

535/1
PHYSICS
Paper 1
20242 ½ HOURS

YAAKA EXAMINATIONS
PHYSICS
Paper 1

INSTRUCTIONSTO 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 **five** items in all.
Any additional item(s) answered will not be scored. All answers **must** be written in the booklets provided*

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SECTION	ITEM	SCORE(S)	EXAMINER'S SIGNATURE
A	1		
	2		
	3		
B	4		
	5		
	6		
	7		
TOTAL			

SECTION A

Answer all the items in this section in the spaces provided.

Item 1

Uganda is rich in natural resources, including minerals such as gold, cobalt, and oil. The extraction and mining of these resources contribute to the country's economy. However, mining activities can have environmental impacts, such as deforestation and pollution of water sources. There is also a political debate about how the wealth generated from natural resources is shared among local communities and the rest of the country.

Task:

Using concepts from physics, explain the process of energy transformation in mining operations, and discuss the environmental consequences of these processes in terms of energy conservation and pollution.

Item 2

In many parts of Uganda, students face challenges in accessing quality education, particularly in rural areas. Limited access to textbooks and science equipment hinders effective learning, especially in subjects like physics. With the growing use of solar-powered devices and online platforms, some schools are beginning to implement digital learning solutions to bridge this gap.

Task:

How can the principle of photovoltaic cells be applied in solar panels to provide electricity for digital learning tools in off-grid rural schools in Uganda?

Item 3

As Uganda continues to industrialize, factories and manufacturing plants are being set up across the country. While industrialization is important for economic growth, there are concerns about safety regulations, particularly in relation to the use of heavy machinery and hazardous materials. Accidents in factories can sometimes be traced back to failures in the design or use of machines.

Task:

Describe how the concepts of force and pressure apply to the operation of heavy machinery in factories, and suggest safety measures based on physics principles to prevent accidents.

SECTION B

PART 1

Answer one item from this part

Item 4

Students observed the thermal expansion of materials by heating metal rods and measuring their length changes. They discussed why different materials expand at different rates.

Task:

Use your knowledge of physics to explain:

- (a) The principle of thermal expansion and its implications in construction.
- (b) Why bridges and railway tracks have expansion joints.
- (c) How thermal expansion affects everyday objects, like thermometers.

Item 5

A student created a circuit using a battery, a resistor, and a light bulb. They observed that increasing the resistance decreased the brightness of the bulb.

Task:

Use your knowledge of physics to:

- (a) Explain the relationship between voltage, current, and resistance (Ohm's Law).
- (b) Discuss how electrical appliances are rated based on power consumption.
- (c) Provide examples of energy-efficient practices that can be applied in households.

PART II
Answer one item from this part.

Item 6

Uganda has a high rate of traffic accidents, especially on highways. Many of these accidents are due to speeding, poor vehicle maintenance, and road conditions. Efforts are being made to improve road safety through better enforcement of speed limits, installation of road signs, and public awareness campaigns about safe driving.

Task:

Using Newton's laws of motion, explain how speeding increases the risk of fatal accidents on Ugandan roads, and suggest how physics principles could be used to design safer vehicles.

Item 7

A group of students analyzed how different surfaces (smooth, rough, inclined) affect the motion of a cart. They recorded the time taken for the cart to travel a set distance on each surface.

Task:

Use your knowledge of physics to:

- (a) Explain the concepts of friction and its effects on motion.
- (b) Discuss how surface texture influences the efficiency of machines and vehicles.
- (c) Provide examples of how engineers design surfaces to optimize performance, such as in roads or sports equipment.

END

ANSWERS TO THE TASKS ABOVE

SECTION A

Item 1 Task: Explain the process of energy transformation in mining operations and discuss the environmental consequences.

Answer: Mining operations transform energy primarily through mechanical processes. The extraction of minerals like gold and oil involves the conversion of kinetic energy (from machinery) and thermal energy (from the combustion of fossil fuels) into mechanical energy to extract and process minerals.

1. Energy Transformation:

- Heavy machinery (e.g., excavators and drills) uses diesel fuel, converting chemical energy into kinetic energy.
- Crushing and grinding processes convert mechanical energy into thermal energy as heat is generated due to friction.

