10 Things to Do to Prepare for...

GCSE Physics

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Activities

If you're about to start, or have just started, your GCSE Physics course then there are some things it would be good for you to spend a bit of time on.

Here are some questions for you to have a go at – they're designed to get you thinking. Some of the answers you might already know but some of the others might need some thought - and you might need to do a bit of research too.

Don't worry if you can't do them all, but do have a go.

1. Testing magnets

Imagine you had a tray of assorted items – bits of metal, pieces of wood, bits of plastic, etc. You've been told that several of the items are magnets and that your job is to sort them all out into three groups: magnets, magnetic items and non-magnetic items. Suggest how you could do this.

2. Magnetic forces and fields

Some magnets are bar magnets but they can be other shapes too. These ones are circular magnets, with the North pole on one face and the South pole on the other.

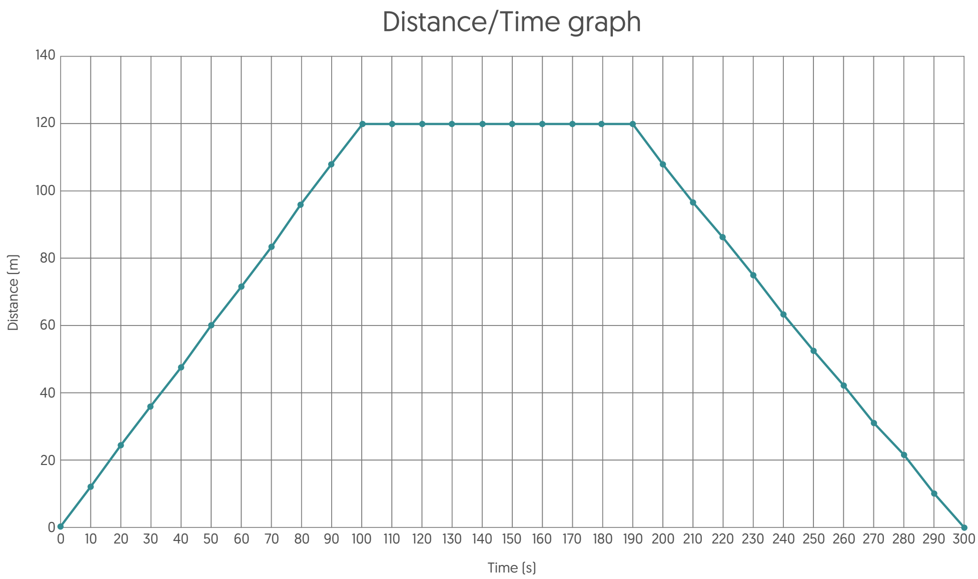
a. Look at this arrangement of circular magnets (right). The upper surface of the top magnet is a South pole. Make a quick sketch of the set up and see if you can label all of the other poles as either North or South.

b. Now look at this arrangement (left). The upper surface of the top magnet is a South pole. Again, make a sketch and label all of the poles.

c. On this sketch, see if you can add the magnetic field lines in the gaps between the magnets. Remember that the lines go from North to South.

3. Distance, speed and time

Rebecca walks from home to the shop to buy some fruit and a bottle of milk, which she then brings home. Using an app on her phone she can measure the distance she has walked. On a graph, the data looks like this:



a. What units have been used to measure:

   i. Distance?

   ii. Time?

b. How far does Rebecca live from the shop?

c. Look at the graph and use it to work out:

   i. How long it takes her to walk to the shop.

   ii. How long it takes her to walk back.

   iii. How long she spends at the shop.

d. We can do some calculations on her speed.

   i. What is the formula to work out speed from distance and time?

   ii. Look at the units of distance and time; what units will speed be in if it is worked out from these?

   iii. What is her speed when walking to the shop?

   iv. What is her speed when walking back?

e. Acceleration is a measure of how speed is changing.

   i. At which points on the graph is there a change of speed?

   ii. Explain how you recognised those.

4. Motion

This picture shows an experiment to investigate motion. A model railway wagon has been set up on a length of track.

There is a pulley at the end of the track.

Some weights are attached by means of a piece of string to the wagon; the string goes over the pulley. When the weights are released the wagon accelerates along the track.

a. What will happen to the speed of the wagon as it travels along the track?

b. How do you think the motion would alter if the experiment was repeated with a larger weight? Try to use the words 'speed' and 'acceleration' in your answer.

c. This is a picture of the wagon on the track.

