LOCKERBIE ACADEMY

TRANSPORT UNIT

SPEED

S1-S3 Road Safety & PHYSICS

LOCKERBIE ACADEMY TRANSPORT UNIT

- We plan to find out and understand about the following terms
- ✓ distance
- ✓ displacement
- ✓ speed
- ✓ velocity
- ✓ instantaneous/ average/ uniform/ speed
- ✓ time & at rest

S1 Physics Transport

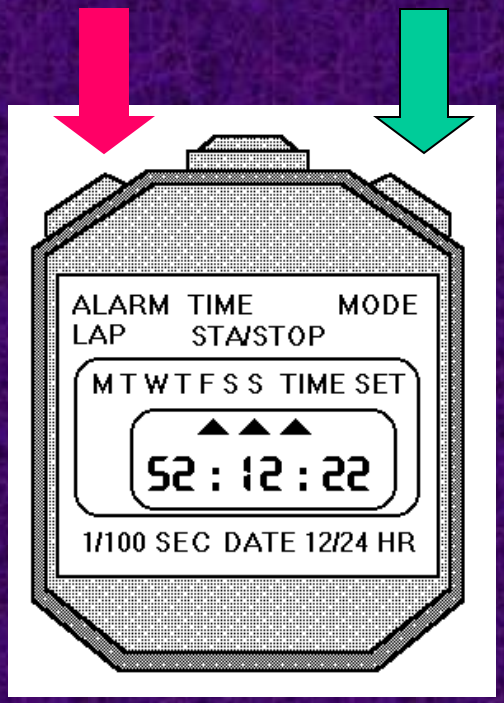
Speed, Distance & Time

Back to mind map

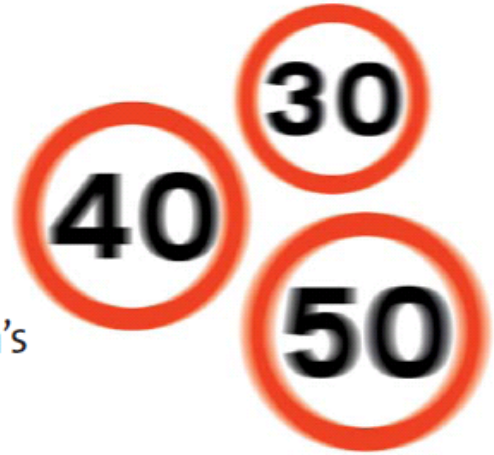
Reading the stopclock

- The stopclock display can be a bit confusing.

- A number that looks like this: 0:0234 means 2.34 seconds.



Did you know?



- Excessive speed contributes to 12% of all injury collisions, 18% of crashes resulting in a serious injury and 28% of all fatal collisions
- This means that around 1,000 people are killed each year on Britain's roads, and over 6,000 are seriously injured, because drivers and riders travel too fast.

Highway Code Rule 103

You MUST NOT exceed the maximum speed limits for the road and for your vehicle. Street lights usually mean that there is a 30 mph speed limit unless there are signs showing another limit.

Speeding is not just exceeding the speed limit. It is also driving within the speed limit but too fast for the conditions (known as 'inappropriate speed'). Describe some situations where it is not safe to drive as fast as the speed limit.

What do you think?

Find out the normal speed limits for different types of roads and different vehicles. Why do some vehicles (for example, heavy goods vehicles) have lower limits?

Why are speed limits necessary? What would happen if drivers were allowed to drive at any speed they wanted? Would they all choose the same speed on a particular road? Would they choose speeds that were safe for pedestrians and cyclists?

How do higher speeds make crashes more likely? How do higher speeds make collisions more serious?

Discussion Points

Stopping Distances

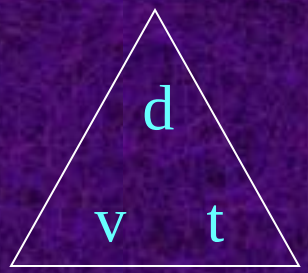
The faster a car is travelling, the longer it takes to stop. At just 30 mph, a car travels 44 feet (about 3 car lengths) each second.

Using the Highway Code, make a chart showing the differences in stopping distances between various speeds in between 20 mph and 70 mph. If a driver reacts slowly, the stopping distance will increase. What else increases stopping distances?

As well as being dangerous itself, going too fast also makes other types of driving more dangerous, e.g. driving too close to the vehicle in front. Make a list of types of bad driving that are made even worse at higher speeds.

