Unit 3: Dynamics:

Subunit 3.1: Momentum and Newton's laws of motion:

Topical Question No: 1

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.

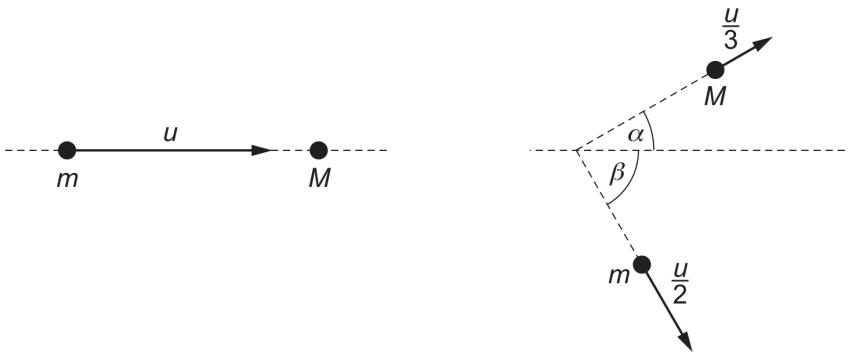
B When a force acts on a body that is free to move, the force is the rate of change of momentum of the body.

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.

Topical Question No: 2

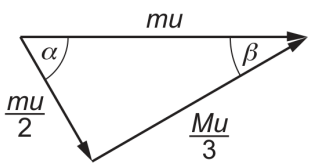
10 A particle of mass m, travelling with speed u, collides with a stationary particle of mass M. The velocities of the two particles before and after the collision are shown.



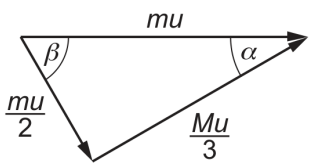
before collision after collision

Which vector diagram correctly shows the momenta before and after the collision?

A



B



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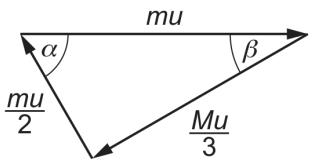

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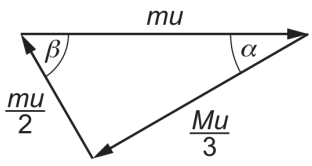


Topical Question No: 3

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

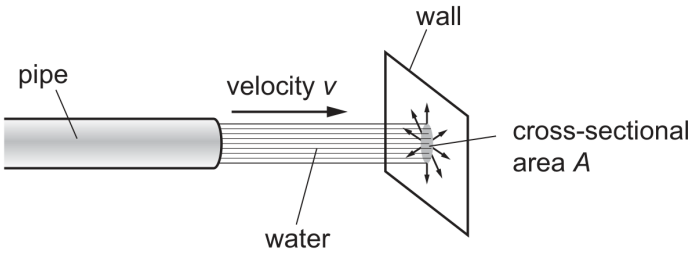
An object weighs 6.0 N on Earth.

What would this object weigh on Pluto?

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

Topical Question No: 4

9 Water flows out of a pipe and hits a wall.



When the jet of water hits the wall, it has horizontal velocity v and cross-sectional area A.

The density of the water is ρ. The water does not rebound from the wall.

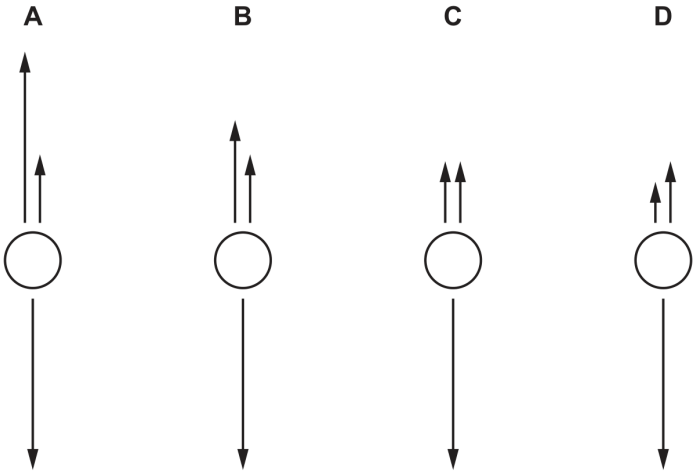
What is the force exerted on the wall by the water?

A $\frac{\rho v}{A}$ **B** $\frac{\rho v^2}{A}$ **C** $\rho A v$ **D** $\rho A v^2$

Topical Question No: 5

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?



