1

An object A of mass 9.0 kg and object B of mass 1.0 kg travel towards each other along a smooth horizontal surface in a straight line and collide head-on. The initial speeds of object A and B before the collision are u and $3u$ respectively.

In Fig. 1.1, the variation with time t of momentum p is shown from t = 0 to 3.0 s for particle A and from t = 0 to 1.0 s for particle B.

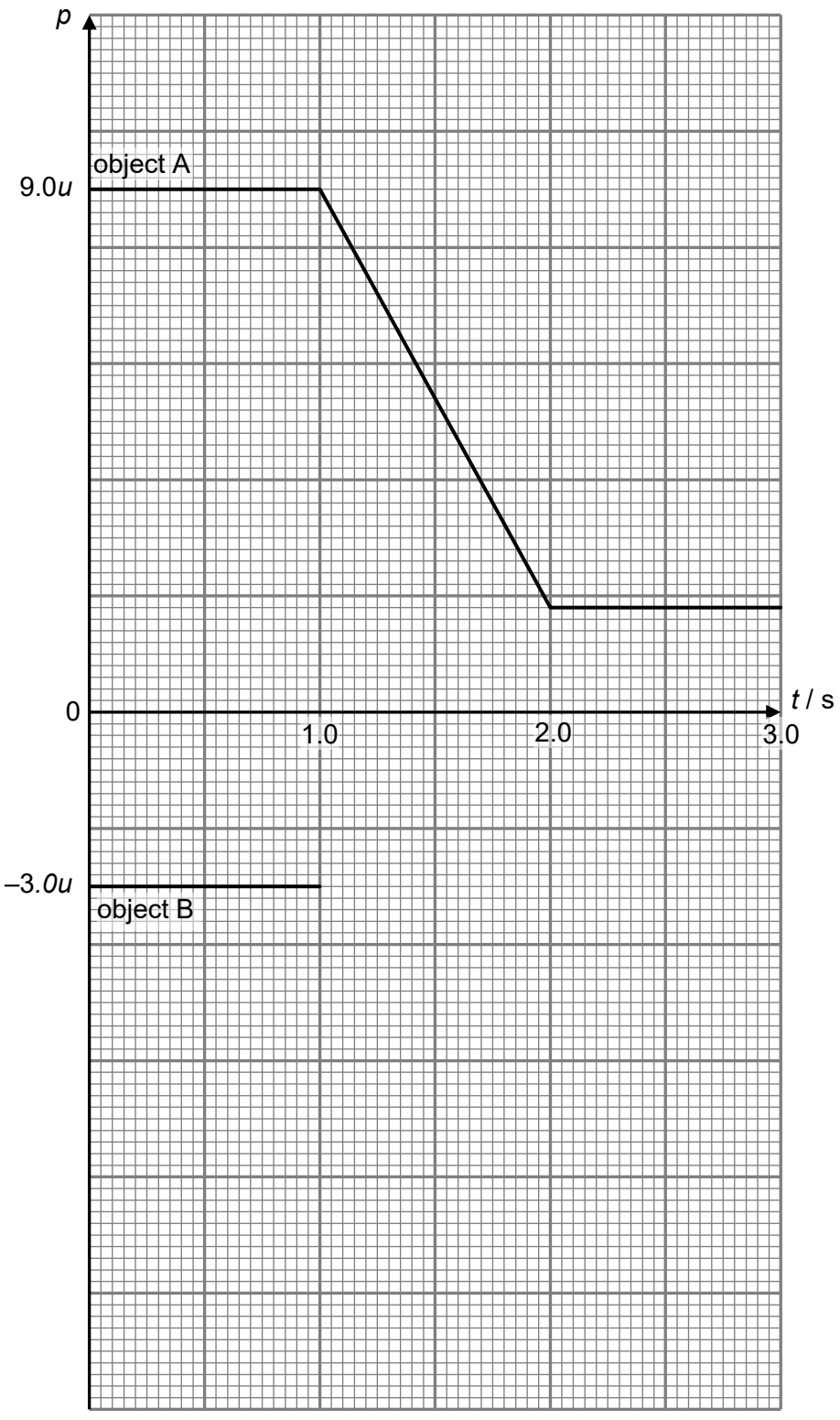

Fig. 1.1

(a)

(i)

Momentum is conserved when two objects collide or interact. State the condition under which momentum is conserved.

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[1]

(ii)

On Fig. 1.1, draw the variation with t of p from 1.0 s to 3.0 s for object B.

[2]

(iii)

Explain how the principle of conservation of momentum is used to complete the graph in **(a)(ii)**.

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[1]

(b)

Explain, with appropriate working, whether the collision between objects A and B is elastic.

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[3]

(c)

(i)

Show that the magnitude of the force acting on object A during the collision is 7.2u.

[1]

(ii)

Explain how the graphs in Fig. 1.1 are consistent with Newton's third law of motion during the collision.

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[2]

[Total: 10]