1)

6 An aircraft, initially stationary on a runway, takes off with a speed of $85\,km\,h^{-1}$ in a distance of no more than 1.20 km.

What is the minimum constant acceleration necessary for the aircraft?

A $0.23\,m\,s^{-2}$ **B** $0.46\,m\,s^{-2}$ **C** $3.0\,m\,s^{-2}$ **D** $6.0\,m\,s^{-2}$

2)

8 The acceleration of free fall on Pluto is $0.66\,m\,s^{-2}$.

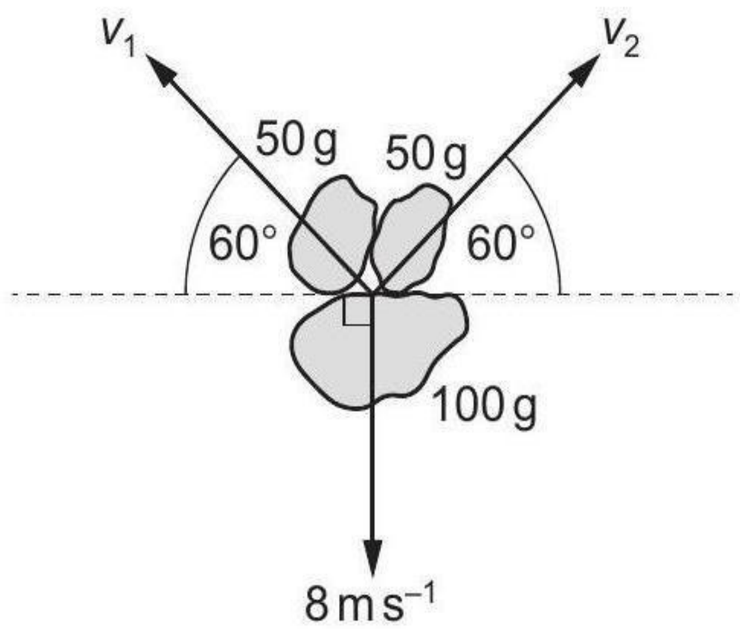
An object weighs 6.0 N on Earth.

What would this object weigh on Pluto?

A 0.40 N **B** 0.93 N **C** 4.0 N **D** 39 N

3)

10 A stationary firework explodes into three pieces. The masses and the velocities of the three pieces immediately after the explosion are shown.



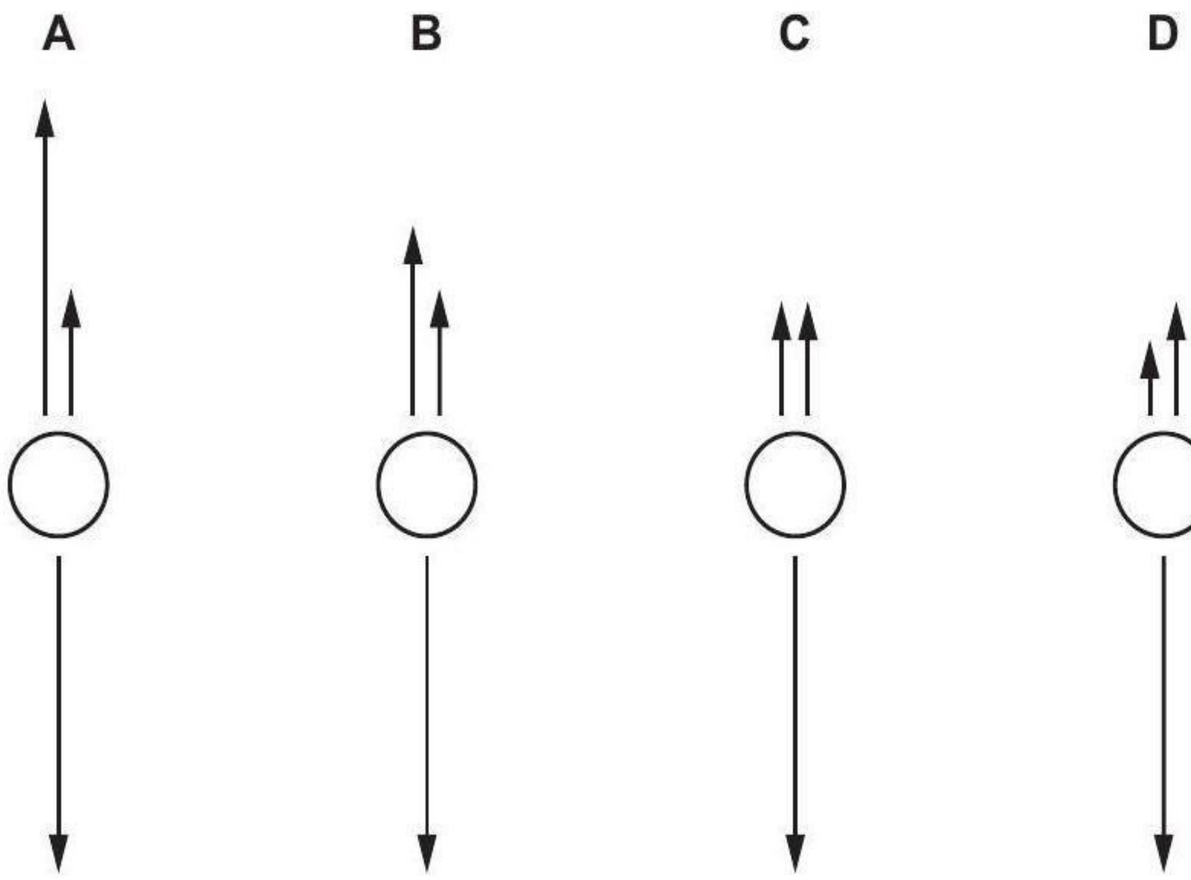
What are speed v_1 and speed v_2?

