

1

Which of the following is a scalar quantity?

- A** kinetic energy ☐
- B** momentum ☐
- C** force ☐
- D** acceleration ☐

(Total 1 mark)

2

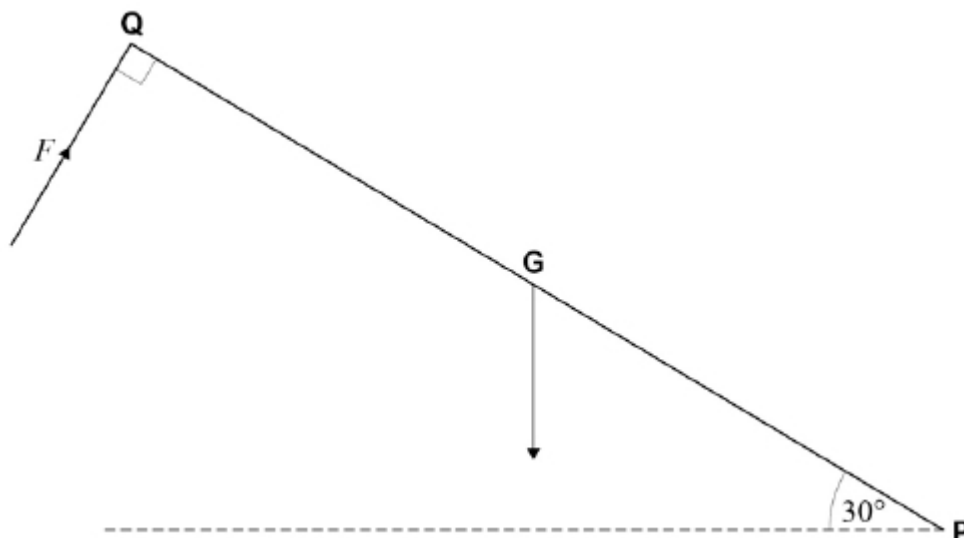
The units of physical quantities can be expressed in terms of the fundamental (base) units of the SI system. In which line in the table are the fundamental units correctly matched to the physical quantity?

	Physical quantity	Fundamental units	
A	charge	$A\ s^{-1}$	<input type="radio"/>
B	power	$kg\ m^2\ s^{-3}$	<input type="radio"/>
C	potential difference	$kg\ m^2\ s\ A^{-1}$	<input type="radio"/>
D	energy	$kg\ m^2\ s^{-1}$	<input type="radio"/>

(Total 1 mark)

3

A car bonnet, represented by **QP**, of mass 12 kg is pivoted at **P**. Its weight acts at **G** where **QG** = **GP** = 1.0 m.



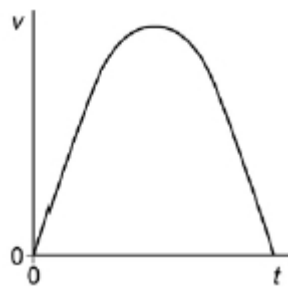
What force, F , acting perpendicular to **QP** as shown, is required to hold the bonnet at 30° to the horizontal?

- | | | |
|----------|-------|-----------------------|
| A | 29 N | <input type="radio"/> |
| B | 51 N | <input type="radio"/> |
| C | 59 N | <input type="radio"/> |
| D | 136 N | <input type="radio"/> |

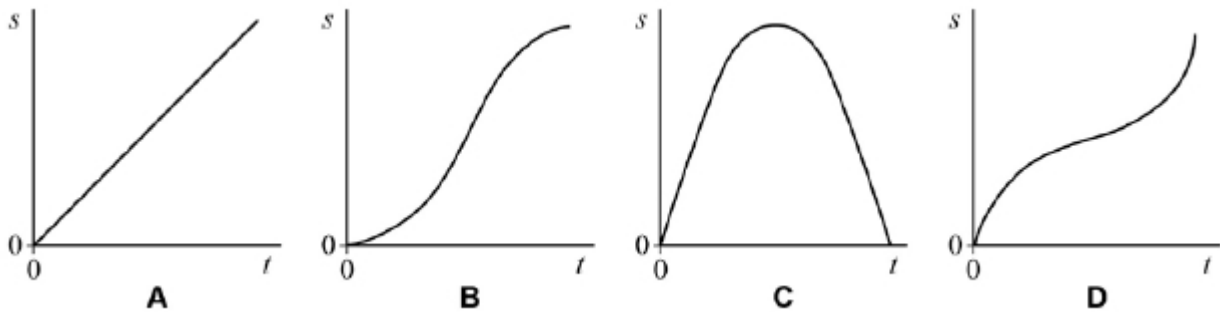
(Total 1 mark)

4

A body travels with speed v , which varies with time t as shown in the graph.



