**Yr 10 Physics work for weeks 5 and 6**

**Forces and elasticity (P4.5.3)**

1. More than one force is needed to bend, stretch or squash an object
2. Force is a vector quantity
3. Force is measured in newtons (N)
4. Elastic materials return to their original shape when the force is removed from them.
5. Inelastic (plastic) materials stay stretched, squashed or bent when the force is removed from them
6. The extension of an object is how much it has stretched by.
7. The extension of an elastic object (eg a spring) is directly proportional to the force applied to it as long as the limit of proportionality is not exceeded
8. Force = spring constant x extension   F = k x e    (e is the extension or the compression)
9. The spring constant k has units of N/m  or N/cm

This pack of work starts by linking up with the work you did last week on Hookes Law.

Open this link to Focus software.

<http://www.tinyurl.com/y9dnpb37>

scroll down to ‘Science Investigations 2’

From the menu on the left hand side, select ‘Bending a beam’

You are going to investigate how the load on a beam affects how much it bends.

1. Set the length of the beam to 90.0cm
2. Set the width of the beam to 30.0mm
3. Set the length of the beam to 5.0mm
4. Click on the ‘Results’ tab and copy the table headings.
5. Add 50g of load and write down the deflection of the beam
6. Continue to add 50g loads until the beam breaks
7. Look at the data (or even better plot a graph) and decide whether the beam obeys Hookes Law.
8. Explain carefully why the graph does not go through 0,0 on the graph.
9. *Extension: Use your graph to calculate the spring constant for the beam*
10. *Calculate the energy stored in the beam when the load on it is 200g (g=9.8N/kg)*

**Force and Motion**

**Read and learn the following facts.**

**Speed (P4.5.6.1.2)**

1. Speed is how fast something is moving - is a scalar quantity.
2. Walking speed is about 1.5m/s
3. Running speed is about 3m/s
4. Cycling speed is about 6m/s
5. Car at motorway speed is travelling at 32m/s
6. Speed of sound in air is 330m/s
7. Speed of light in air is 3.0x108 m/s
8. Speed is calculated using the equation            speed = distance ÷ time   
   NOTE. **v** is used for speed and **s** for distance      **v  =    s     ÷   t**
9. Average speed = total distance travelled ÷ total time taken
10. The units of speed depend on the units of distance and time used.    
    Distance in metres ÷ time in seconds = speed in metres per second   
    Distance in kilometres ÷ time in hours = speed in kilometres per hour

**Velocity (P4.5.6.1.3)**

1. Velociy is the speed in a given direction. Velocity is a vector quantity.
2. Velocty is calculated using the equation    velocity = displacement ÷ time   
                                                                          **v    =        s      ÷   t**

**Questions.**

1. State what is meant by the term *vector* and give 2 examples of vectors.
2. State what is meant by the term *scalar* and give 2 examples of scalars.
3. What is the difference between speed and velocity.
4. What is the equation for speed?
5. What is the equation for velocity?
6. How fast is running speed?
7. How many times faster is cycling speed than walking speed?
8. How many times faster is the speed of light compared to running speed?
9. Calculate the speed of a lorry which travels 200m in 40 seconds.
10. A person walks 200m in 143 seconds. Calculate their speed
11. Calculate how long it will take a person to walk 300m.
12. A person cycles for 200ceconds. How far does she travel?
13. A car travels for 2 minutes on the motorway. How far does it travel?
14. A snail travels 80cm in 5 minutes. Calculate its speed in metres per second.
15. Calculate the ratio of speed of light to the speed of sound.
16. A bird flies 400m north in a time of 30 seconds. What is its velocity?
17. A hawk flies 400m north in 20 seconds, then 300m east in 18 seconds.   
    a. What is it’s total distance travelled?  
    b. what is the total time of it’s journey?  
    c. Calculate the average speed of the bird.   
    d. Calculate the bird’s displacement after 38 seconds?  
    d. Calculate the bird’s average velocity for the journey.
18. *Extension: A person sees a lightning strike and hears the thunder 3.5 seconds later. How far away was the lightning strike?*
19. *A cyclist and a runner set off in a straight line from the same point at the same time. How far ahead will the car be after 8 minutes?*
20. *A person shouts and hears and hears an echo from a cliff 6 seconds later. How far away is the cliff from the person?*

**Read and learn the following facts:**

**The distance-time relationship (P4.5.6.1.4)**

1. A straight horizontal line on a distance time graph represents a  stationary object
2. On a distance /time graph, constant speed is represented by a diagonal straight line.
3. The gradient of a distance time graph gives the speed
4. A curved line on a distance time graph represents acceleration. The gradient of the tanjent of the curve at a particular time,  gives the speed at that time.

**Distance-Time Graphs questions**



*Write the following labels onto the correct part of the graph:*

|  |  |  |
| --- | --- | --- |
| ***Backwards, slow*** | ***Accelerating*** | ***Forwards, fast*** |
| ***Forwards, slow*** | ***Stopped*** | ***Backwards, fast*** |

**Question 1**

*Read the description of the journey below and draw the* ***distance-time*** *graph*

1. Harmeet sets off on her bicycle and travels 100 metres in 50 seconds.

2. She stops for 30 seconds...

3. then travels 150 metres in 120 seconds...

4. then stops for 10 seconds.

5. She turns round and cycles straight back, covering the entire   
250 metres in 100 seconds.

a) Work out Harmeet's speed for each of the three stages when she was moving:

Stage 1: Speed = distance / time =

Stage 3:

Stage 5:

b) When was Harmeet travelling fastest?

c) Using the equation: **average speed = total distance total time** calculate Harmeet's average speed for the **outward** journey.

**Question 2**

The Haggis family catch the train down to London to visit their relatives.   
Their train journey goes like this

1. The train leaves Edinburgh at 8:00 a.m. and travels 180 miles to York in 1½ hours.

2. At York, the train waits for 15 minutes, then sets off again.

3. It travels 100 miles in 1 hour, then...

4. ...it has to stop for 30 minutes due to leaves on the line.

5. Eventually it travels the last 100 miles to London in ¾ hour.

Draw the **distance-time** graph for the train.

a) How long did the entire journey take?

b) How far is London from Edinburgh?

c) Using the equation  work out the average speeds for:

Edinburgh York

York London

Edinburgh London

d) A different train travels from Edinburgh to London without stopping, at an average speed of 120 miles per hour. How long would the journey take?

**Question 3.**

Tajinder pops out to the newsagent for a quick chocolate fix The shop is at the other end of a straight road. Her distance time graph looks like this:

1. Tajinder had to stop to cross the road at a zebra crossing. Was it on the way there or on the way back?..................................
2. How long did she have to wait for?..............................
3. How long did she spend in the newsagent's shop?...............
4. How far is the shop from her house?..................................
5. What was her average speed on the way there?
6. What was her average speed on the way back?
7. Tajinder had to walk slower nearer the shop because the pavement was busy. What was her slowest speed?
8. If she didn't have to wait at the zebra crossing, how long would her journey have taken?

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