The effects of a force

Definition of force

Force is defined as anything that changes the state of rest or motion of an object moving in a straight line.

Force is a vector quantity which has both direction and magnitude

The S.I. unit for force is N or $kg\, m\, s^{-2}$

Force is measured by using a Spring Balance

The effects of a force

A force can
- move a stationary object
- stop a moving object
- accelerate a moving object
- decelerate a moving object
- change the direction of a moving object
- alters the size of the object
- alters the shape of the object

NEWTON 'S LAWS OF MOTION

Newton's First Law : An object will remain at rest or continue with a constant speed in a straight line unless acted on by an unbalanced force.

Newton's Second Law : The acceleration of a body ,a, is directly proportional to the net force acting on it, F , and inversely proportional to its mass, m.

Newton's Third Law : For every action there is an equal and opposite reaction.

The relationship between the acceleration ,a ,the net force ,F and the mass , m.

Based on the Newton's Second Law of motion,

$$a \;\; \alpha \;\; F$$

$$a \;\; \alpha \; \frac{1}{m}$$

we obtain $a \;\; \alpha \; \frac{F}{m}$

$$a = \frac{k\,F}{m}$$

$$F = k\,ma$$

In S.I. units , the definition of a force of 1 N is given as the amount of force which is applied on a mass of 1 kg and which causes it to experience an acceleration of $1\ ms^{-2}$
Thus,
$$1\,N = k\,(\,1\,kg\,)\,(\,1\,ms^{-2}\,)$$
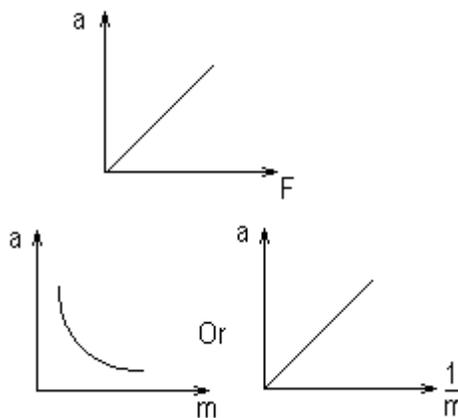Thus $k = 1$
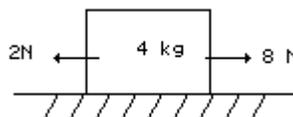
Therefore   **F = ma**

Where F = net force
m = mass
a = acceleration

Example 1

Two forces act horizontally to a block of wood of mass 4 kg as shown in figure above. What is the acceleration and the direction of motion of the block.

Example 2

An object of mass 2 kg is pulled on the floor by a force of 5 N and having a constant velocity.
(a) What is the frictional force between the object and the floor.
(b) Calculate the acceleration of the object if the object is pulled by a 17 N force?
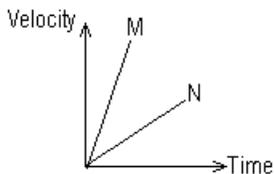
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1 1 N is equivalent to

A   1 kg ms^{-1} **B**   1 kg ms^{-2}
C   1 ms kg^{-1} **D**   1 kg s m^{-1}

2 Which of following is **not** effects of a constant force?

A   Change the direction of motion
B   Change the shape of an object
C   Change the velocity of a moving object
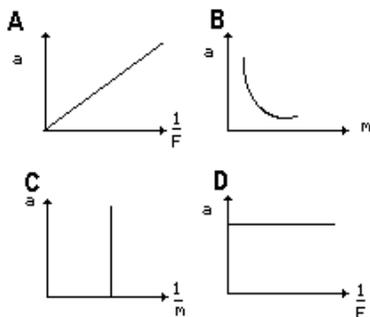**D**   Change the acceleration of a moving object

**3** The figure shows the graph of motion for two objects M and N is acted on by a same force.

Which comparison is correct about the mass of M and N?

A   Mass of M = Mass of N
B   Mass of M < Mass of N
C   Mass of M > Mass of N

4 Which of the following graph is true to show the relationship between the acceleration ,a , the mass , m and the force ,F

5 The figure shows forces , F$_1$ and F$_2$, exerted on a wooden block placed on a table surface. The friction between the block and the table surface is 2 N.
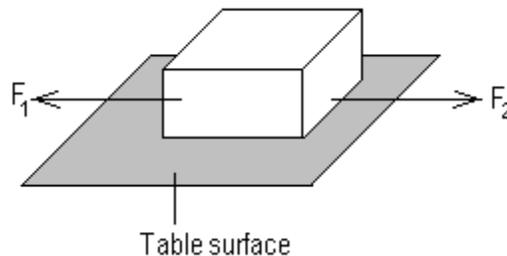

Which pair of forces F$_1$ and F$_2$ causes the wooden block to move with an acceleration?

	F$_1$ / N	F$_2$/ N
A	5	7
B	3	5
C	6	4
D	3	2
E	4	1

6 An object of mass 0.2 kg is pulled on a smooth floor by a force of 8 N. What is the acceleration of the object ?

A   20 ms^{-2} **B**   40 ms^{-2}
C   60 ms^{-2} **D**   80 ms^{-2}
E   160 ms^{-2}

7 Figure shows an object of mass 2 kg is pulled on a floor by a force of 15 N. The frictional force between the object and the floor is 3 N.
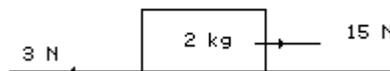
What is the acceleration of the object?
A   2 ms^{-2} **B**   5 ms^{-2}
C   6 ms^{-2} **D**   8 ms^{-2}
E   10 ms^{-2}

8 A box with a mass 3 kg is pushed along a rough surface with a force 10 N. If the acceleration of the box is 3 ms^{-2} , what is the frictional force between the box and the rough surface?

A   0.5 N   **B**   1.0N
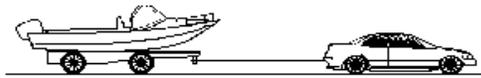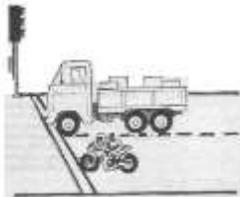**C**   1.5 N   **D**   2.0 N
E   2.5 N

Figure (a)

Figure (b)

9 Figure (a) shows a car is pulling a boat and moving without the boat respectively.
Figure (b) shows the car is moving without the boat.
Observe the Figure(a) and (b). Compare the mass and the acceleration of the moving objects.
Relate the mass and the acceleration of the moving objects to deduce a relevant physics concept.

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The motorcycle and the lorry stop
Figure (a)
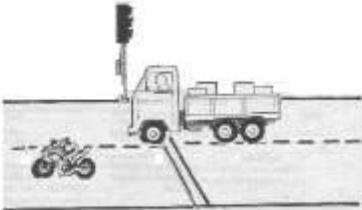
The motorcycle and the lorry accelerate
Figure (b)

Each figure below shows a motorcycle and a lorry in two situations at a traffic light.
Observe the situations of the motorcycle and the lorry of each diagram.
Based on the observations:

(a) State **one** suitable inference that can be made.
(b) State **one** appropriate hypothesis for an investigation.
(c) With the use of apparatus such as trolley, ticker timer and other apparatus , describe an experimental framework to test your hypothesis.
In your description , state clearly the following:
(i) Aim of the experiment
(ii) Variables in the experiment
(iii) List of apparatus and materials
(iv) Arrangement of the apparatus
(v) The procedure of the experiment which include the method of controlling the manipulated variable and the method of measuring the responding variable.
(vi) Way you would tabulate the data
(vii) Way you would analysis the data