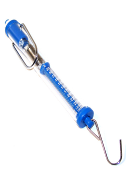
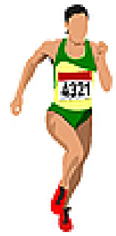
S2 Forces and Motion

Homework



Homework 1

1. At a school sports day Paula and Steve are both competing in the 800m race. Paula finishes the race in 2 minutes 30 seconds. Steve takes 3 minutes.



(a) Describe how to measure the average speed of Paul and Steve in the race. Your answer should include the following:

(i) What you are measuring.

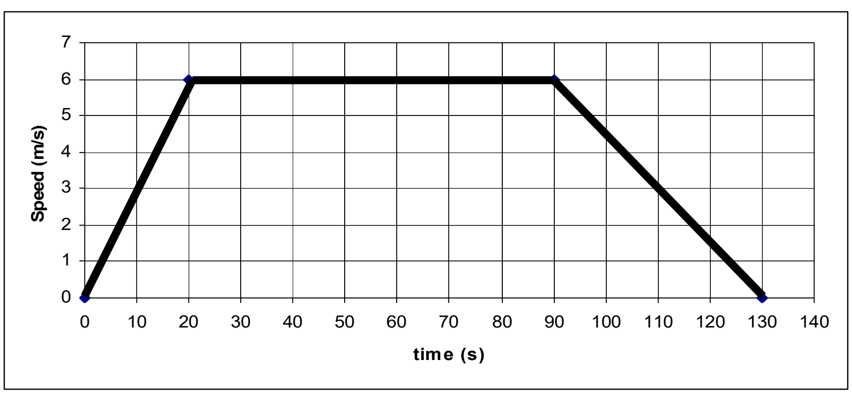
(ii) The equipment used.

(iii) Any equation that you may have to use.

(b) Calculate both Paula and Steve's average speed for the journey.

(c) Describe how someone could measure Paula's speed as she crosses the line (her instantaneous speed).

2. Stacey plots a speed time graph of her journey to the end of her road. The graph is shown below.



(a) Describe the motion of Stacey;

(i) Between 0 s and 20 s

(ii) Between 90 s and 130 s

(b) How far does Stacey travel between 20 and 90 s?

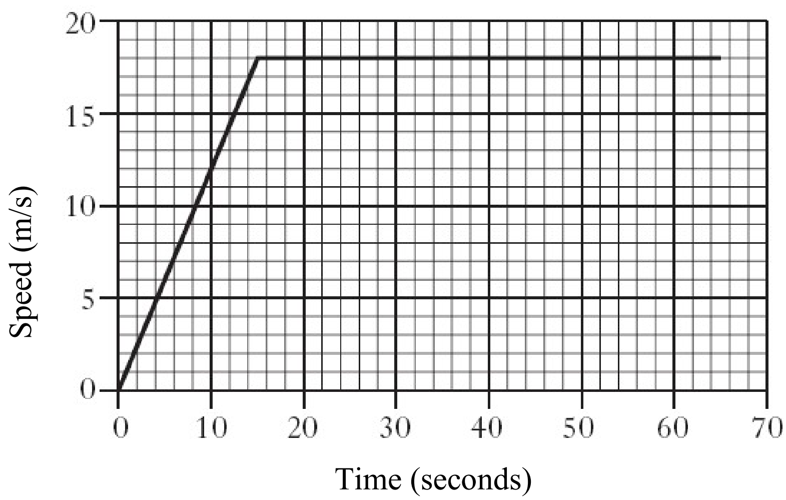
Homework 1 Continued

3. A school bus picks up a group of pupils from a bus stop 3500 m away from the school gates. It takes the bus 5 minutes to arrive at the school.

   Calculate the average speed of the school bus for this journey.

4. The return journey for the bus in question 3 takes the bus 2.5 minutes longer than it did in the morning. Calculate the average speed for the return bus journey.

5. A competitor takes part in a cycling event. The cyclist takes 65 s to complete the race. The graph below shows how the speed of the cyclist changes with time during the race.



(a) How long does it take the cyclist to reach their maximum speed?

(b) How far does the cyclist travel at their maximum speed?

Homework 2

1. Whilst playing ice hockey Kevin tells Joe that when you hit the puck you are "applying a force to it"

   (a) Describe three changes that could happen when the puck is hit that indicate a force is acting on it.

   (b) Kevin explains that when the puck is hit in ice hockey it travels further than in field hockey. Give a reason for this in terms of friction.

