SCHOOL: **Your school name**

SENIOR FOUR PHYSICS

END OF TERM EXAMINATION · FREE SAMPLE

Academic year: 20…… – 20…… **Date:** ……/……/20……

Name: …… Class: ……

Duration: 2 hours 30 minutes **Total marks:** 40

Content covered: Unit 1: Reflection and Refraction of Light · Unit 2: Optical Instruments · Unit 3: Moments and Equilibrium of Bodies · Unit 4: Conservation of Linear Momentum and Collision · Unit 9: Laws of Thermodynamics · Unit 10: General Structure of the Solar System

INSTRUCTIONS

1. A full paper has THREE sections and 100 marks: A 55 marks (all questions), B 30 marks (any three of four), C 15 marks (one of two).
2. This free sample shows one extract of each section.
3. Silent non-programmable calculators may be used.
4. Write your answers in the answer booklet provided.
5. Show all your working clearly.

SECTION A (extract of 55 marks)

Attempt ALL questions.

1. A student 1.60 m tall, with eyes 1.50 m above the floor, wants to see her whole body in a vertical plane mirror on the dormitory wall. What is the shortest mirror she needs, and where must its top edge be? (3 marks)

2. Without any equipment, how can an optician quickly tell whether a pair of spectacles is for short sight or long sight? (3 marks)

3. A light rod 100 cm long carries a 2.0 kg mass at the 0 cm end and a 3.0 kg mass at the 100 cm end. Where is the centre of gravity of the system? (3 marks)

4. A rigid 2.0 L tank contains gas at 300 K and 1.0×10^5 Pa. It is heated to 450 K. What is the new pressure? (3 marks)

5. Two moons orbit the same planet. Moon B's orbit radius is 4 times that of moon A. Using Kepler's third law, how does B's orbital period compare with A's? (3 marks)

6. Matching. Match each item in column A with the correct answer in column B. Write the letter in the answer column. (4 marks)

Column A	Answer	Column B
1. The law of conservation of linear momentum applies strictly to which type of system?		**a.** 50 W
2. In a glancing (two-dimensional) collision, how must momentum conservation be applied?		**b.** An isolated system with no net external force
3. A spring with spring constant 200 N/m is compressed by 0.1 m. What elastic potential energy is stored in it?		**c.** Separately along two perpendicular axes (e.g., x and y)
4. A machine does 500 J of work in 10 seconds. What is its power output?		**d.** 1 J

7. Fill in the blanks. Use the words in the box to complete the sentences. One word in the box is not needed. (3 marks)

momentum · constant · 500 W · ½kx²

(i) The elastic potential energy stored in a stretched or compressed spring of spring constant k and extension x is given by the formula ..... .

(ii) The law of conservation of momentum states that in the absence of a net external force, the total momentum of a system remains ..... .

(iii) Rocket propulsion works based on the principle of conservation of ..... .

SECTION B (extract of 30 marks)

Attempt any THREE questions.

8. Conservation of Linear Momentum and Collision **(10 marks)**

(a) A 50 kg girl and a 75 kg boy stand still on smooth ice. She pushes him and moves off at 1.5 m/s. What is the boy's velocity? (3 marks)

(b) On a smooth floor a 2.0 kg puck moving east at 3.0 m/s collides with a 1.0 kg puck moving north at 4.0 m/s, and they stick together. What is their velocity afterwards? (3 marks)

(c) A ball is dropped from rest from a height of 20 m (g = 10 m/s², ignore air resistance). What is its speed just before hitting the ground? (4 marks)

SECTION C (extract of 15 marks)

Attempt only ONE question.

9. Laws of Thermodynamics **(15 marks)**

(a) An engine works between 500 K and 300 K. To raise its Carnot efficiency, is it better to raise the hot temperature by 50 K or to lower the cold temperature by 50 K? (5 marks)

(b) A paddle wheel stirs a gas inside a rigid, insulated container, doing 200 J of work on it. Using $\Delta U = Q - W$ (W = work done BY the gas), what are Q, W and ΔU? (5 marks)

(c) Where does the heat removed from food in a refrigerator go? (5 marks)

END