Topical Question No: 6

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

Topical Question No: 7

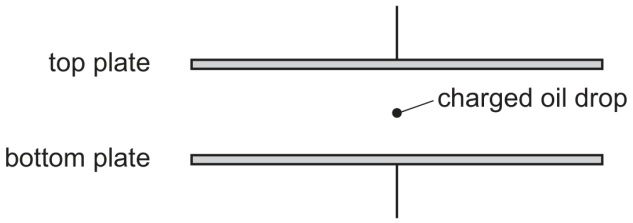
10 Steel pellets, each with a mass of 0.60 g, fall vertically onto a horizontal plate at a rate of 100 pellets per minute. They strike the plate with a velocity of 5.0 m s^{-1} and rebound with a velocity of 4.0 m s^{-1}.

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

Topical Question No: 8

12 A charged oil drop is held stationary between two charged parallel plates.



Which forces act on the oil drop?

A both electric and gravitational

B electric only

C gravitational only

D neither electric nor gravitational

Topical Question No: 9

11 A ball falls through a liquid at a constant speed. It is acted upon by three forces: an upthrust, a drag-force and its weight.

Which statement is correct?

A The drag-force increases with increasing depth.

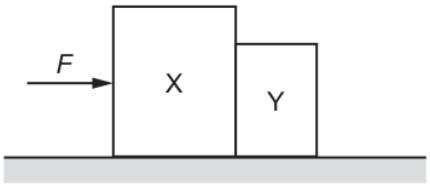
B The drag-force is equal to the sum of the upthrust and weight.

C The upthrust is constant with increasing depth.

D The weight is greater than the sum of the drag-force and the upthrust.

Topical Question No: 10

7 A single horizontal force *F* is applied to a block X which is in contact with a separate block Y, as shown.



The blocks remain in contact as they accelerate along a horizontal frictionless surface. Air resistance is negligible. X has a greater mass than Y.

Which statement is correct?

A The acceleration of X is equal to force *F* divided by the mass of X.

B The force that X exerts on Y is equal to *F*.

C The force that X exerts on Y is less than *F*.

D The force that X exerts on Y is less than the force that Y exerts on X.

Topical Question No: 11

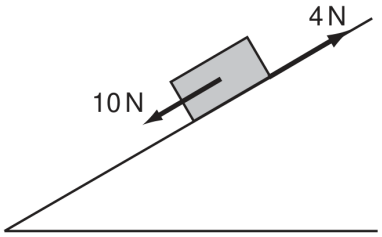
8 A car of mass 750 kg has a horizontal driving force of 2.0 kN acting on it. It has a forward horizontal acceleration of 2.0 $m\,s^{-2}$.

What is the resistive force acting horizontally?

A 0.50 kN **B** 1.5 kN **C** 2.0 kN **D** 3.5 kN

Topical Question No: 12

11 A brick weighing 20 N rests on an inclined plane. The weight of the brick has a component of 10 N parallel with the plane. The brick also experiences a frictional force of 4 N.



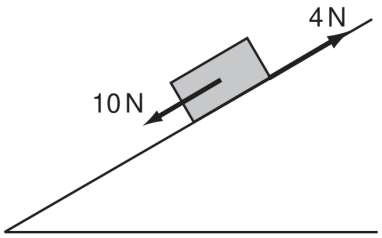
What is the acceleration of the brick down the plane? Assume that the acceleration of free fall *g* is equal to $10\,m\,s^{-2}$.

A $0.3\,m\,s^{-2}$ **B** $0.8\,m\,s^{-2}$ **C** $3.0\,m\,s^{-2}$ **D** $8.0\,m\,s^{-2}$

Space for working

Topical Question No: 13

14 A brick weighing 20 N rests on an inclined plane. The weight of the brick has a component of 10 N parallel with the plane. The brick also experiences a frictional force of 4 N.



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A $0.3\,m\,s^{-2}$ **B** $0.8\,m\,s^{-2}$ **C** $3.0\,m\,s^{-2}$ **D** $8.0\,m\,s^{-2}$

Topical Question No: 14

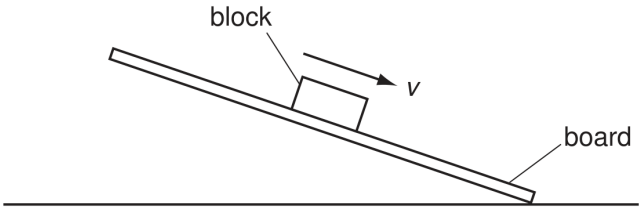
8 A body has a weight of 58.9 N when on the Earth. On the Moon, the acceleration of free fall is $1.64\,m\,s^{-2}$.