	$v_1/m\,s^{-1}$	$v_2/m\,s^{-1}$
A	4.0	4.0
B	9.2	9.2
C	14	14
D	16	16

4)

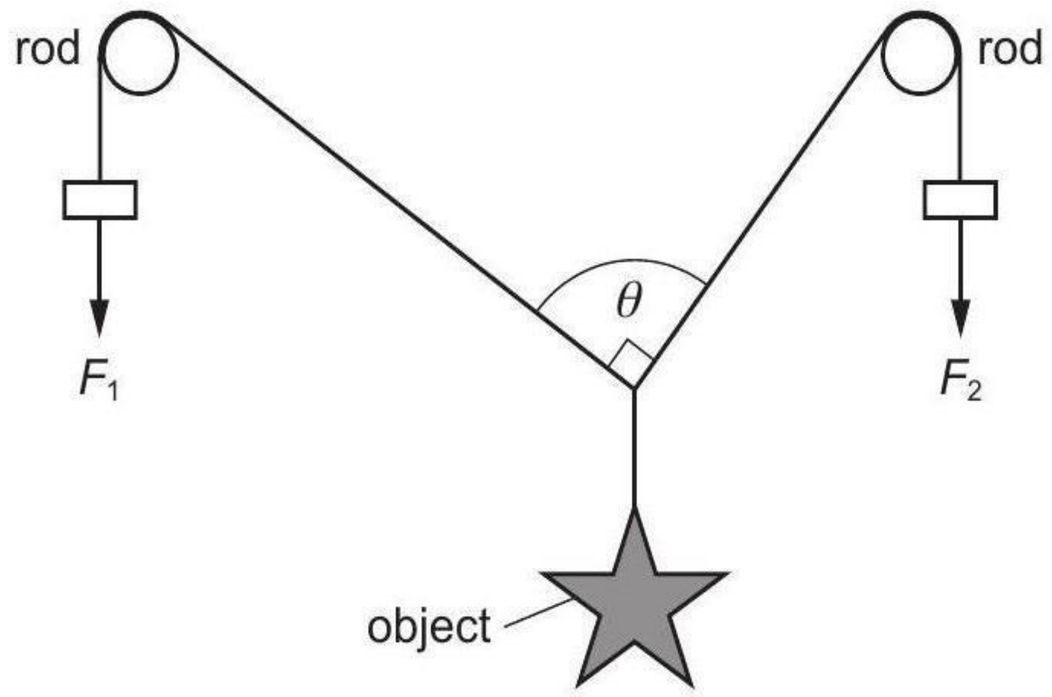
11 A spherical object falls through water at constant speed. Three forces act on the object.

Which diagram, showing these three forces to scale, is correct?