Which one of the graphs, **A** to **D**, shows how the distance s covered by the body varies with time t ?



- | | |
|----------|-----------------------|
| A | <input type="radio"/> |
| B | <input type="radio"/> |
| C | <input type="radio"/> |
| D | <input type="radio"/> |

(Total 1 mark)

5

A stone of mass 0.4 kg is projected horizontally at a speed of 6.0 m s^{-1} from the top of a wall, 5.0 m above the surrounding ground. When it arrives at the ground its speed is 10 m s^{-1} .

How much energy is lost by the stone in falling through the air?

A 2.4 J ☐

B 6.8 J ☐

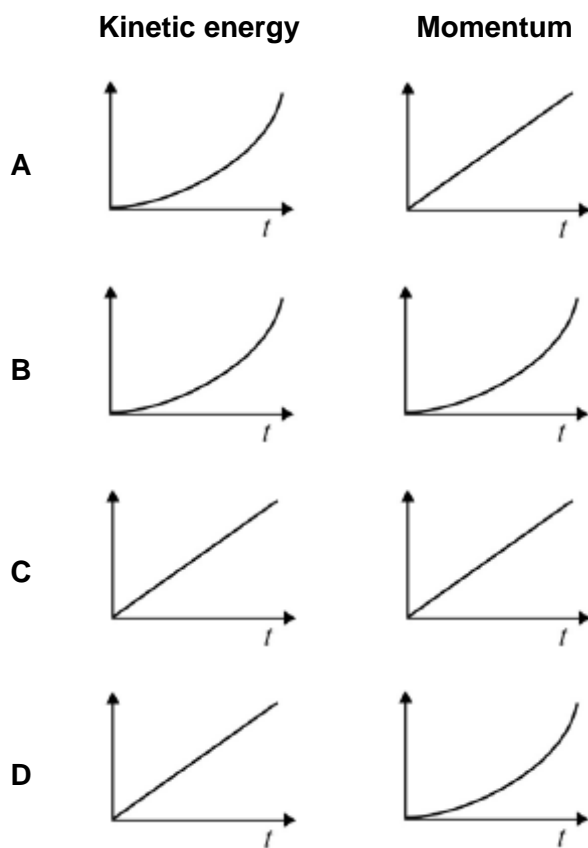
C 12.8 J ☐

D 14.4 J ☐

(Total 1 mark)

6

An object is accelerated from rest by a constant force F for a time t . Which graphs represent the variation of time with the change in the kinetic energy and the change in momentum of the object?



- A ☐
- B ☐
- C ☐
- D ☐

(Total 1 mark)

7

A firework rocket is fired vertically into the air and explodes at its highest point. What are the changes to the total kinetic energy of the rocket and the total momentum of the rocket as a result of the explosion?

	total kinetic energy of rocket	total momentum of rocket	
A	unchanged	unchanged	<input type="checkbox"/>
B	unchanged	increased	<input type="checkbox"/>
C	increased	unchanged	<input type="checkbox"/>
D	increased	increased	<input type="checkbox"/>

(Total 1 mark)

8

Which of the following statements is correct?

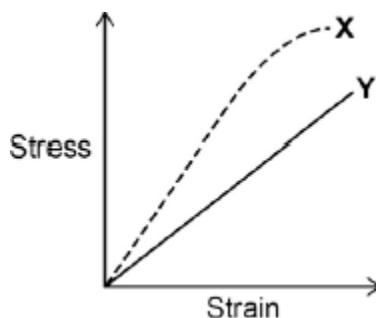
The force acting on an object is equivalent to

- A** its change of momentum. ☐
- B** the impulse it receives per second. ☐
- C** the energy it gains per second. ☐
- D** its acceleration per metre. ☐

(Total 1 mark)

9

The diagram shows how the stress varies with strain for metal specimens X and Y which are different. Both specimens were stretched until they broke.



