

## PART 1

This part carries 33% of the total examination marks.

You should attempt **ALL ELEVEN** questions in this Part.

Pencil your answers on the CME form provided. Detailed instructions for completing it are printed opposite. Note that each question requires only **ONE** answer. No marks will be given for questions where more than one answer has been selected from the key. There are no penalty marks for incorrect answers.

**Q1** The key contains five statements about the motion of a particle. Four of these statements are wrong and one is correct. Select the **CORRECT** statement from the key for Q1, and pencil across **one** cell in row 1.

KEY for Q1

- A If a particle is in motion, it must be experiencing a force.
- B The greater the magnitude of the force acting on a particle, the greater its speed.
- C A particle that is slowing down must be experiencing a force.
- D A particle cannot accelerate unless its speed changes.
- E If a particle has a constant acceleration vector, it must travel in a straight line.

**Q2** Figure 1 (below) shows a collision between two objects on a straight horizontal frictionless track. Both objects have a mass of 1.0 kg. Their speeds and direction of motion along the track before the collision are marked on the diagram, as is the speed and direction of motion of one object after the collision. What is the speed of the second object after the collision? Choose the response from the key for Q2 closest to your own answer, and pencil across **one** cell in row 2.

KEY for Q2

- A  $2.1 \text{ m s}^{-1}$
- B  $1.7 \text{ m s}^{-1}$
- C  $1.6 \text{ m s}^{-1}$
- D  $0.6 \text{ m s}^{-1}$
- E The question is impossible to answer without knowing whether the collision is elastic.

**Q3** The key consists of five statements about angular momentum and torque. Which statement is **WRONG**? Pencil across **one** cell in row 3.

KEY for Q3

- A If the total external torque acting on a body is zero, its angular momentum cannot change.
- B If the total external force acting on a body is zero, its angular momentum cannot change.
- C A particle on the rim of a revolving wheel has

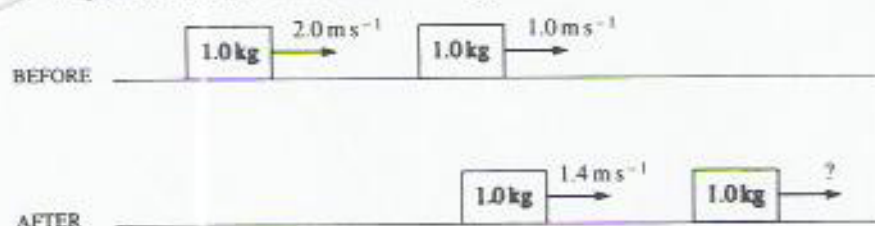


Figure 1

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angular momentum of greater magnitude than that of an identical particle halfway between the axle and the rim.

- D If a body is initially at rest, a force applied through its centre of mass cannot cause it to rotate about the centre of mass.
- E If a single force is applied to the edge of a solid object that is pivoted about its centre, then the resulting torque is always at right angles to the direction of the force.

**Q4** Figure 2 shows two different Maxwell-Boltzmann energy distributions for gases. The key for Q4 lists five statements about these distributions, only four of which are correct. Which is the **INCORRECT** statement? Pencil across **one** cell in row 4.

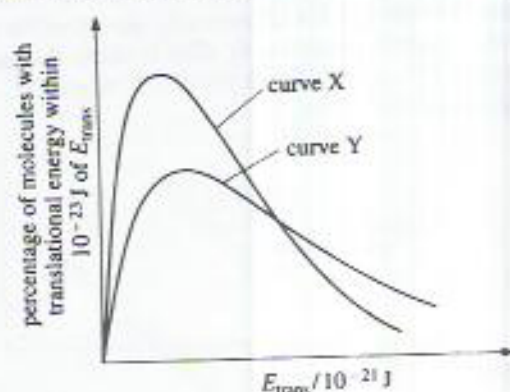


Figure 2

KEY for Q4

- A Curve X corresponds to a lower temperature than curve Y.
- B Curve X and curve Y cannot correspond to the same temperature.
- C Curve X and Y cannot correspond to the same gas.
- D Curve X could correspond to hydrogen and curve Y to oxygen.
- E The average molecular translational energy for curve X is less than that for curve Y.

**Q5** A pendulum is constructed from a thread of negligible mass, one end of which is attached to a heavy bob while the other end is attached to the ceiling. Neglecting the effects of air resistance, estimate the length of the thread if the period of the pendulum is 2.0 s. Select from the key the option that is **closest** to your answer. Pencil across **one** cell in row 5.

KEY for Q5

- A 0.5 m
- B 1.0 m
- C 1.5 m
- D 2.0 m
- E 2.5 m

$$T = 2\pi\sqrt{\frac{l}{g}}$$

$$l = \frac{T^2 g}{4\pi^2}$$

TURN OVER