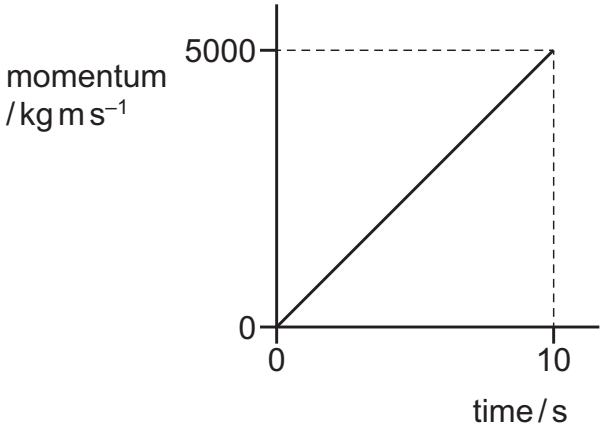
11 The graph shows how the momentum of a motorcycle changes with time.



What is the resultant force on the motorcycle?

A 500 N **B** 5000 N **C** 25 000 N **D** 50 000 N

12 A rocket has a weight of W and an initial acceleration of a as the rocket leaves the ground vertically. The acceleration of free fall is g.

Which expression gives the initial upward force exerted on the rocket due to the engine?

A $\frac{Wa}{g} + W$ **B** $\frac{Wa}{g}$ **C** $\frac{Wa}{g} - W$ **D** $Wa + W$

8 Which statement describes the weight of an object?

A It is equal to the mass of the object multiplied by its acceleration.

B It is equal to the resultant force when the object falls at terminal (constant) velocity.

C It is the force acting on the object due to a gravitational field.

D It is the property of the object that resists change in motion.

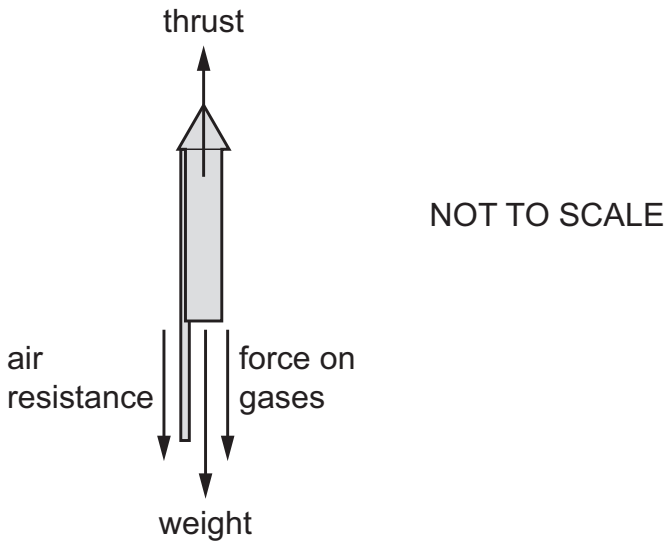
8 The acceleration of free fall on the Earth is different to the acceleration of free fall on the Moon.

How do the mass and weight of an object on the Earth compare to its mass and weight on the Moon?

	mass	weight
A	different	different
B	different	same
C	same	different
D	same	same

10 A firework travels vertically upwards in air. Gases are pushed vertically downwards from the firework.

Several forces that act on the firework and gases are shown.



Which forces are a Newton's third law pair?

A air resistance and force on gases

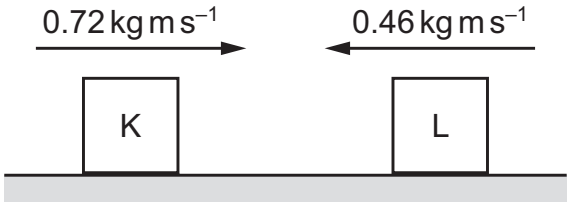
B air resistance and thrust

C force on gases and thrust

D thrust and weight

11 Two blocks K and L slide towards each other along a horizontal frictionless surface.

The diagram shows the momentum of the two blocks just before they collide.



During the collision, the blocks are in contact with each other for a time of 0.084 s.

After the collision, the blocks separate and block L moves back along its original path with a momentum of 0.12 kg m s^{-1}.

What is the magnitude of the average force exerted on block L by block K during the collision?

A 3.1 N **B** 4.0 N **C** 6.9 N **D** 7.1 N

9 A rocket engine ejects 90 kg of exhaust gas per second at a velocity of 190 m s^{-1} relative to the rocket.

What is the force acting on the rocket due to the ejected gas?