5)

14 An object hangs by means of two cords around two rods, as shown.



The object is held in equilibrium by the forces F_1 and F_2. The object weighs 10 N. There is negligible friction between the rods and cords. Angle θ is 90°.

Which row of the table gives an angle θ of 90°?

	F_1 / N	F_2 / N
A	4.0	6.0
B	6.0	4.0
C	6.0	8.0
D	8.0	6.0

6)

19 A car of mass 1400 kg is travelling on a straight, horizontal road at a constant speed of 25 m s^{-1}. The output power from the car's engine is 30 kW.

The car then travels up a slope at 2° to the horizontal, maintaining the same constant speed.

What is the output power of the car's engine when travelling up the slope?

A 12 kW **B** 31 kW **C** 42 kW **D** 65 kW

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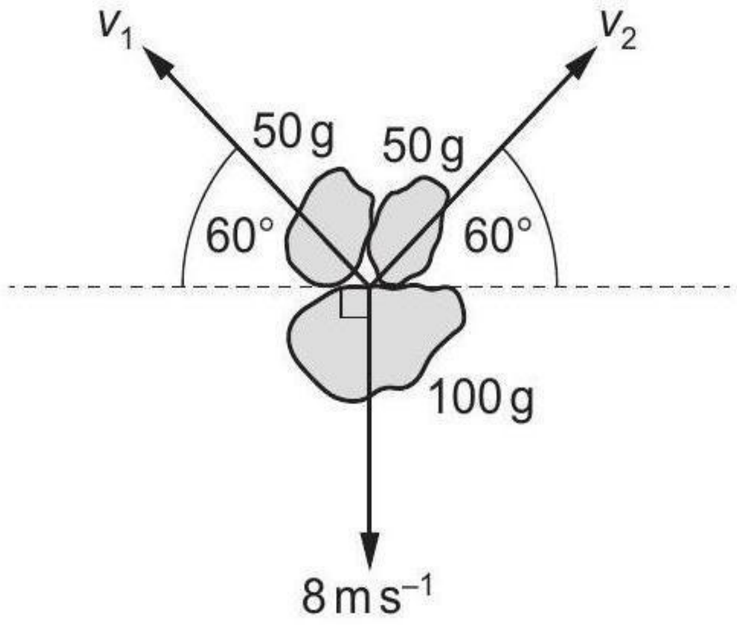

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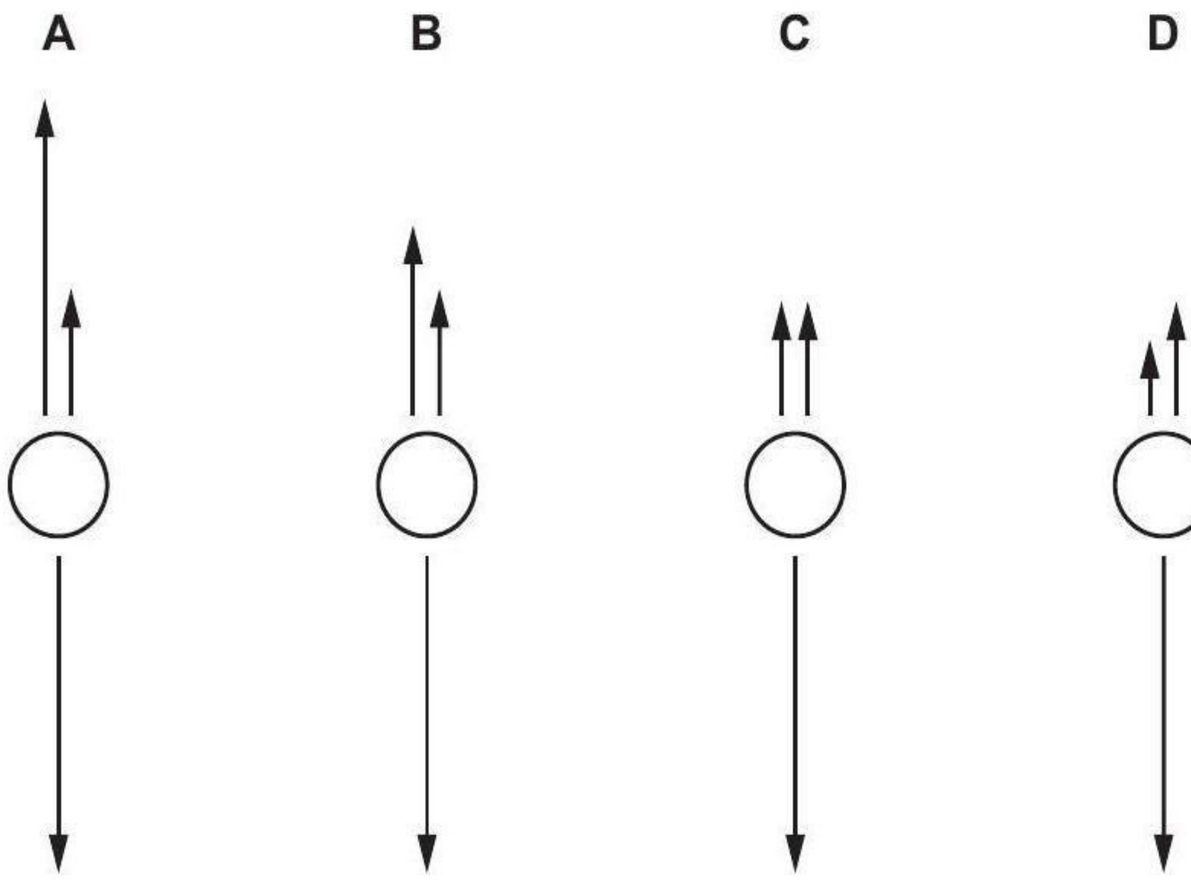