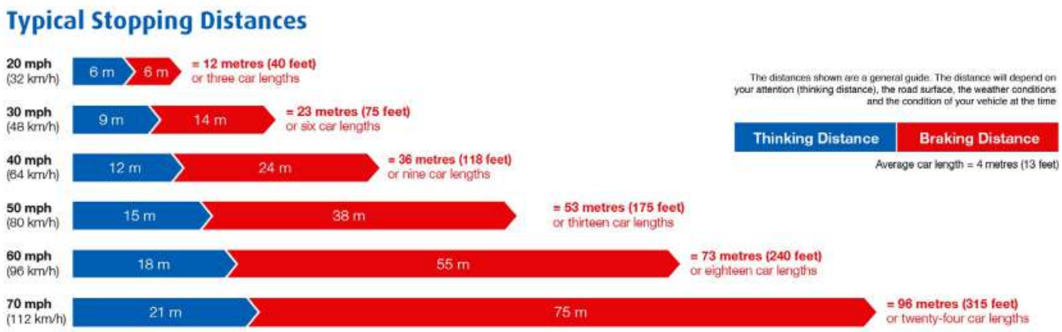
i. Which direction is the force due to the weights acting?

ii. Do a simple sketch of the wagon and show this force by means of an arrow to show the direction it is acting in.

iii. There are other forces acting on the wagon as well – friction and air resistance. Add arrows to your diagram to show these too.

5. Motion and road safety

This chart is from the Highway Code:



Source: http://www.thedrivingtests.co.uk/theory-test/highway-code/stopping-distances/Distances.pdf

It shows how far a car travelling at various speeds will travel before it comes to rest if the driver suddenly sees something on the road ahead. People wanting to get a driving licence have to be familiar with this.

Look at the chart and see if you can work out:

a. What units are being used to measure:
   i. Distance?
   ii. Speed?

The chart shows the thinking distance and the braking distance. The thinking distance is the distance the car travels whilst the driver is reacting.

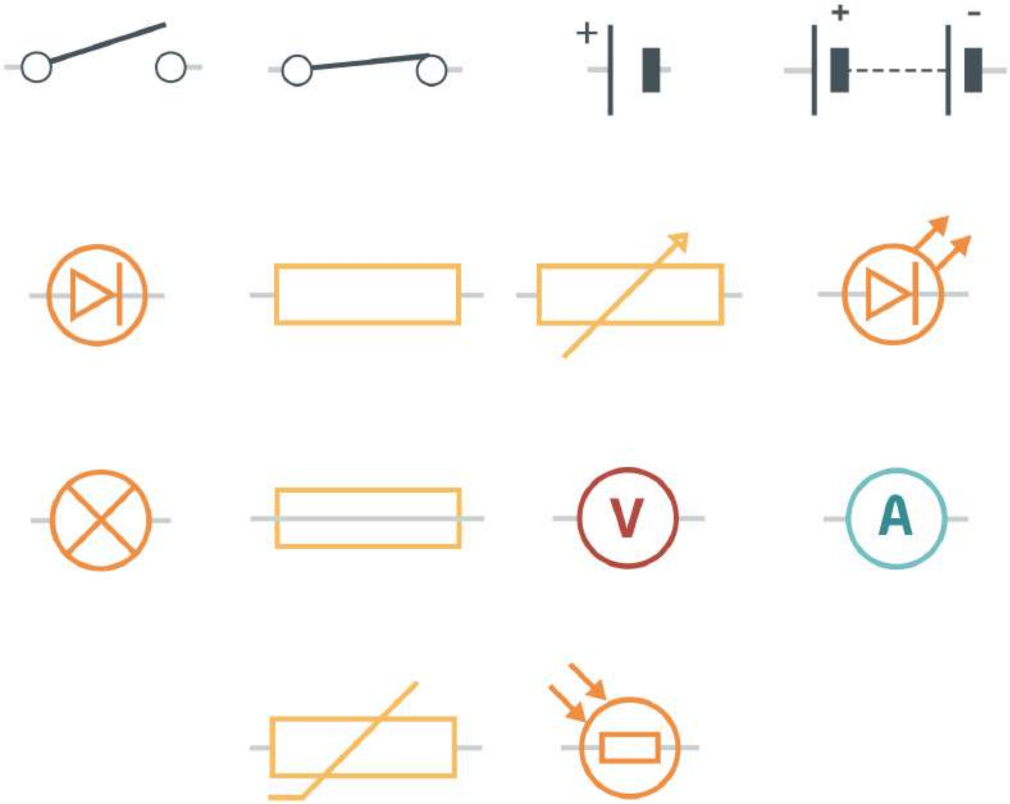
b. How does the speed of the car alter whilst it is covering the thinking distance?
c. What might affect a driver's reaction time?
d. Eric says, "I think that doubling the speed doubles the thinking distance."
   i. Look at the table and find evidence to decide if he is right.
   ii. Why do you think the thinking distance increases at higher speeds?

