

Written Final Examination in Physics

I. Numerical Problems

1. A model train is travelling around a circular track of radius 1m at a speed of 0.4 m/s. Find the period of revolution and its angular speed. 10 marks

2. A railway freight wagon with a mass of 30 tonnes travelling at a velocity of 12 m/s catches up with another freight wagon with a mass of 20 tonnes travelling at a velocity of 7 m/s and collides into it. The two wagons move on coupled together.

- a) What will be the momenta and velocities of the two wagons after the collision?
- b) How much will the kinetic energy of the system change?

15 marks

3. An immersion heater is connected to a voltage of 230V. Determine its resistance, given that it takes 10 minutes to raise the temperature of 1kg of water by 20°C.

(The specific heat of water is $4.2 \cdot 10^3 \frac{\text{J}}{\text{kg K}}$. Ignore all losses of energy.)

15 marks

4. A cylinder in a workshop contains gas at a pressure of 6 MPa and a temperature of 27 °C.

- a) What will be the pressure of the remaining gas in the cylinder if 20% of the gas is used up, and the temperature stays constant?
- b) What will be the pressure if the used cylinder is transferred from the workshop to a storeroom where the temperature is 7 °C?

20 marks

II. Analysis of an Experiment

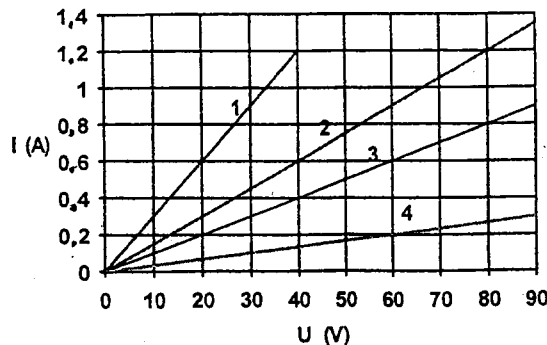
5. An object hanging from a helical spring is oscillating harmonically.

- a) We want to determine the angular frequency of the oscillation.. The materials available are a stopwatch, and a ruler with a millimetre scale on it. Explain how the measurement is carried out and how the measured quantities are used to determine the angular frequency.
- b) How can the measured oscillation period be checked, given the mass of the oscillating object used in the experiment?

20 marks

III. Theoretical Question

6. The graph below shows the currents flowing in four different pieces of wire against the voltage applied between the ends.



a) Explain the theoretical law that can be used to determine the resistances of the wires from the data of the graphs.

b) Using the data of the graphs, list the resistances of the wires in increasing order,

20 marks

A total of 100 marks can be received on this paper.

Evaluation: From 0 to 19 inclusive: fair (1); 70 and above: excellent (5).