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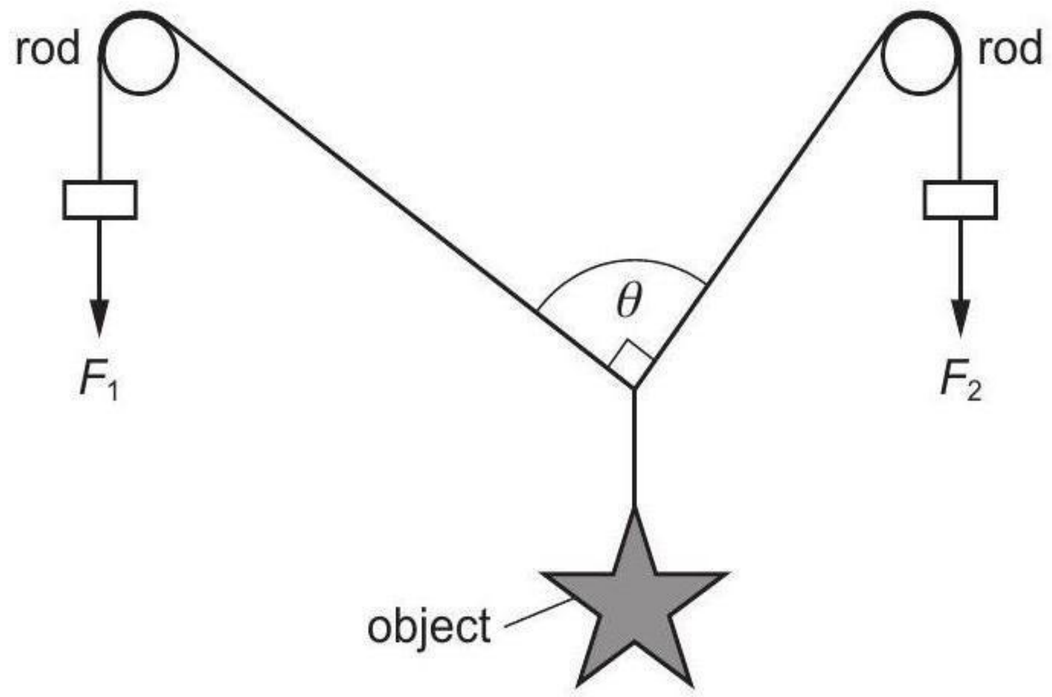

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What is the output power of the car's engine when travelling up the slope?

A 12 kW **B** 31 kW **C** 42 kW **D** 65 kW

12) **3** Two forces of equal magnitude are represented by two coplanar vectors. One is directed towards the east and the other is directed towards the north.

What is the direction of a single force that will balance these two forces?

A towards the north-east

B towards the north-west

C towards the south-east

D towards the south-west

13) **7** A stone of mass *m* is dropped from a tall building. There is significant air resistance. The acceleration of free fall is *g*.

