Forces

Forces push, pull, stretch, squash, hold or bend the things they touch.

You can feel some forces. You can't see or hear a force.

Sometimes you can see or hear what a force is doing.

A **force** can cause something to

- speed up,
- slow down,
- turn (change direction)
- change shape,
- get longer (extend),
- get shorter (compress).

1 Is each sentence always true (**AT**), sometimes true (**ST**) or false (**F**)?

Sentence	**AT / ST / F**
When you catch a fast ball, you feel a force as it stops.	
You can feel forces.	
You need a force to start things moving.	
You need a force to stop things moving.	
You can see forces.	
You need a force to keep something stationary.	

2 Match the forces in the table to the thing you see which tells you the force is there.

What you see		**Force**
A dropped apple falls.		A contact force supports it.
A cyclist speeds up.		Water pushes it upwards.
A ball bounces off a wall.		There is a contact force from wall.
A heavy printer sits on a shelf.		Weight pulls it down to the floor.
A paper aeroplane glides.		Rider pushes on pedals.
A ship floats.		Force on wings stops it dropping.

A force can also be used to cancel out the effect of another force. Examples:
- a bag won't fall to the floor if you are holding it. Your support cancels out the weight.
- the **driving force** of an engine can prevent friction slowing down a train.

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3 Do you need a force to do these things? How did you decide?

(a) Lift a suitcase off the floor,

(b) Hold a suitcase above the floor,

(c) Make a train get faster,

(d) Make a motorcycle turn a corner,

(e) Stretch a rubber band to make it longer,

(f) Shorten a rubber band when you let it go.

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4 Do you need a force to do these things? How did you decide?

(a) Stop a moving bus,

(b) Hold a ball still on flat ground,

(c) Bring a diver up to the surface,

(d) Push a nail into a wall,

(e) Hold a ball still on sloping ground.

(f) Take a submarine down to the sea bed.

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5 Some forces have special names. Fill in the table with their names and directions.
For the missing force names, choose from **Friction**, **Upthrust** and **Weight**.
For the directions choose from **upwards**, **downwards**, **forwards** (in the direction of motion) and **backwards** (against motion).
Direction labels can be used more than once, once or not at all.

Force	**Example**	**Direction**
	anything on (or near) the Earth	downwards
	a block slides along a table	backwards
Driving force (or thrust)	a jet engine on an aeroplane	
Normal reaction	a shelf supports a book	
Air resistance (or drag)	a cyclist riding quickly along a road	
	causes floating	
Lift	made by wings	

The force where one object (or surface) pushes into another is called a normal reaction.
Support forces from solid surfaces are usually normal reactions.
When describing directions, normal means '**at right angles to**'.

Force diagrams show the forces pushing or pulling each object.

- force arrows start on the object
- arrows point in the direction of the force
- longer arrows are used for stronger forces
- you can have lots of arrows on one object

If you have objects touching each other, you may find it helpful to draw them with a thin gap between. This makes it easier for you to show which force is pulling which object.

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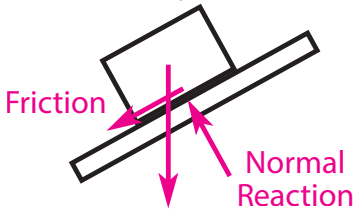
6 The diagram shows a box on a sloping shelf.

(a) What is wrong with this diagram?



(b) Make a better diagram

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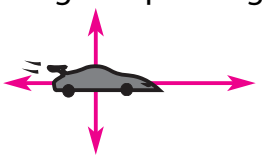
7 Label the forces on the diagrams.

(a) A bag on a flat floor.

(b) A falling basketball.

(c) A racing car speeding up.



(d) A stone falling in a pond.

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8 Draw force arrows on the objects. Use longer arrows for stronger forces.

(a) A supermarket trolley being pushed.

(b) A helicopter hovering.

Contact forces rely on objects touching.
Non-contact forces pull and push objects even when they are not touching.

9 Are these forces contact or non-contact forces?

(a) Friction

(b) Force of gravity

(c) Upthrust

(d) Lift

(e) Static electric force

(f) Weight

(g) Magnetic force

(h) Normal reaction