**END OF TERM TWO EXAMINATIONS 2025**

**S.5 PHYSICS PAPER ONE**

**TIME: 2 HOURS :30 MINUTES**

**INSTUCTIONS:**

This paper consists of two sections; **A** and **B** having **four** items.

Answer **four** items in the whole paper.

**SECTION A (MECHANICS)**

**ITEM 1:**

During the designing of a vehicle, an engineer mentioned some terms to his helpers such as **moment of a force, centre of gravity and stability** which are applicable during the design. In the same sense he wanted them to know more practically about the terms before designing. He had a uniform rod **AB** of length **2m** weighing **3.5kg**. He hangs a mass of **10kg** from end **A** and a mass of **2.6kg** from end **B.** The system was suspended from point **N** of the rod where **N** is **y** metres from end **A** so that the rod is horizontal.

**Task:**

As a physics student, help:

 (a) Explain the following terms to the helpers:

 (i) Moment of a force

(ii) Centre of gravity

(iii)Stability

1. Understand the daily life application of:
2. Moment of a force.
3. Principle of moment.
4. Explain the three different types of equilibrium.
5. Explain why the tyres are made wide and the designed vehicle short.
6. Determine the value of y.

**ITEM 2**

Your father hires a vehicle to transport you to school. While in the vehicle some terms were mentioned which are already in physics. The vehicle sets off from home at 6:00am and accelerates uniformly from rest to attain a final velocity of 25𝑚𝑠−1 in 400𝑠. On reaching the highway road, it maintains this velocity for 700s and it finally reaches the school at 8:30am.

### Task

As a student of physic help your father to

(a) (i)Draw a sketch of velocity time graph

(ii) Determine the total distance covered and hence find the total amount of money the father paid if the hiring company charges a fee of UGX **800 per kilometre** of the distance covered.

 (b)understand the following terms and their sI units:

 (i) speed

 (ii) velocity

 (iii) acceleration

 (c) briefly explain how the acceleration due to gravity can be determined in the laboratory if given a pendulum bob.

**ITEM 3**

In a physics lab, a student investigates how energy is stored and stored and transferred in an elastic system. She suspends a spring vertically and gradually adds weights. When a 2.0 kg mass is attached, the spring stretches by 10.0 cm. She then pulls the mass down by an additional 5.0 cm and releases it, initiating vertical oscillations. Assume the spring obeys Hooke’s law, and there is no energy loss.

Later, the same spring is used to lift a 3.0 kg object vertically through a height of 1.5 m using a pulley system powered by a motor that takes 5.0 seconds.

**TASKS:**

1. Using the experimental data, determine the spring constant of the spring. Show your reasoning.
2. Using appropriate energy principles, derive an expression for the expression for the **maximum speed** of the 2.0 kg mass as it oscillates through equilibrium. Hence calculate the **maximum speed**.
3. Compare the **gravitational potential energy lost** with the **elastic potential energy gained** when the spring is stretched by 10.0 cm. Discuss whether mechanical energy is conserved at equilibrium.
4. The student claims, “elastic potential energy can be used to lift masses more efficiently than electric motors.’’ Using energy and power concepts, **critically assess** this claim with reference to both stages of the experiment.
5. Derive an expression for the **energy stored per unit volume** in the spring, in terms of **stress** and **strain**. Clearly show your working.

**SECTION B (HEAT)**

**ITEM 4**

The data blow was obtained during an experiment to determine the specific heat capacity of a liquid using the **continuous flow method**. The specimen liquid was to be used as a coolant in the chicken feeds power plant at **SEETA POULTRY FARM.**

The technician had earlier advised that any suitable liquid must have a specific heat capacity in a range of 2300Jkg-1K-1 to 3500Jkg-1K-1.

|  |  |  |
| --- | --- | --- |
|  | **EXPERIMENT 1** | **EXPERIMENT 2** |
| **P.D across heater (V)** | 10.00 | 3.00 |
| **Heating current (A)** | 0.30 | 0.20 |
| **Inflow temperature (0C)** | 35 | 35 |
| **Outflow temperature (0C)** | 41 | 41 |
| **Mass of liquid used (kg)** | 0.25 | 0.03 |
| **Time taken (s)** | 200 | 120 |

As a physics student, help the society leaders to:

1. Understand the difference between heat capacity and specific heat capacity, giving their respective SI unit.
2. Be aware of any advantages of the method used above.
3. Know any precautions taken in the above experiment.
4. Confirm if the specimen liquid tested is suitable for this purpose.

**END**