Which of the following is incorrect?

A X is stiffer than Y

☐

B X has a higher value of the Young modulus

☐

C X is more brittle than Y

☐

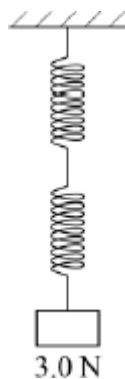
D Y has a lower maximum tensile stress than X

☐

(Total 1 mark)

10

A load of 3.0 N is attached to a spring of negligible mass and spring constant 15 N m^{-1} .



What is the energy stored in the spring?

A 0.3 J

☐

B 0.6 J

☐

C 0.9 J

☐

D 1.2 J

☐

(Total 1 mark)

11

A car exerts a driving force of 500 N when travelling at a constant speed of 72 km h^{-1} on a level track. What is the work done in 5 minutes?

A $3.0 \times 10^6 \text{ J}$

☐

B $2.0 \times 10^6 \text{ J}$

☐

C $2.0 \times 10^5 \text{ J}$

☐

D $1.1 \times 10^5 \text{ J}$

☐

(Total 1 mark)

12

What is the relationship between the distance y travelled by an object falling freely from rest and the time x the object has been falling?

A y is proportional to x^2

☐

B y is proportional to \sqrt{x}

☐

C y is proportional to $\frac{1}{x}$

☐

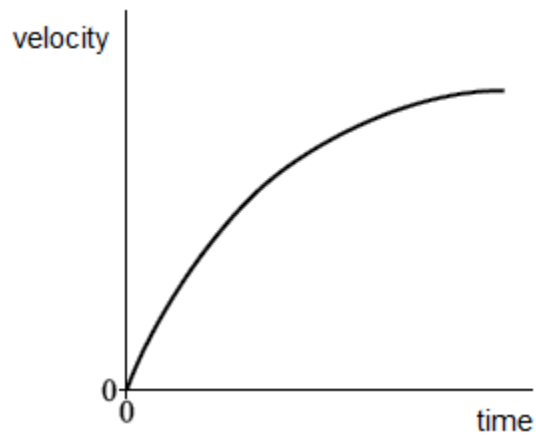
D y is proportional to $\frac{1}{x^2}$

☐

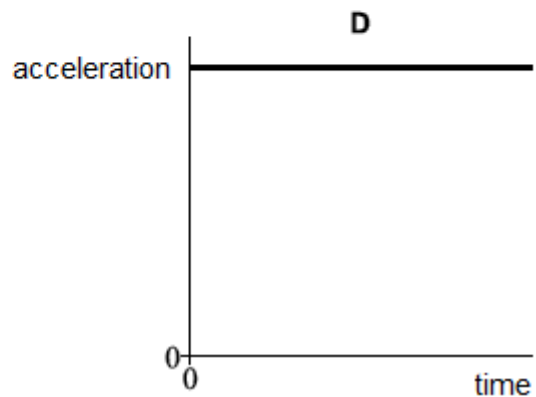
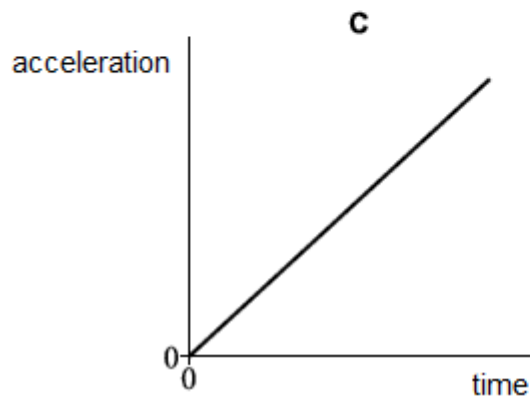
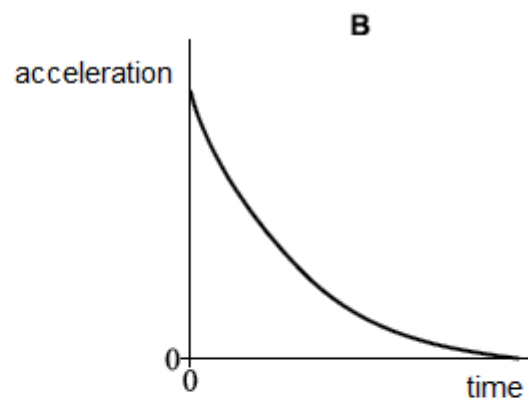
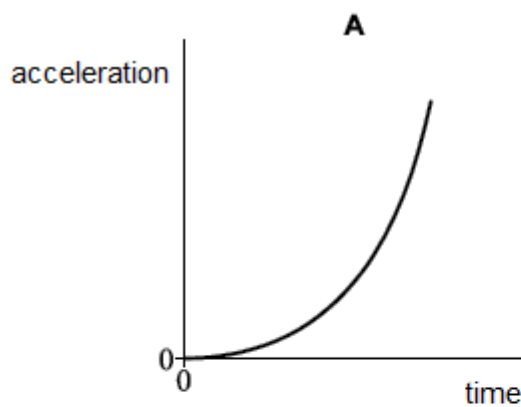
(Total 1 mark)

