AGA KHAN UNIVERSITY EXAMINATION BOARD

HIGHER SECONDARY SCHOOL CERTIFICATE

CLASS XI

MODEL EXAMINATION PAPER 2023 AND ONWARDS

Physics Paper II

Time: 1 hour 30 minutes   Marks: 35

INSTRUCTIONS

Please read the following instructions carefully.

1. Check your name and school information. Sign if it is accurate.

> **I agree that this is my name and school.**
> **Candidate's Signature**

RUBRIC

2. There are TEN questions. Answer ALL questions. Questions 9 & 10 each offer TWO choices. Attempt any ONE choice from each.

3. When answering the questions:

    Read each question carefully.
    Use a black pointer to write your answers. DO NOT write your answers in pencil.
    Use a black pencil for diagrams. DO NOT use coloured pencils.
    DO NOT use staples, paper clips, glue correcting fluid, or ink erasers.
    Complete your answer in the allocated space only. DO NOT write outside the answer box.

4. The marks for the questions are shown in brackets ( ).

5. You may use a scientific calculator if you wish.

Q.1. (Total 3 Marks)

The consequence of special theory of relativity gives the following relation of an object moving with a speed 'v' approaching to the speed of light 'c', relativistic mass 'm' and rest mass 'm_o'.

$$m = \frac{m_o}{\left(1 - \frac{v^2}{c^2}\right)^{1/2}}$$

By using the given dimensions, show that 'm' in the given expression approaches infinity ($m \rightarrow \infty$).

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Q.2. (Total 2 Marks)

Consider the given situations having no acceleration.

Situation 1: A man pulls a spring balance attached to a fixed wall with a force of 10 N.

Situation 2: Two different ropes are attached to each end of a spring balance. Two men pull the spring balance by applying a force of 5 N at each end in opposite directions.

i. Identify whether the reading on the spring balance in **situation 1** is greater than, less than or equal to the reading on the spring balance in **situation 2**.

ii. Identify the condition of equilibrium based on your answer in part (i).

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Q.3. (Total 3 Marks)

Prove that the rate of change of linear momentum of a body is equal to the net force acting on the body.

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Q.4. (Total 2 Marks)

Define centripetal force and write its mathematical formula.

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Q.5. (Total 3 Marks)

In THREE points, relate the equation of continuity with the propulsion of a rocket.

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Q.6. (Total 2 Marks)

Calculate the frequency of a simple pendulum, if its length is 50 cm.

(**Note**: The acceleration due to gravity 'g' is 9.8 m/s^2.)

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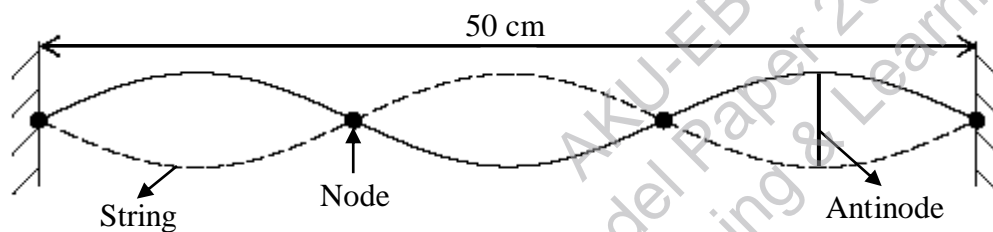**Q.7.** (Total 3 Marks)

Standing waves are formed in an inextensible vibrating string as shown in the given diagram.

Find the wavelength of the standing wave.

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Q.8. (Total 3 Marks)

Two ambulances 'A' and 'B' are moving with velocity of 20 m/s with normal siren frequency of 650 Hz. Ambulance 'A' moves towards a stationary listener while ambulance 'B' moves away from the stationary listener.

Calculate the frequency of the siren heard by the stationary listener from each ambulance.

(**Note**: The speed of sound in the air is 340 m/s.)

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Q.9. (Total 7 Marks)

EITHER

a. Calculate the escape velocities, in kilometre per second, for the Earth and the Moon if their masses are 6.0×10^{24} kg and 7.35×10^{22} kg with radii 6.4×10^{6} m and 1.7×10^{6} m respectively.

(**Note**: The value of Universal Gravitational Constant is 6.67×10^{-11} N.m^2/kg^2.)

OR

b. An 18 horse power (hp) motor raises 200 kg of water through a height of 125 m. Calculate the time (in seconds) that would be needed to raise the water to this height.

(**Note**: The acceleration due to gravity 'g' is 9.8 m/s^2.)

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Q.10. (Total 7 Marks)

EITHER

a. Oceanologists are discussing about the difference in the temperature of the water at the surface and the bottom of the ocean for operating a heat engine.

If they observed 20°C as high temperature and 4°C as low temperature, then calculate the efficiency in the percentage of the heat engine. (7 Marks)

OR

b. 100 J of heat is added in the system of a gas at constant pressure of 1.50×10^2 Pa. If the system experiences a change in volume of 0.1 m^3, then calculate the

i. work done by the gas. (4 Marks)

ii. internal energy change in the process. (3 Marks)

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