2. Environmental Consequences:

- **Energy Conservation:** Inefficient energy use in mining can lead to wastage, reducing the overall energy available for sustainable practices.
- **Pollution:** Emissions from machinery contribute to air pollution, while runoff from mining sites can pollute water sources, affecting local ecosystems and communities.

Item 2 Task: Explain how photovoltaic cells can provide electricity for digital learning tools in off-grid rural schools in Uganda.

Answer: Photovoltaic (PV) cells convert sunlight directly into electricity through the photovoltaic effect. When light photons strike the PV cell, they excite electrons, generating an electric current.

1. Application in Off-Grid Schools:

- Solar panels can be installed on school rooftops to capture sunlight, which is then converted into usable electricity.
- This electricity can power digital learning tools like computers and tablets, enhancing educational resources in rural areas lacking reliable electricity.

2. Benefits:

- Reduces dependency on fossil fuels.
- Provides a sustainable, renewable energy source for education.

Item 3 Task: Describe how the concepts of force and pressure apply to the operation of heavy machinery and suggest safety measures.

Answer:

1. Force and Pressure:

- Heavy machinery operates by exerting force on materials. Pressure is defined as force per unit area ($P = F/A$). In a factory setting, the force applied by heavy machinery can create significant pressure on surfaces and materials.
- Proper understanding of pressure helps in designing equipment that can withstand operational loads without failure.

2. Safety Measures:

- Implementing regular maintenance schedules to ensure machinery operates within safe pressure limits.
- Using pressure gauges to monitor machinery operations in real-time.
- Training workers on safe handling and operation practices to prevent accidents.

SECTION B

PART 1

Item 4 Task: Explain thermal expansion and its implications.

Answer: (a) **Thermal Expansion:** The principle states that materials expand when heated and contract when cooled. This phenomenon occurs because increasing temperature causes atoms to vibrate more, requiring more space.

(b) **Expansion Joints:** Bridges and railway tracks have expansion joints to allow for movement due to thermal expansion. Without these joints, structures could warp or crack under temperature changes.

(c) **Everyday Objects:** Thermometers utilize thermal expansion; as liquids (like mercury) heat up, they expand and rise in the tube, indicating temperature changes.

Item 5 Task: Explain voltage, current, and resistance.

Answer: (a) **Ohm's Law:** Ohm's Law states that $V = I \times R$, where V is voltage, I is current, and R is resistance. Increasing resistance in a circuit decreases the current if voltage remains constant, resulting in a dimmer bulb.

(b) **Power Ratings:** Electrical appliances are rated based on power consumption (measured in watts). This rating indicates the amount of energy the device consumes when in use.

(c) **Energy-Efficient Practices:**

- Using LED bulbs instead of incandescent ones.

- Unplugging devices when not in use to reduce standby power consumption.
- Utilizing power strips with timers to limit energy usage.

PART II

Item 6 Task: Explain how speeding increases the risk of fatal accidents.

Answer: Using Newton's laws, particularly the first and second laws of motion:

1. **Increased Risk:** When a vehicle speeds, it has greater momentum ($\text{mass} \times \text{velocity}$), making it harder to stop and increasing the distance needed to brake, which can lead to fatal accidents.
2. **Safer Vehicle Design:** Implementing crumple zones and improved braking systems can reduce the impact force in accidents, as these designs use physics principles to manage energy during collisions.

Item 7 Task: Explain friction and its effects on motion.

Answer: (a) **Friction:** Friction is a force that opposes motion between two surfaces in contact. It affects how objects move; high friction slows down motion, while low friction allows smoother movement.

(b) **Surface Texture:** Surface texture significantly impacts efficiency; rough surfaces create more friction, which can slow down vehicles and machines, while smooth surfaces reduce friction, allowing for more efficient operation.

(c) **Engineering Designs:**

- Roads may be designed with textured surfaces to enhance traction for vehicles.
- Sports equipment, like tennis rackets or skis, is engineered with specific surface textures to optimize performance by balancing grip and glide.



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