2. Give one example of how the force of friction can be increased.

3. Give one example of how the force of friction can be decreased.

4. Give one situation where friction is "useful".

5. Claire has been given a lot of homework now she has reached 2nd year. She has noticed that her school bag now seems to be heavier.

   (a) Describe how Claire could use a Newton balance to find out how much force she applies when lifting her school bag.

   (b) Claire's friend says that her bag has a weight of 4 kg. Why is her statement incorrect?

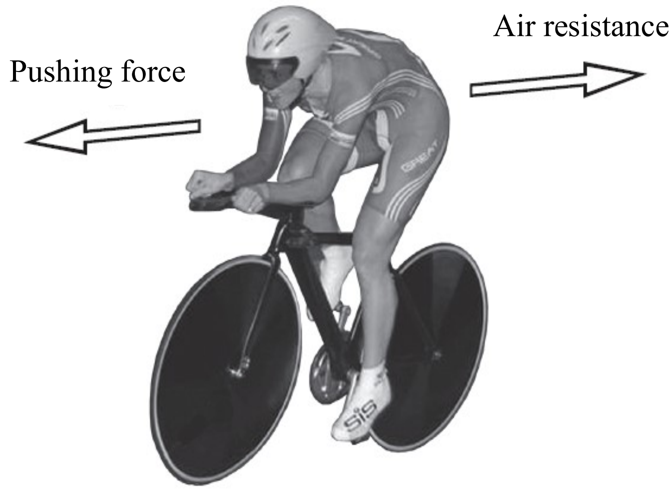
   (c) It is found that Claire's bag actually has a mass of 5.5 kg. Calculate the weight of the bag. (g = 10 N/kg).

   (d) If Claire were to travel to the moon, why would her bag weigh less?

   (e) What is the mass of Claire's bag on the moon?

Homework 3

1. The diagram below shows some of the forces acting on a cyclist during the race.



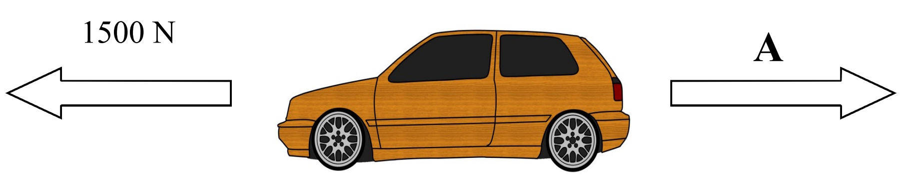
The forces acting on the cyclist are balanced.

(a) If the cyclist applies a pushing force of 300 N, what value is the air resistance?

(b) What is the size of the unbalanced force acting on the cyclist?

(c) Is the cyclist accelerating? Explain your answer.

2. When a 2000 kg car is been driven along a road, at a constant speed, the force applied to the engine is 1500 N.



(a) Copy the diagram above showing the value of the force labelled A.

(b) What is the name given to the force labelled A?

(c) Name one way in which force A could be reduced.

(d) The driver is wearing a seatbelt for safety. Explain in terms of forces why seatbelts are an important safety device.

Homework 3 Continued

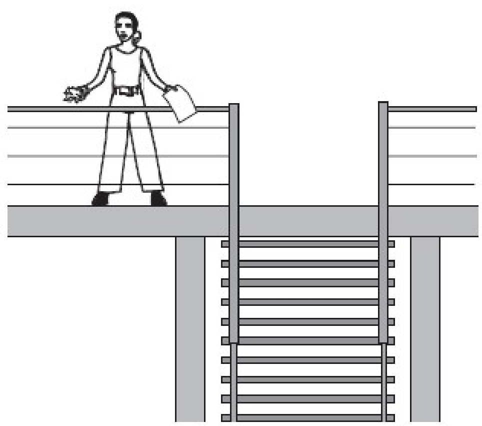
3. A stunt driver is aiming to jump over a number of cars whilst on his motorbike. He sets up the stunt as shown below:

(a) What factors will effect how far the motorcyclist will travel?

(b) What angle should he set the ramp at to ensure he travels as far possible?

(c) Before reaching the ramp the motorcyclist travels along a flat 250m road in 4.5 seconds. Calculate the speed at which he reaches the ramp.

4. A student stands at the top of a flight of stairs. She decides to carry out an investigation by dropping two identical sheets of paper down the stairwell. **One sheet is crumpled into a ball.** Both sheets are dropped from the same height at the same time.



