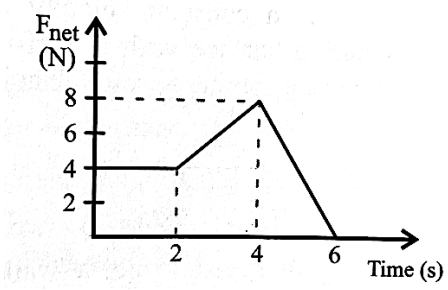
MOMENTUM AND IMPULSE: PART 2

MULTIPLE CHOICE

Question 1

1.1 The graph shows the resultant force variation which acts on an object over a time interval of 6 seconds.



The change in momentum of the object over the 6 second interval is …

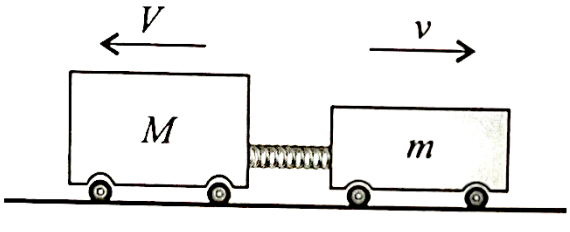
A. 48 kg.m.s^{-1}

B. 24 kg.m.s^{-1}

C. 28 kg.m.s^{-1}

D. 36 kg.m.s^{-1}

1.2 Two trolleys of mass **M** and **m** are joined by a compressed spring. When the spring is released the stationary trolleys separate. Mass **M** attains velocity **V** and mass **m** attains velocity **v**.



If **M > m**, which of the relationships below is true for the trolleys after they have separated?

A. V = v

B. MV + mv = 0

C. MV = mv

D. ½ MV^2 = ½ mv^2

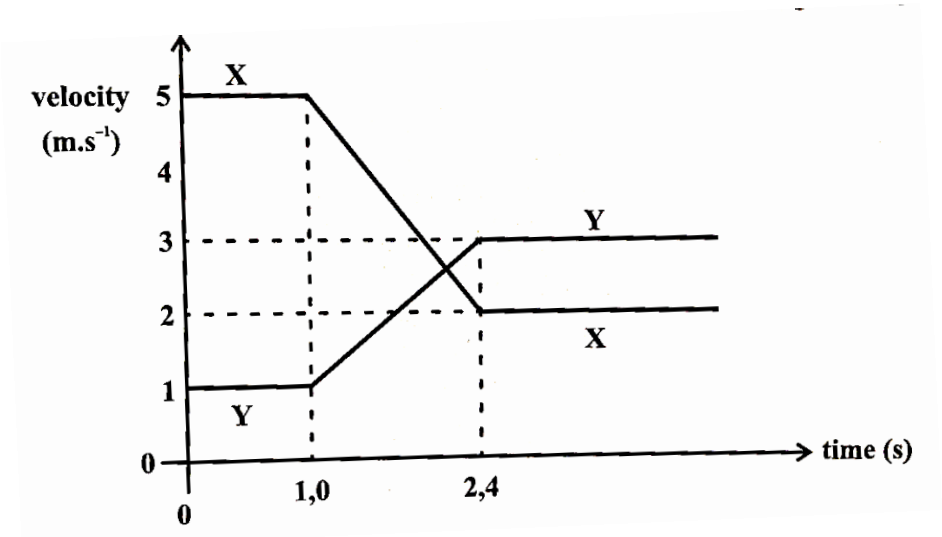
1.3 An object of mass **m** travelling at speed **v** hits a wall in a direction perpendicular to the wall. The collision is elastic.

What is the magnitude of the change in momentum and the kinetic energy of the object?

	Magnitude of change in momentum	**Change in kinetic energy**
A.	0	$2mv^2$
B.	2mv	0
C.	0	mv^2
D.	mv	0

Question 2

Railway carriage **X**, of mass 21 000 kg, crashes into the back of railway carriage **Y**, which is travelling in the same direction as **X** on a straight level track. The graph shows how the velocity of each railway carriage varies with time.



Ignore frictional forces between the railway carriages and the track during the collision. Ignore air resistance.

