

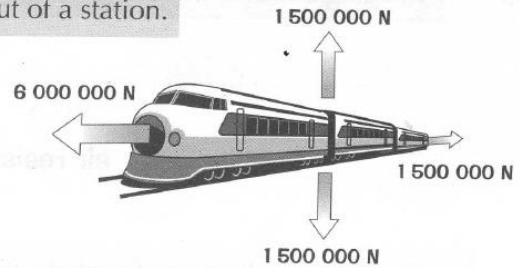
Forces and Motion

1.

The **force diagram** on the right shows a **train** pulling out of a station.

Calculate the resultant force acting on the train in the following directions:

- a) Vertical:
- b) Horizontal:



2.

A teapot sits on a table.

- a) Explain why it doesn't sink into the table.

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- b) Chris carelessly knocks the teapot off the table and it accelerates towards the floor.

- i) Explain whether the vertical forces are balanced.

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- ii) The teapot hits the floor without breaking and bounces upwards. Name the force that causes the teapot to bounce upwards.

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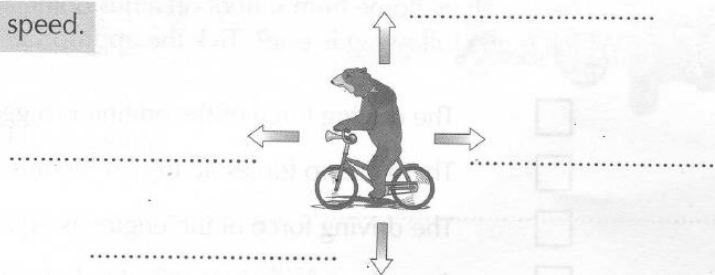


3.

A bear rides a bike north at a constant speed.

- a) Label the forces acting on the bear.

- b) The bear brakes and slows down. Are the forces balanced **as** he slows down? If not, which direction is the resultant force in?



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4.

State whether there is a resultant force in each of the following situations. Explain your answers.

a) A cricket ball slowing down as it rolls along the outfield.

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b) A car going round a roundabout at a steady 30 mph.

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c) A vase sat on a window ledge.

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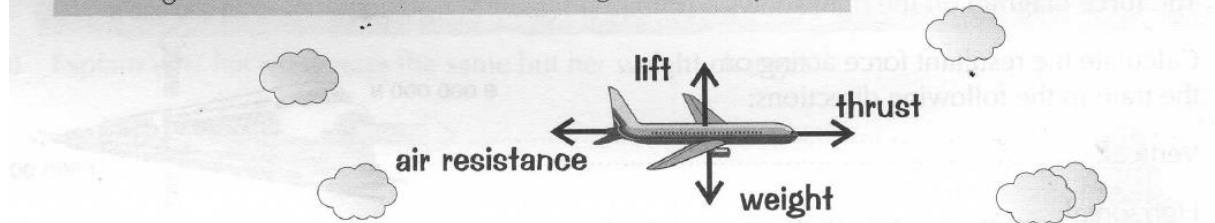
5.

You're travelling home from school on a bus doing a steady speed in a straight line. Which of the following is true? Tick the appropriate box.

- The driving force of the engine is bigger than friction and air resistance combined.
- There are no forces acting on the bus.
- The driving force of the engine is equal to friction and air resistance combined.
- A resultant force is required to keep the bus moving.

6.

The diagram below shows the **forces** acting on an aeroplane.



a) The aircraft is flying horizontally at a constant speed of 200 m/s. Which of the following statements about the aeroplane is true? Circle the appropriate letter.

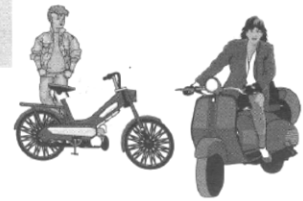
- A The thrust is bigger than the air resistance and the lift is bigger than the weight.
- B The thrust is smaller than the air resistance and the lift is equal to the weight.
- C The thrust is equal to the air resistance and the lift is equal to the weight.
- D The thrust is equal to the air resistance and the lift is bigger than the weight.

b) What happens to the forces as the plane descends for landing and slows down to 100 m/s? Choose the correct options to complete the following statements:

- i) The thrust is **greater than / less than / equal to** the air resistance.
- ii) The lift is **greater than / less than / equal to** the weight.

7.

Jo and Brian have fitted both their scooters with the same engine. Brian and his scooter have a combined mass of 110 kg and an acceleration of 2.80 m/s^2 . On her scooter, Jo only manages an acceleration of 1.71 m/s^2 .



a) What **force** can the engine exert?

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b) Calculate the combined mass of Jo and her scooter.

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8.

Tom drags a 1 kg mass along a table with a newton-meter so that it accelerates at 0.25 m/s^2 . If the newton-meter reads 0.4 N, what's the force of friction between the mass and the table?

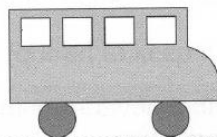
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9.

A camper van with a mass of 2500 kg has a maximum driving force of 2650 N. It is driven along a straight, level road at a constant speed of 90 kilometres per hour. At this speed, air resistance is 2000 N and the friction between the wheel bearings is 500 N.

a) i) What force is the engine exerting?

ii) Complete the diagram to show all the forces acting on the camper van. Give the size of each force.



b) A strong headwind begins blowing, with a force of **200 N**. The van slows down. Calculate its deceleration.

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- c) The driver notices that the van is slowing and puts his foot right down on the accelerator, applying the maximum driving force. How does the acceleration of the camper van change? (Assume that air resistance and friction remain at their previous values.)

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10.

A **teapot** sits on a table.

- a) Explain why it **doesn't** sink into the table.

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- b) Jane picks up the teapot and hangs it from the ceiling by a **rope**. What **vertical** forces now act on the teapot?

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- c) Draw on and label the diagram on the right to show the forces **acting on the teapot** as it hangs.