A 2.1 kN **B** 17 kN **C** 18 kN **D** 162 kN

11 A cyclist is riding at a constant speed on a level road.

According to Newton's third law of motion, what is equal and opposite to the backward push of the back wheel on the road?

A the force exerted by the cyclist on the pedals

B the forward push of the road on the back wheel

C the tension in the cycle chain

D the total air resistance and friction force

9 Which statement **defines** force?

A When a force acts on a body that is free to move, the force is the product of the mass of the body and its acceleration.

B When a force acts on a body that is free to move, the force is the rate of change of momentum of the body.

C When a force acts on a body that is free to move, the force is the work done by the force divided by the distance moved by the body.

D When a force acts on a lever and causes a moment, the force is the moment divided by the perpendicular distance of the force from the pivot.

2 An object of constant mass moves in a straight line. The variation with time t of the momentum p of the object is shown in Fig. 2.1.

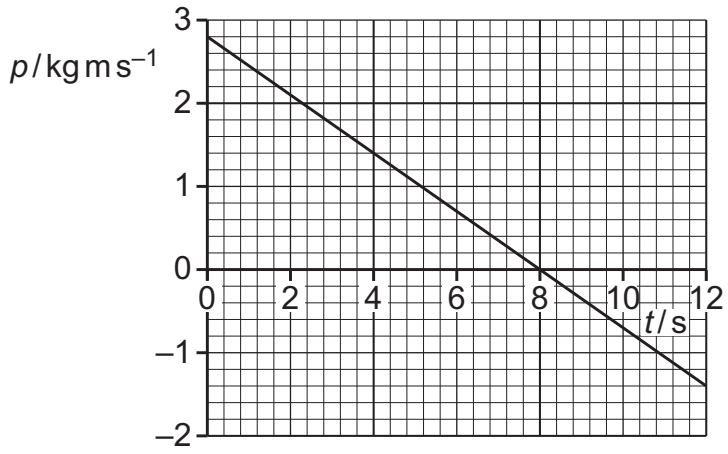


Fig. 2.1

(a) Define momentum.

.....

..... [1]

(b) Calculate the change in momentum of the object from time $t = 0$ to $t = 12\,s$.

change in momentum = ... kg m s^{-1} [1]

(c) Calculate the magnitude of the resultant force acting on the object.

force = ... N [2]

(d) Describe the variation of the speed of the object from time $t = 0$ to $t = 8.0\,s$.

.....

..... [1]

(e) By reference to Fig. 2.1, explain why the resultant force acting on the object during the first 8.0 s of its motion cannot be due to air resistance.

.....

.....

.....

..... [2]

(f) At time $t = 0$ the displacement d of the object is zero.

On Fig. 2.2, sketch the variation of d with time t from $t = 0$ to $t = 12\,s$.

Numerical values of d are not required.

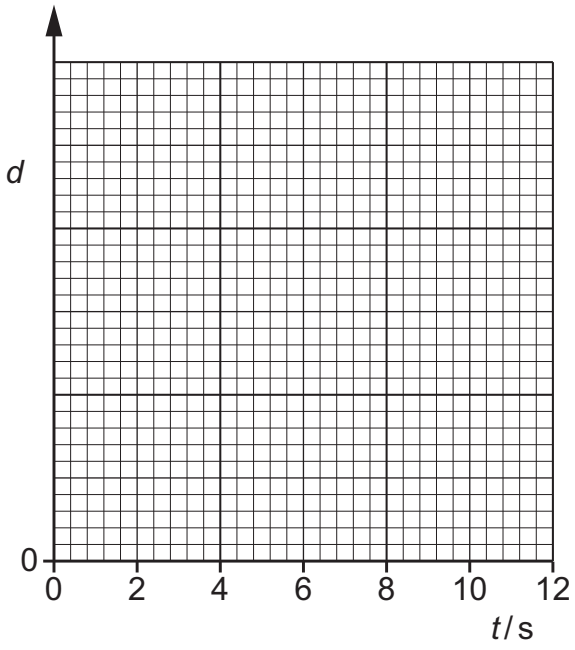


Fig. 2.2

[3]

[Total: 10]

8 An astronaut of mass m in a spacecraft experiences a gravitational force $F = mg$ when stationary on the launchpad.

What is the gravitational force on the astronaut when the spacecraft is launched vertically upwards with an acceleration of $0.2g$?

A $1.2mg$ **B** mg **C** $0.8mg$ **D** 0