What are the weight and the mass of the body when it is on the Moon?

	weight / N	mass / kg
A	9.85	1.00
B	9.85	6.00
C	58.9	1.00
D	58.9	6.00

Topical Question No: 15

13 A wooden block rests on a rough board. The end of the board is then raised until the block slides down the plane of the board at constant velocity *v*.



Which row describes the forces acting on the block when sliding with constant velocity?

	frictional force on block	resultant force on block
A	down the plane	down the plane
B	down the plane	zero
C	up the plane	down the plane
D	up the plane	zero

Topical Question No: 16

10 A car has mass *m*. A person needs to push the car with force *F* in order to give the car acceleration *a*. The person needs to push the car with force 2*F* in order to give the car acceleration 3*a*.

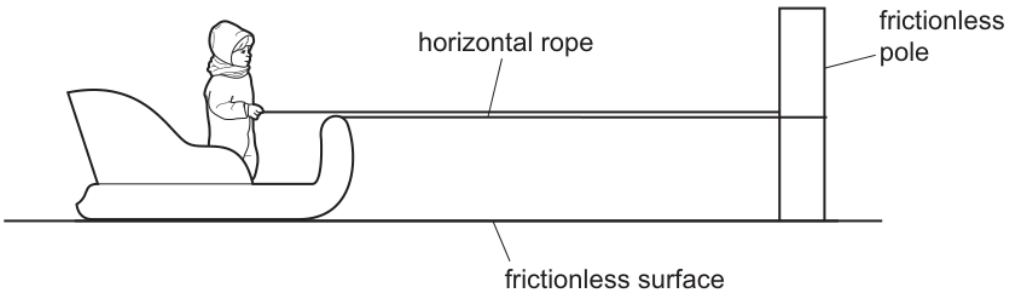
Which expression gives the constant resistive force opposing the motion of the car?

A *ma* **B** 2*ma* **C** 3*ma* **D** 4*ma*

Topical Question No: 17

8 A child of mass 20 kg stands on the rough surface of a sledge of mass 40 kg. The sledge can slide on a horizontal frictionless surface.

One end of a rope is attached to the sledge. The rope passes around a fixed frictionless pole, and the other end of the rope is held by the child, as shown.



The rope is horizontal. The child pulls on the rope with a horizontal force of 12 N. This causes the child and the sledge to move with equal acceleration towards the pole.

What is the frictional force between the child and the sledge?

A 4.0 N **B** 6.0 N **C** 8.0 N **D** 12 N

Topical Question No: 18

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

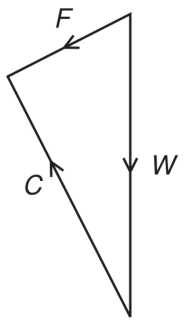
D the total air resistance and friction force

Topical Question No: 19

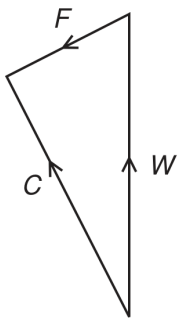
17 A sledge slides down a slope at a constant velocity. The three forces that act on the sledge are the normal contact force *C*, the weight *W* and a constant frictional force *F*.

Which diagram represents these forces acting on the sledge?

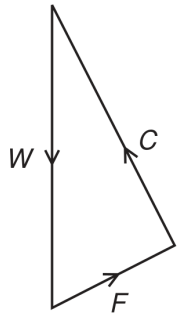
A



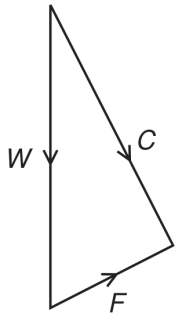
B



C



D



8 A snowflake is falling from the sky on a still day. Its weight acts vertically downwards and air resistance acts vertically upwards. As the snowflake falls, air resistance increases until it is equal to the weight and there is no resultant force acting on the snowflake.

When the forces become equal, which statement is correct?

A The snowflake accelerates.

B The snowflake decelerates.

C The snowflake is stationary.

D The snowflake moves at a constant velocity.

Answer Key

1. N/A
2. N/A
3. N/A
4. N/A
5. N/A
6. N/A
7. N/A
8. N/A
9. N/A
10. C
11. A
12. N/A
13. N/A
14. N/A
15. N/A
16. N/A
17. A
18. B
19. N/A
20. N/A