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S.2 PHYSICS
PAPER 1
(THEORY)
SARB EXAMS
NOV/DEC 2024

SESEMAT MBARARA REGION

END OF YEAR PROMOTIONAL SARB EXAMS 2024

S.2 PHYSICS

535/1

PAPER 1 (THEORY)

TIME: 2 hours

INSTRUCTIONS

- Attempt any four items.
- Graph papers should be provided.

Item I

On a certain construction site, building materials included sand, ceramic tiles, timber, nails, cement, iron bars, aggregates, iron sheets, glass panes bricks, among others. These materials were kept in a central store that had a metallic door. The store keeper observed that on rainy days, the metallic door opened and closed easily while on sunny days, a lot of force had to be applied to close or open the door.

Concrete was raised to the first floor using a pulley system. 350,000 bricks were to be raised to the same floor of height 12m above the ground. Using an inclined plane of length 60m. This machine was only 50% efficient. Each brick had a mass of 3kg and 15 bricks would be carried on a wheel barrow along the inclined plane. (Ignore the mass of a wheel barrow).

Task

As a learner of physics

a) (i) Classify the building materials on the site depending on their strength.
   (ii) What is concrete and how can it be reinforced in the process of construction?
b) Explain why the metallic door behaved the way it did on the different days and conditions.
c) What is the;
   i) Velocity ratio
   ii) Mechanical advantage
   iii) Work input, of the inclined plane.

Item 2

A business man owns a salon car and uses it for special hire. One day, while on duty his car developed a mechanical problem arising from the braking system of the car. He took the car to a garage for servicing.

The car was lifted using a hydraulic lift whose pistons had areas as $3.0 \times 10^{-2} m^2$ and $2 \times 10^{2} m^2$ respectively. The smaller piston of the hydraulic press was pushed down with a force of 120N and the car, placed on a larger piston was seen rising up for clear check up. The mechanic also discovered that the same car had broken side mirrors that needed replacement.

Task

As a learner of physics

a) (i) Name the suitable mirror that should be bought to replace the broken ones.

(ii) Draw ray diagrams to show and explain why such a mirror is preferred to other mirrors for this purpose.

b) (i) State the principle on which the hydraulic lift works.

(ii) What force was required to push the larger piston so as to raise the car?

Item 3

In a physics practical lesson for S.2 a teacher prepared different materials including magnets with known poles, piece of thread, stand and clamp, plane paper, iron nails, bicycle spoke, campus needle and iron fillings. Learners in their different groups were tasked to make a magnet and they all did. However the magnets made did not have specific polarity labeled on them.

Later on in one group, learners were seen suspending the made magnet and it rested pointing in a specific direction. In another group two learners used the made magnets to pull a bicycle spoke horizontally on a table. One of them applied a force of 6N pulling the spoke eastwards and another applied a force of 2N pulling westwards.

Task

As a learner of physics

a) (i) Describe any one method you could have used in your group to make a magnet using the materials provided. Include also how polarity would be determined.

(ii) Mention the direction the made magnet kept pointing when it rested and explain why a magnet rests in this specific direction.

b) What is the magnitude of the resultant force that acted on the bicycle spoke when pulled by the two learners?

Item 4

Students from a certain school in Uganda visited the United Kingdom in June – July and experienced dry weather conditions, long hours of day time and short hours of night time. Another group of students visited the same country in November – December and experienced very cold weather conditions, long night time.

The two groups of students had carried digital thermometers calibrated in Kelvin scale and were interested in recording temperatures in their rooms. The group that visited in summer recorded an average temperature of 295K and the group that visited in winter recorded an average temperature of 246K.

These students were given chance to share their experiences with parents on an Annual General Meeting (AGM) in school and even mentioned the four seasons experienced in the United Kingdom. The parents were excited but also

confused since in Uganda we experience only two seasons – the dry season and wet season.

Task

As a learner of physics

a) (i) Name the four seasons in the United Kingdom mentioned by the students.
   (ii) Explain what causes long hours of day time and short hours of night time.
   (iii)Explain to the parents how seasons occur.
b) What is the equivalent of the two temperatures in degrees Celsius, measured by the two groups of students?

Item 5

A group of S.2 learners did a project at school to solve a problem of too much sunshine striking cars of staff members since they were always parked outside. They designed a car shed and the roof structure was made of timber.

When the teacher saw this product, he advised the learners to improve on the roof structure and make it stronger so as to sustain the weight of iron sheets.

In the same car shed the learners designed hangers using a spiral spring and other materials so that staff members could use them for hanging their jackets and raincoats. They used a spiral of spring constant $20Nm^{-1}$ since they had carried out a scientific investigation to confirm this. The results they obtained in this investigation were recorded in table 1 below.

Extension (cm)	5.0	20.0	32.0	42.0	42.5	40.0	41.0	40.0
Load (N)	0.4	2.3	4.0	5.8	6.5	7.0	7.5	8.5

Table 1

Task.

As a learner of physics,

a) Advise the learners on how to improve the car shed model and draw a sketch diagram to support your explanation. On your diagram identify and name any two different girders.
b) Use the data in table 1 to plot a graph of extension against load. Use the graph to determine whether the force constant of the spring was the right one.
c) From the graph determine the maximum load beyond which the spring does not return to the original length if it is to sustain the weight of jackets.