage in everyday technology.

END