87. 9702_w18_qp_23 Q: 2

(a) State what is meant by *kinetic energy*.

.....

.....[1]

(b) A cannon fires a shell vertically upwards. The shell leaves the cannon with a speed of 80 m s^{-1} and a kinetic energy of 480 J. The shell then rises to a maximum height of 210 m. The effect of air resistance is significant.

(i) Show that the mass of the shell is 0.15 kg.

[2]

(ii) For the movement of the shell from the cannon to its maximum height, calculate

1. the gain in gravitational potential energy,

gain in gravitational potential energy = ... J [2]

2. the work done against air resistance.

work done = ... J [1]

(iii) Determine the average force due to the air resistance acting on the shell as it moves from the cannon to its maximum height.

force = ... N [2]

(iv) The shell leaves the cannon at time $t = 0$ and reaches maximum height at time $t = T$.

On Fig. 2.1, sketch the variation with time t of the velocity v of the shell from time $t = 0$ to time $t = T$. Numerical values of v and t are not required.

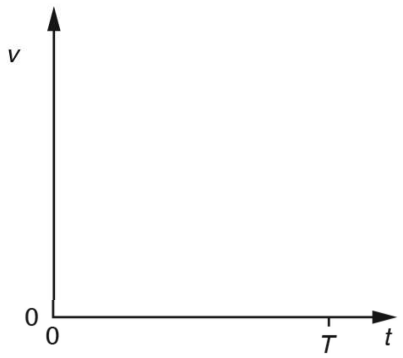

Fig. 2.1

[2]

(v) The force due to the air resistance is a vector quantity.

Compare the force due to the air resistance acting on the shell as it rises with the force due to the air resistance as it falls.

.....

.....

.....

.....

.....[2]

[Total: 12]

69. 9702_s17_qp_22 Q: 4

(a) State Newton's first law of motion.

.....

.....[1]

(b) An object A of mass 100 g is moving in a straight line with a velocity of 0.60 m s^{-1} to the right. An object B of mass 200 g is moving in the same straight line as object A with a velocity of 0.80 m s^{-1} to the left, as shown in Fig. 4.1.

Fig. 4.1

Objects A and B collide. Object A then moves with a velocity of 0.40 m s^{-1} to the left.

(i) Calculate the magnitude of the velocity of B after the collision.

magnitude of velocity = ...m s^{-1} [2]

(ii) The collision between A and B is inelastic.

Explain how the collision is inelastic and still obeys the law of conservation of energy.

.....

.....

.....[1]

[Total: 4]

83. 9702_s18_qp_22 Q: 2

(a) State the principle of conservation of momentum.

.....

.....

.....[2]

(b) A stationary firework explodes into three different fragments that move in a horizontal plane, as illustrated in Fig. 2.1.

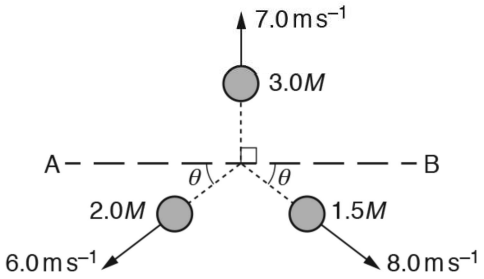

Fig. 2.1

The fragment of mass $3.0M$ has a velocity of $7.0\,m\,s^{-1}$ perpendicular to line AB.
The fragment of mass $2.0M$ has a velocity of $6.0\,m\,s^{-1}$ at angle θ to line AB.
The fragment of mass $1.5M$ has a velocity of $8.0\,m\,s^{-1}$ at angle θ to line AB.

(i) Use the principle of conservation of momentum to determine θ.

θ = ... ° [3]

(ii) Calculate the ratio

$$\frac{\text{kinetic energy of fragment of mass } 2.0M}{\text{kinetic energy of fragment of mass } 1.5M}.$$

ratio = ...[2]

[Total: 7]