13

The velocity–time graph for a falling object is shown.



Which of the following shows the corresponding acceleration–time graph?



A

☐

B

☐

C

☐

D

☐

(Total 1 mark)

14

A girl jogs at 2.0 m s^{-1} in a straight line for 30 seconds, turns around and returns to her starting point 20 seconds later.

What is her average velocity and average speed?

	Average velocity/ m s^{-1}	Average speed/ m s^{-1}	
A	0 m s^{-1}	2.4 m s^{-1}	<input type="radio"/>
B	0 m s^{-1}	2.5 m s^{-1}	<input type="radio"/>
C	1.0 m s^{-1}	2.0 m s^{-1}	<input type="radio"/>
D	2.5 m s^{-1}	2.5 m s^{-1}	<input type="radio"/>

(Total 1 mark)

15

A golf ball was hit from the surface of the Moon. The time of flight was 4.0 s.

What is the best estimate for the maximum height reached by the ball?

acceleration due to gravity on the Moon = 1.6 m s^{-2}

- A 3 m ☐
- B 15 m ☐
- C 40 m ☐
- D 80 m ☐

(Total 1 mark)

16

A roller coaster car is raised to a height of 65 m and released from rest.

What is the maximum possible speed of the car?

- A 11 m s^{-1} ☐
- B 25 m s^{-1} ☐
- C 36 m s^{-1} ☐
- D 130 m s^{-1} ☐

(Total 1 mark)

17

In a test a 500 kg car travelling at 10 m s^{-1} hits a wall. The front 0.30 m of the car crumples as the car is brought to rest.

What is the average force on the car during the impact?

A 830 N ☐

B 7500 N ☐

C 8300 N ☐

D 83 000 N ☐

(Total 1 mark)

18

Which line, **A** to **D**, in the table correctly shows what is conserved in an elastic collision?

	Mass	Momentum	Kinetic energy	Total energy
A	conserved	not conserved	conserved	conserved
B	not conserved	conserved	conserved	not conserved
C	conserved	conserved	not conserved	conserved
D	conserved	conserved	conserved	conserved

(Total 1 mark)

19

Trolley T_1 , of mass 2.0 kg, collides on a horizontal surface with trolley T_2 , which is also of mass 2.0 kg. The collision is elastic. Before the collision T_1 was moving at 4.0 m s^{-1} and T_2 was at rest.



Which one of the following statements is correct?

Immediately after the collision

A T_1 is at rest and T_2 moves at 4.0 m s^{-1} .

B T_1 will rebound from T_2 at 4.0 m s^{-1} .

C T_1 and T_2 will both move at 2.8 m s^{-1} .

D T_1 and T_2 will both move at 1.4 m s^{-1} .

(Total 1 mark)

20

The graph shows how the force acting on a rocket varies with time.



Which one of the following is represented by the area under the graph?