The braking distance is the distance the car travels whilst it is slowing down.

e. Felicity says, "I think that if the speed is twice as great then the braking distance is four times as great." Look at the table and find evidence to decide if she is right.
f. Which of these distances (the thinking distance and the braking distance) will alter if the roads are wet?
g. Write down a formula to show how stopping distance is calculated from braking distance and thinking distance.

6. Circuit symbols

It is useful when drawing circuits to use symbols rather than having to draw pictures of the actual components every time. Here are some symbols; see if you can work out what each of them means. Some of them you may know but others you may have to research.



7. Circuits

These questions are about current flowing in a circuit. You may have done some work on this either using batteries or power packs. The questions refer to batteries, but the ideas are the same if power packs were used instead.

a. Draw a circuit with a battery, a switch and a bulb. Imagine setting this up and getting the bulb to light. Think of the bulb as being at 'normal brightness'.

b. Now draw another circuit with a battery, a switch and two bulbs in series. Describe the brightness of these bulbs in relation to 'normal brightness'.

c. Now draw a circuit with a battery, a switch and two bulbs in parallel. Describe the brightness of these bulbs in relation to 'normal brightness'.

d. Imagine that one of the bulbs was faulty and had stopped working. Describe how this would affect:

   i. The series circuit in part (b)

   ii. The parallel circuit in part (c)

e. In the mains electricity circuit in a classroom or in the home various appliances can be plugged in. Suggest whether this is a series or a parallel circuit and explain your answer.

8. Pressure in solids

Lucy has a job driving large machinery on building sites. She drives a huge caterpillar tractor with wide tracks that will go over soft mud. She goes to work on a bike. "It's weird" she says "I spend all day driving over soft mud without any difficulty but when it's time to go home there's no way I can ride my bike on this ground. I just sink in, even though me and my bike weigh a fraction of the tractor."

Explain why the bike gets stuck in the mud and the tracked vehicle doesn't. Your answer should include the words 'area', 'force' and 'pressure'.

9. Pressure in a liquid

This picture shows an experiment on water pressure. A large plastic bottle has had some holes made in it at different points. The bottle has been filled with water and the water is running out.

a. What do you notice about the different jets of water?

b. Suggest a reason for this.

c. Three students are discussing why the jets are like this. Comment on what each of them says and indicate which you think is the best answer and why.

i. Anil says, "I think the water pressure is greater nearer the bottom of the bottle – that's why the upper jet comes out the shortest distance from the side of the bottle."

ii. Bea says, "I think the water pressure is higher up the bottle. Pressure always gets more when you go higher – that's why your ears pop in an express lift."

iii. Carl says, "I don't think the pressure of the water varies – nothing is compressing the water. It's just sat there in the bottle."

10. Applying a force to a material

Will's group are doing an experiment to see how an elastic band stretches when it is loaded. They set up an elastic band next to a ruler and they add weights to it. They know that each of the weights applies a force of 1 Newton.

They were going to start with no load at all but when they tried this the elastic band went into an oval shape instead of hanging down straight so they decided to start at 1N.

Each time they add another weight they record the length. They set up a pointer to take the readings with. They are using the scale down the right-hand side of the ruler, which is marked in centimetres.

They decided to stop at 6N because the elastic band was tightly stretched and they thought it might break.

These are their results:

Load (N)	Reading on scale (cm)
1	12.7
2	13.6
3	14.5
4	15.9
5	16.3
6	17.1

a. Work out the difference between each pair of readings and find out how much it goes up by every time they add another Newton.

b. Generally speaking, how much does the length increase for every Newton added?

c. They got one of the readings wrong; suggest which one it was.

d. If they had found a way of keeping the elastic band straight with no load on it, what do you think its length would have been?

e. Will says, "I think that adding the same extra load should cause the same extra extension, as long as we don't overdo it." Explain whether this is supported by their evidence.