

PART I

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 a moving particle, only one of which is correct. Select the **CORRECT** statement from the key for Q1, and pencil across *one* cell in row 1.

KEY for Q1

- A A particle moving in a straight line at a constant speed experiences a net force of constant (non-zero) magnitude.
- B If the total force acting on a particle is doubled, its speed will also double.
- C When the magnitude of the total force, acting on a particle moving in a straight line, is reduced to zero, the particle will slow down.
- D A particle in uniform circular motion experiences a net force of constant magnitude.
- E The velocity of a particle must have the same direction as its acceleration.

Q2 On a frictionless, horizontal surface, a coin A of mass m approaches a stationary coin B, also of mass m , along the straight line connecting the centres of mass of the two coins. Assuming that v is the constant velocity of A *before* it collides **elastically** with B, select from the key for Q2 the one **CORRECT** option for the velocities of the two coins *after* the collision. Pencil across *one* cell in row 2.

KEY for Q2

- A $v_A = 0; v_B = 0$
- B $v_A = 0; v_B = v$
- C $v_A = -v; v_B = 0$
- D $v_A = \frac{1}{2}v; v_B = \frac{1}{2}v$
- E $v_A = -\frac{1}{2}v; v_B = \frac{1}{2}v$

Q3 The five statements in the key below concern relationships between force, torque and angular momentum; four of them are true. Select the *one* statement that is **WRONG** in the key for Q3, and pencil across *one* cell in row 3.

KEY for Q3

- A The total torque acting on a body is equal to the rate of change of its angular momentum.
- B If the total force acting on a body is zero, its angular momentum remains constant at all times.
- C A force acting at the centre of mass of a stationary object does not change the angular momentum of the object about its centre of mass.

D The internal torques acting within a system of objects do not change its total angular momentum.

E If the total external torque acting on a system is zero, the total angular momentum of the system is a constant vector.

Q4 For an ideal gas, consisting of a fixed number of molecules, the ratio PV/T is a constant. Select from the key for Q4 the **CORRECT** SI units for this constant. Pencil across *one* cell in row 4.

KEY for Q4

- A Nm K
- B $\text{Nm}^{-1} \text{K}$
- C $\text{Nm}^{-1} \text{K}^{-1}$
- D Nm K^{-1}
- E Since it is a constant, the ratio PV/T has no units.

Q5 Figure 1 shows a standing wave on a string fixed between two points 10 m apart. Choose from the key for Q5 the **CORRECT** value for the wavelength, and pencil across *one* cell in row 5.

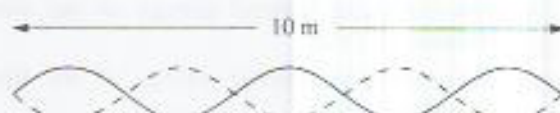


Figure 1

KEY for Q5

- A 2 m
- B 3 m
- C 4 m
- D 5 m
- E 6 m
- F 10 m

Q6 Calculate (to one significant figure) the separation of two 3 nC (i.e. $3 \times 10^{-9} \text{ C}$) point charges in free space that repel each other with a force of magnitude $2 \times 10^{-7} \text{ N}$. Choose *one* answer from the key for Q6, and pencil across *one* cell in row 6.

KEY for Q6

- A 0.1 m
- B 0.2 m
- C 0.4 m
- D 0.6 m
- E 0.8 m

Q7 The magnetic energy stored by a solenoid is 200 mJ when a current of 4.0 A is flowing. What is the inductance of the solenoid? Choose *one* item from the key for Q7, and pencil across *one* cell in row 7.

KEY for Q7

- A 50 mH
- B 25 mH
- C 13 mH
- D 6 mH
- E The question cannot be answered because the number of turns in the solenoid is not given.

$$200 \times 10^{-3} = \frac{1}{2} L I^2$$

TURN OVER