- A distance travelled
- B gain in kinetic energy
- C change in velocity
- D change in momentum

(Total 1 mark)

21

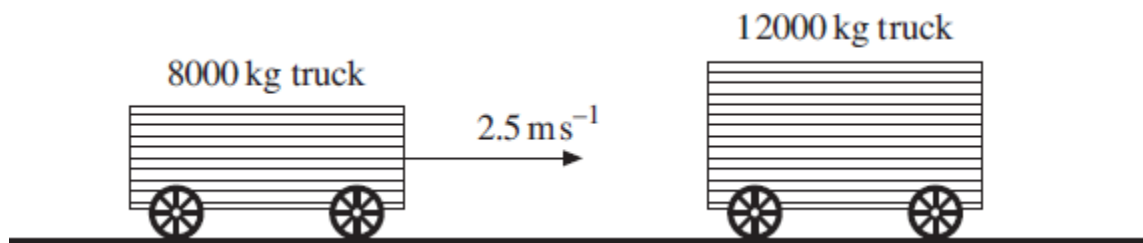
A golf club strikes a stationary golf ball of mass 4.8×10^{-2} kg and the ball leaves the club with a speed of 95 m s^{-1} . If the average force exerted on the ball is 7800 N, how long are the ball and club in contact?

- A $5.8 \times 10^{-4} \text{ s}$
- B $1.2 \times 10^{-2} \text{ s}$
- C 0.51 s
- D 0.58 s

(Total 1 mark)

22

A railway truck of mass 8000 kg travels along a level track at a velocity of 2.5 ms^{-1} and collides with a stationary truck of mass 12000 kg. The two trucks move together at the same velocity after the collision.



What is the change in momentum of the 8000 kg truck due to the impact?

- A 8000 N s
- B 12000 N s
- C 20000 N s
- D 25000 N s

(Total 1 mark)

23

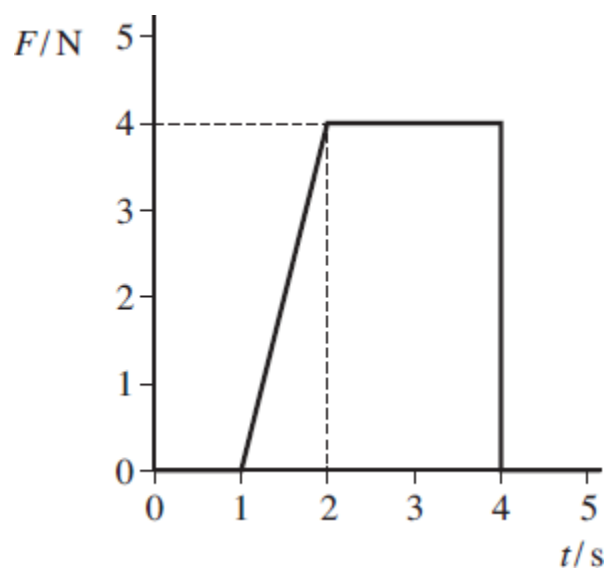
A gas molecule of mass m moving at velocity u collides at right angles with the side of a container and rebounds elastically. Which one of the following statements concerning the motion of the molecule is **incorrect**?

- A The magnitude of the change in momentum of the molecule is zero.
- B The magnitude of the change in momentum of the molecule is $2mu$.
- C The force exerted by the molecule on the side of the container is equal to the force exerted by the container on the molecule.
- D The change in kinetic energy of the molecule is zero.

(Total 1 mark)

24

The graph shows how the resultant force, F , acting on a body varies with time, t .



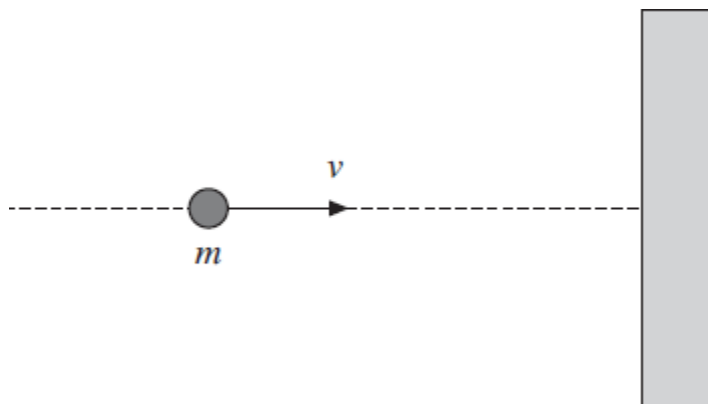
What is the change in momentum of the body over the 5 s period?

