

KRYPTON SHARIF EXAMINATION BODY (KSB)

Senior 2 – Physics – Term 2 Mock Examination

Time Allowed: 2 Hours 30 Minutes

INSTRUCTIONS TO CANDIDATES

This paper consists of Section A, Section B Part I, and Section B Part II.

Section A: Attempt ALL three items.

Section B Part I: Attempt ONE item only.

Section B Part II: Attempt ONE item only.

All working should be clearly shown.

Use:

$$g = 10 \text{ m/s}^2$$

Density of water = 1000 kg/m^3 ,

Density of mercury = $13,600 \text{ kg/m}^3$,

Density of air = 1.25 kg/m^3 , unless stated otherwise.

SECTION A (30 Marks) – Attempt ALL items

Item 1

At a construction site, workers use a wheel and axle system to lift loads of cement from the ground to a 3 m raised platform. The radius of the wheel is 40 cm and that of the axle is 10 cm.

The load lifted is 600 N and the applied effort is 200 N.

As a Physics student, your task is to:

- (i) Calculate the velocity ratio of the system.
- (ii) Determine the mechanical advantage.
- (iii) Hence, calculate the efficiency of the machine.
- (iv) Suggest two reasons why the machine is not 100% efficient.
- (v) State any two types of machines that use the wheel and axle principle.

Item 2

In a school project, students install a steel water tank weighing 5000 N on a tower with a metal base of area 1.5 m^2 . The tank supplies water to taps in the kitchen below.

- (i) Calculate the pressure the tank exerts on the tower base.
- (ii) Determine the pressure at the taps if the tank is raised 5 m above the kitchen floor.
- (iii) If the school wants to increase the water pressure at the taps to 2500 Pa, to what minimum height should the tank be raised?
- (iv) In the school's science fair, a lifting pump is demonstrated that pulls water from a depth of 10 m. Calculate the minimum pressure required for the water to rise to this height.
- (v) Suggest one situation where lifting pumps are useful in rural settings, and explain why.

Item 3

While climbing Mount Aegon, a tourist records a barometric height of 76 cm of mercury at the base and 62 cm of mercury near the summit.

As a Physics student, your task is to:

- (i) Convert both barometric heights to pressure in Pascals.
- (ii) Calculate the difference in pressure between the two altitudes.
- (iii) Using air density $\rho = 1.25 \text{ kg/m}^3$, estimate the height of the mountain the tourist has climbed.
- (iv) Explain why cooking takes longer at high altitudes.
- (v) Give two reasons why mountain climbers or passengers in planes might suffer from nose bleeding or headaches.

(vi) Suggest two practical ways to reduce these problems during high altitude travel.

SECTION B PART I (20 Marks) – Attempt ONLY ONE item

Item 4 –

During a school community service day, a group of students lifts water cans (each 20 L) from a borehole 6 m deep. One student takes 8 seconds to lift one full jerrycan.

As a Physics student, your task is to:

- (i) Calculate the weight of one jerrycan.
- (ii) Find the work done in lifting the water.
- (iii) Calculate the power developed by the student.
- (iv) If the student is tired and now takes 12 seconds per lift, calculate the new power and comment on the result.
- (v) Give three ways energy is conserved or lost in this situation.
- (vi) Mention two energy conversions involved in human physical work.

Item 5 –

In a science classroom, a metallic seesaw is set up using a uniform plank of 3 m resting on a pivot at 1 m from one end. A 100 N child sits on the shorter side and a 60 N child sits on the longer side.

As a Physics student, your task is to:

- (i) Calculate the moment of each child about the pivot.
- (ii) State whether the seesaw is balanced or not and justify your answer.
- (iii) Determine the position where a 40 N child could sit to balance the seesaw.
- (iv) Explain how this principle applies to a carpenter balancing a ladder.
- (v) Describe two ways of increasing the stability of tall objects like cabinets and refrigerators.

SECTION B PART II (20 Marks) – Attempt ONLY ONE item

Item 6

Your school plans to install a manual lifting pump to fetch water from a 10 m deep well. The engineering team consults the Physics club to help in planning.

As a Physics student, write a full explanation to:

Describe how a lifting pump works using pressure principles.

Calculate the pressure required to raise water from a 10 m depth.

Discuss whether the atmosphere can provide enough pressure for this height, and explain your answer.

State the maximum height a lifting pump can realistically raise water and why.

Suggest any improvement for the system if the water table drops deeper.

Comment on the sustainability and limitations of using such a pump in a dry season.

Describe how pressure increases with depth

Item 7

In a village mechanical workshop, a gear system is used to lift engines. A gear with 24 teeth is connected to a larger gear of 96 teeth, rotating a drum through a compound pulley system.

As a Physics student, explain clearly:

How the gear system affects speed and force.

Calculate the gear ratio and interpret what it means.

Explain how the pulley system reduces the required effort.

If the pulley system has a mechanical advantage of 4 and lifts a 400 N engine, calculate the required effort.

Describe one way friction can affect the system and how to reduce it.

Suggest a safety practice to observe while operating such compound machines.

The marking guide/responses for this paper.call +256709911018