When the stone is falling at a constant (terminal) velocity, which information is correct?

	magnitude of the acceleration of the stone	magnitude of the force of gravity on the stone	magnitude of the force of air resistance on the stone
A	*g*	zero	*mg*
B	zero	*mg*	*mg*
C	zero	zero	*mg*
D	zero	*mg*	zero

14)

10 Steel pellets, each with a mass of 0.60 g, fall vertically onto a horizontal plate at a rate of 100 pellets per minute. They strike the plate with a velocity of 5.0 m s^{-1} and rebound with a velocity of 4.0 m s^{-1}.

What is the average force exerted on the plate by the pellets?

A 0.0010 N **B** 0.0054 N **C** 0.0090 N **D** 0.54 N

15)

13 In which example is it **not** possible for the underlined body to be in equilibrium?

A An aeroplane climbs at a steady rate.

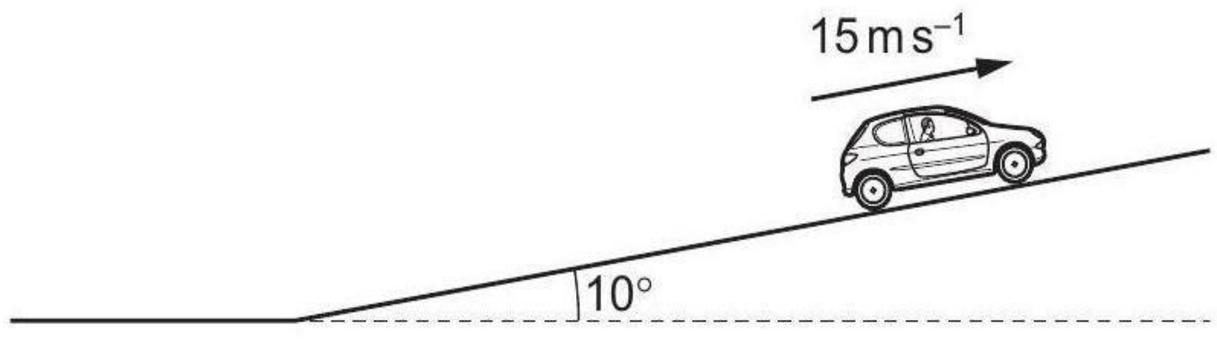
B An aeroplane tows a glider at a constant altitude.

C A speedboat changes direction at a constant speed.

D Two boats tow a ship into harbour.

16)

14 A car of mass 1100 kg is travelling at a constant speed of 15 m s^{-1} up a slope inclined at 10° to the horizontal. The combined frictional forces acting on the car are directed down the slope and are equal to $\frac{W}{5}$, where W is the weight of the car.