2.1. Calculate the distance travelled by carriage **Y** between 1,0 s and 2,4 s. (4)

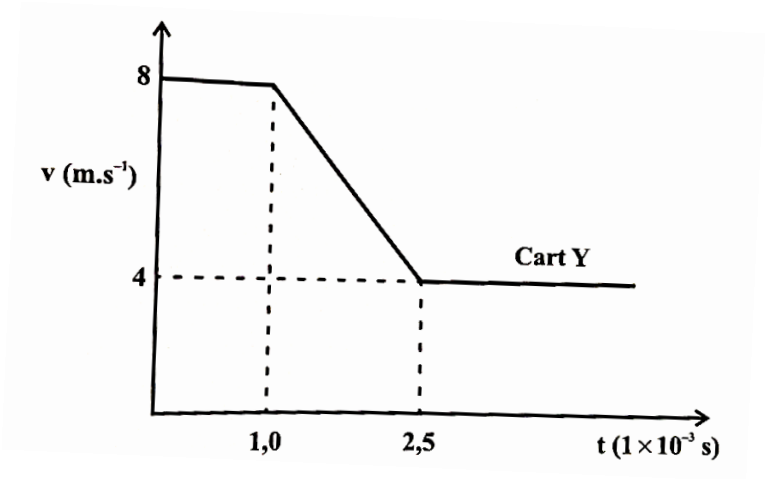
2.2 Calculate the magnitude of the change in momentum of railway carriage X between 1,0 s and 2,4 s. (4)

2.3 Calculate the net force experienced by railway carriage **X** between 1,0 s and 2,4 s. (4)

2.4 Calculate the mass of railway carriage **Y**. (4)

Question 3

A student is experimenting with two carts on a frictionless surface. Cart **X** has a mass of 0,5 kg and is initially at rest. Cart **Y** has a mass of 1,2 kg and collides with cart **X**. Cart **Y** is initially travelling at 8 $m.s^{-1}$ east and travels at 4 $m.s^{-1}$ east after colliding with cart **X**. The velocity of cart **Y** is represented on the velocity time graph below.



3.1 State the law of conservation of momentum. (2)

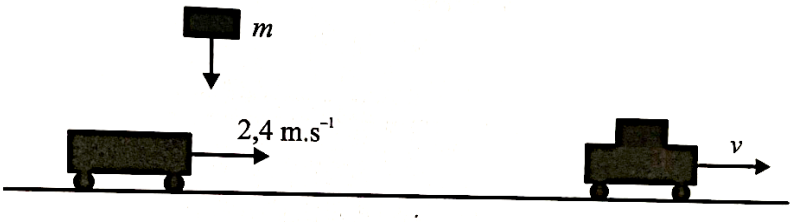
3.2 Calculate the magnitude of the final velocity of cart **X**. (4)

3.3 Calculate the change in momentum of cart **Y**. (4)

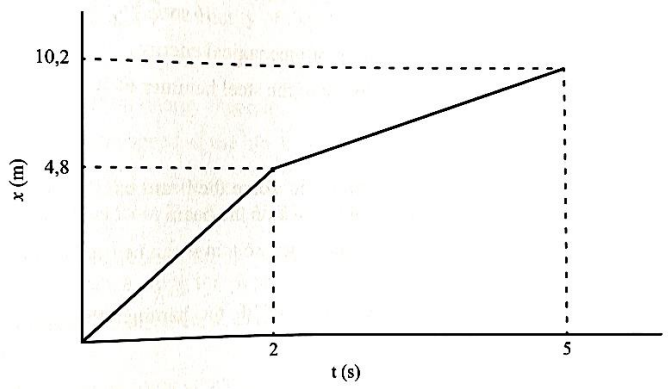
3.4 Calculate the magnitude of the force that cart **X** exerts on cart **Y**. (4)

Question 4

Students are performing an experiment in the lab. A 0,9 kg trolley is travelling with a constant velocity of 2,4 $m.s^{-1}$ on a long frictionless track when a metal cylinder of mass **m** is dropped vertically onto the trolley. The trolley with the metal cylinder continues to move with velocity **v** as shown in the diagram.



The students use video analysis to plot the following **position vs time** graph of the trolley.



4.1 Use the graph to determine the magnitude of the velocity (**v**) of the trolley after the metal cylinder is dropped on the trolley. (3)

4.2 The law of conservation of momentum is a consequence of which of Newton's law? (2)

4.3 Calculate the mass (**m**) of the metal cylinder. (4)