- A** 2N s
- B** 8N s
- C** 10N s
- D** 12N s

(Total 1 mark)

25

A ball of mass m travelling at velocity v collides normally with a smooth wall, as shown in the diagram, and rebounds elastically.



Which line, **A** to **D**, in the table, gives the correct expressions for the magnitude of the change of momentum, and the change of kinetic energy, of the ball?

	magnitude of change of momentum	change of kinetic energy
A	$2mv$	0
B	$2mv$	mv^2
C	0	0
D	0	mv^2

(Total 1 mark)

26

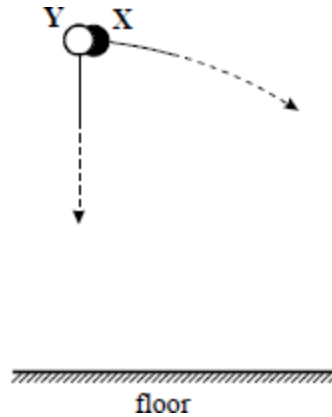
Coplanar forces of 5 N, 4 N and 3 N act on an object. Which force, in N, **could not possibly** be the resultant of these forces?

- A** 0
- B** 4
- C** 12
- D** 16

(Total 1 mark)

27

A ball **X** is projected horizontally from a certain point at the same time as a ball **Y** of the same diameter but twice the mass is released from rest and allowed to fall vertically from the same level. Air resistance is negligible. Which one of the following will occur?



- A Y will hit the floor just before X
- B X will hit the floor just before Y
- C X and Y will hit the floor at the same time
- D Y hits the floor while X is half way to the floor

(Total 1 mark)

28

Which one of the following pairs contains one vector and one scalar quantity?

A	Displacement	Acceleration
B	Force	Kinetic energy
C	Power	Speed
D	Work	Potential energy

(Total 1 mark)

29

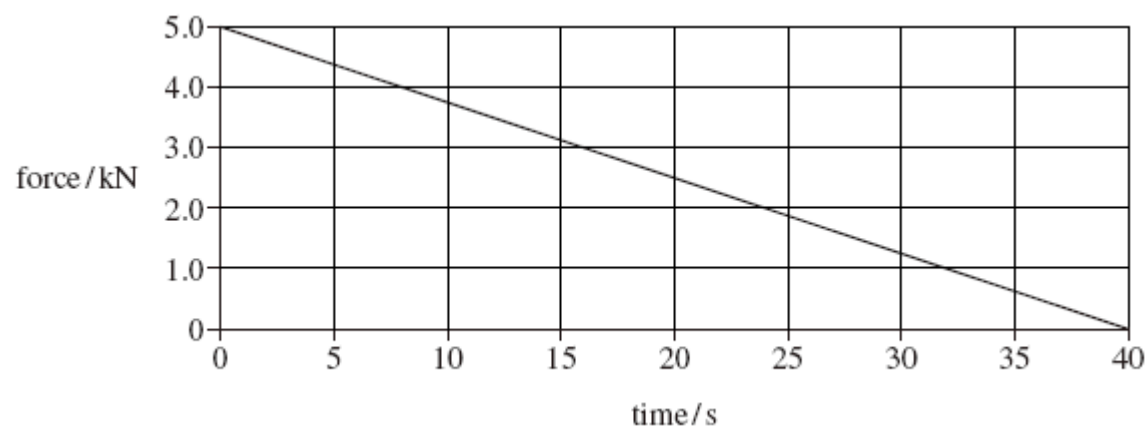
A steel ball of weight W falls through oil. At a time **before** the ball reaches terminal velocity, the magnitude of the viscous resistance force on the ball is

- A zero
- B between zero and W
- C equal to W
- D greater than W

(Total 1 mark)

30

The graph shows how the force on a glider of mass 2000 kg changes with time as it is launched from a level track using a catapult.



Assuming the glider starts at rest what is its velocity after 40 s?

- A** 2.5 m s⁻¹
- B** 10 m s⁻¹
- C** 50 m s⁻¹
- D** 100 m s⁻¹

(Total 1 mark)