Which sheet will hit the ground first? Explain your answer.

Homework 4 : Revision

1. A student writes the following method in a scientific report:

   "Measure the length of the track using a trundle wheel or measuring tape. The stop clock should start when the car passes the starting line and stop when the car crosses the finishing line. The speed can be calculated by dividing the length of the track in metres by the time taken to complete the track."

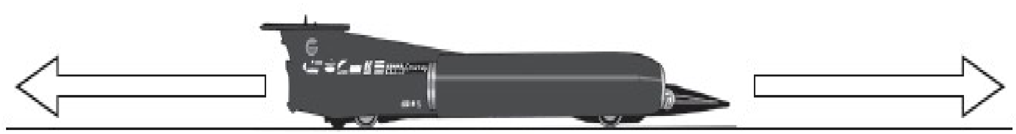
   (a) Explain whether the student is describing a method to measure the average speed or instantaneous speed of the car?

   (b) The track is measured to be 5.2 km and the car takes 1 minute 13 seconds to complete one lap. Calculate the average speed of the car.

   (c) Explain why it is important that the driver wears their seatbelt.

2. A vehicle called Thrust SSC broke the land speed record in 1997 in the Nevada Desert, USA.

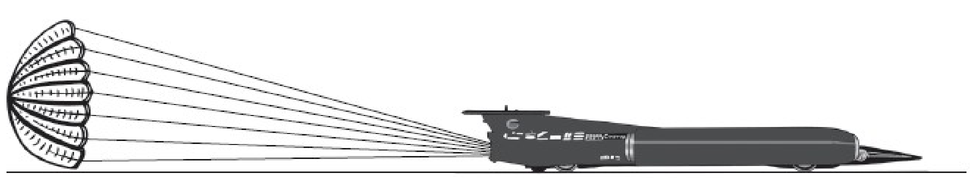
   The diagram below shows the Thrust SSC travelling at a constant speed.



   (a) What can be said about the forces acting on the vehicle?

   (b) The engine provides a thrust of 105 000 N. What is the size of the frictional forces acting on the vehicle?

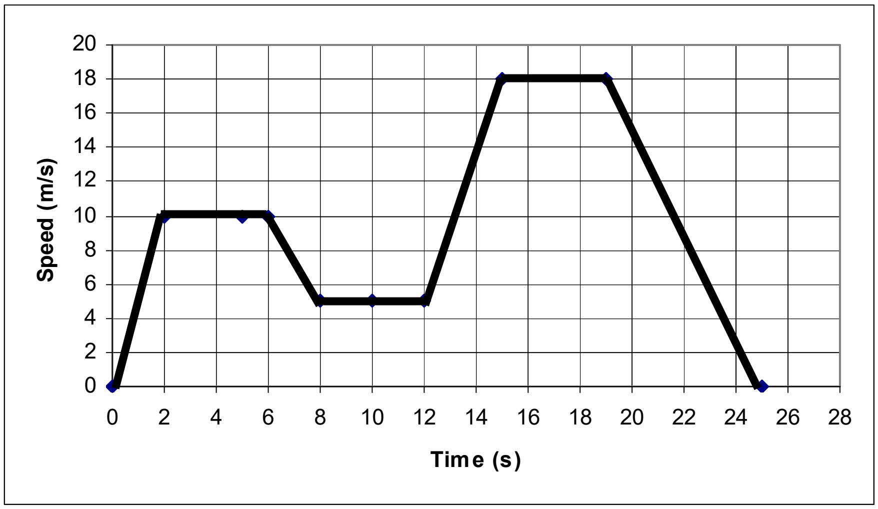
   (c) At the end of the run, Thrust SSC uses a parachute as shown.



   What effect does this have on the speed on the vehicle? Explain your answer in terms of forces.

Homework 4 Continued

3. A pupil goes on a fun ride at a local theme park. At the end of the ride, each person gets a print out of a speed time graph to see how their journey progressed. The speed time graph below is an example of the print out.



(a) Describe the motion of the ride during the first 12 seconds.

(b) What distance is covered between 2 and 6 seconds?

(c) The mass of a typical roller coaster cart is 5000 kg. Calculate the weight of the cart.

4. Students use a Newton Balance like the one shown below to measure the weight of objects.

(a) What is inside a Newton Balance which makes it useful to measure forces?

(b) An object is found to have a weight of 50N on Earth, what is its mass?

(c) What will happen to the weight of the object if it is taken to Jupiter, where g = 26 N/kg?

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