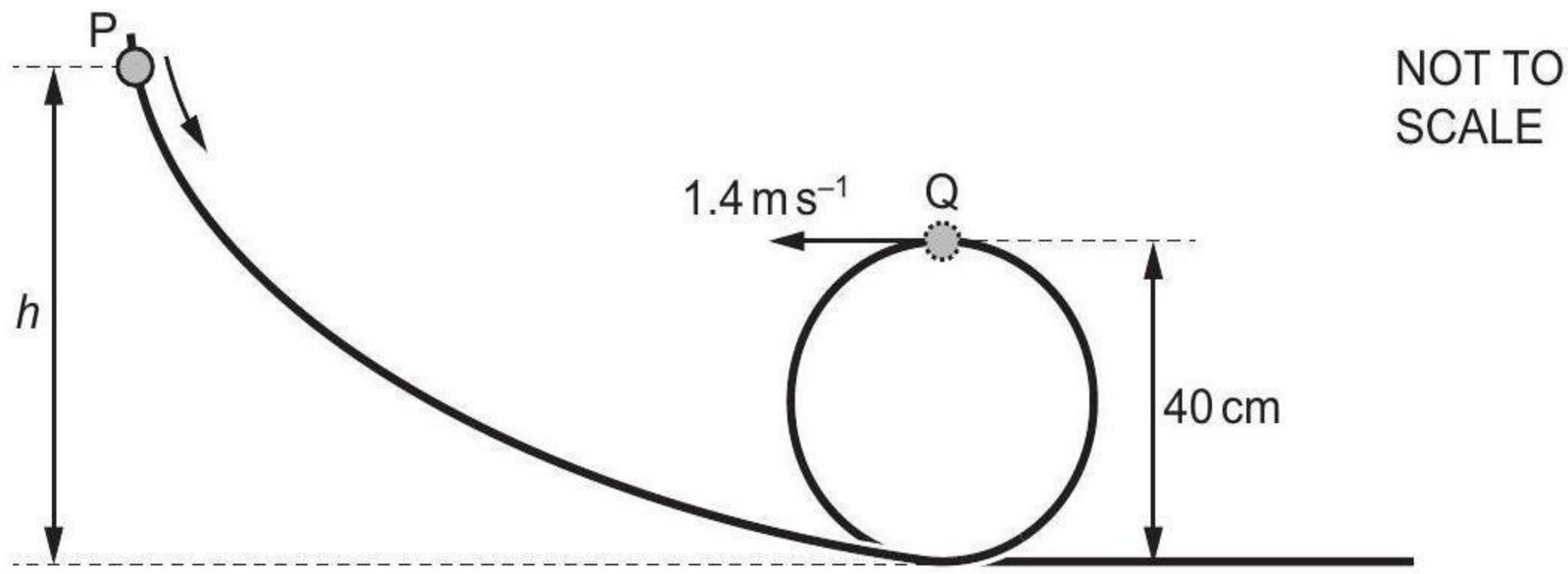


What is the useful output power of the car's engine?

A 28 kW **B** 32 kW **C** 60 kW **D** 190 kW

17)

16 A bead is released from rest at point P and slides along a wire, as shown.



The track loops around and forms a vertical circle of diameter 40 cm. At point Q, the bead has a speed of $1.4\,m\,s^{-1}$.

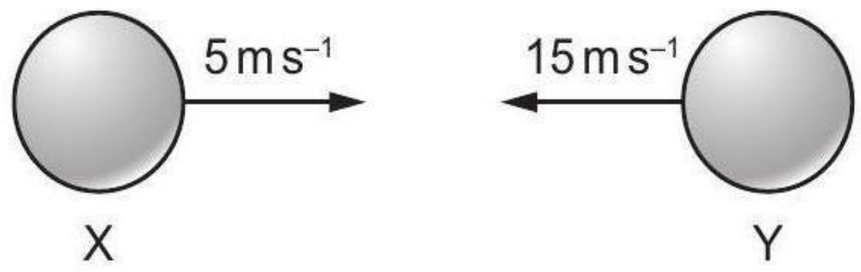
Air resistance and friction on the wire are negligible.

What is the height *h* from which the bead is released?

A 0.30 m **B** 0.40 m **C** 0.50 m **D** 0.60 m

18)

8 Two balls X and Y are moving towards each other with speeds of $5\,m\,s^{-1}$ and $15\,m\,s^{-1}$ respectively.



They make a perfectly elastic head-on collision and ball Y moves to the right with a speed of $7\,m\,s^{-1}$.

What is the speed and direction of ball X after the collision?

A $3\,m\,s^{-1}$ to the left

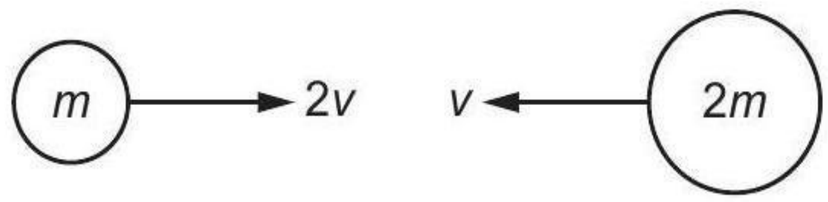
B $13\,m\,s^{-1}$ to the left

C $3\,m\,s^{-1}$ to the right

D $13\,m\,s^{-1}$ to the right

19)

10 Two balls, of masses m and $2m$, travelling in a vacuum with initial velocities $2v$ and v respectively, collide with each other head-on, as shown.



After the collision, the ball of mass m rebounds to the left with velocity v.

What is the loss of kinetic energy in the collision?

A $\frac{3}{4}mv^2$ **B** $\frac{3}{2}mv^2$ **C** $\frac{9}{4}mv^2$ **D** $\frac{9}{2}mv^2$