Speed

$$v = d \div t$$



$$v = \frac{d}{t}$$

$$Speed\ (\text{metres/second}) = \frac{Distance\ (\text{metres})}{Time\ (\text{second})}$$

Examples using the Speed Formula (Showing full working):

1. The sprinter ran 100 metres in 10 seconds. What was his speed ?

$$Speed = \frac{Distance}{Time} = \frac{100\ m}{10\ s} = 10\ m/s$$

- In Physics we show the divide by sign as a line and say "over"

$$\text{speed} = \frac{\text{distance travelled}}{\text{time for the journey}}$$

$$\bar{v} = \frac{d}{t}$$

where v=speed, d=distance and t=time

Your Team Challenge

Each member of your team must drive the course with their vehicle. They must NOT stray off the track or they have to return to the start.

Your Team Challenge

You must time how long it takes each member to complete the journey and measure the distance travelled along the track.

Record each team member's time and calculate the average speed for each journey.

LOC NIT

LOCKERBIE ACADEMY TRANSPORT UNIT

YOUR TASK.

TASK

Working in teams you need to:

1. Measure the DISTANCE that the car will travel along the pre-defined course.
2. Record this value on your worksheet.
3. Time how long each person in the group takes to complete the course.
4. Record this value on your worksheet
5. Record as tally marks on your worksheet every time each person in the group leaves the track

WORDBANK

- <u>Vehicle</u>
- A thing used for transporting people or goods, especially on land, such as a car, truck, or cart.

WORDBANK

- Distance- is how far you have travelled. It is another name for length. It is measured in metres or during our road safety topic miles.

- Time- is how long your journey took. It is measured in seconds or during our road safety topic hours.

Additional Notes- For Printing only if repeat measurements required

- To find the average speed from your results
- Find the average time for the 3 runs (if the race was run 3 times)
  - Do this by adding the times for the three runs in the calculator, PUSH the = button on the calculator and then divide this answer by 3 (as there were 3 runs). Add this number to your table where it says average time)
- Find the speed using the formula
  - Speed = distance ÷ time
- Add this value of speed to your table.
- DO NOT give your average speed to more than 1 decimal place unless the value is very small.

WORDBANK

- Speed – how far you travel every second.

OR

- Speed is the distance travelled in unit time.
- In the lab our distances are measured in metres and our time is measured in seconds so our units of speed would be metres per second.
- In road safety we look at miles travelled every hour or miles per hour.

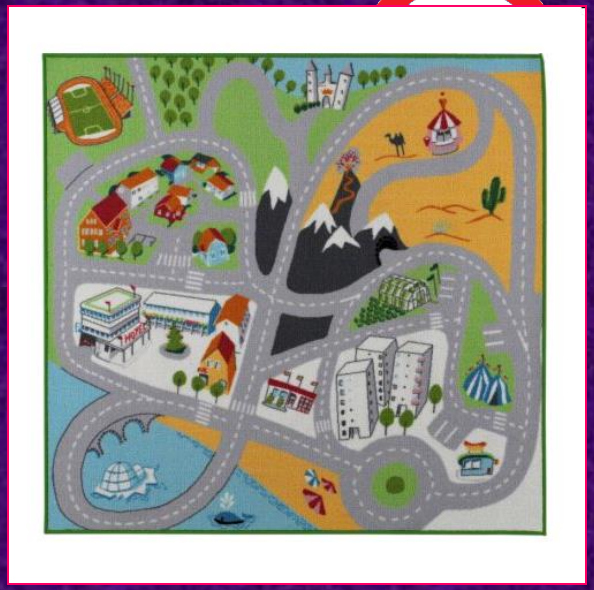
WORDBANK

- At rest- in Physics we use this term to mean not moving. We can also say the object is stationary.

- *It is not the same word as pens and pencils which are stationery!*

Let's try some examples

1. Matt's time for the course was 00:01:55. The course was 1.78m. What was Matt's speed around the course?



$$t = 00:01:55$$

$$= 1\min 55s = (1 \times 60) + 55s = 115s$$

$$d = 1.78m$$

$$v =$$

$$Speed = \frac{Distance}{Time}$$

$$v = \frac{d}{t}$$

$$v = \frac{1.78}{115}$$

$$\underline{\underline{v = 0.015m/s}}$$

AND THE WINNING TEAM IS

- FIXING your calculators

FIX allows you to fix how many figures after the decimal point should be displayed i.e. it fixes the number of decimal places you quote a value to. This is really useful if you suffer from calculator diarrhoea, but be careful you could end up with zero!

AND THE WINNING TEAM IS

- Calculate the average speed for each of your team drivers.

AND THE WINNING TEAM IS

- And the winner is……

Let's try some examples

- Let's try some more examples of speed distance and time and then in your groups we can do the domino challenge.

- But first let's look at how to set out equations

HOW TO LAY OUT EQUATIONS IN PHYSICS

http://www.youtube.com/watch?v=u7akhlAS5Ck

Check before you play!

IESSUU

- Information
- Equation
- Substitution
- Solution
- Units
- Underline

& remember no SECS in PHYSICS

$$Speed\ (\text{metres/second}) = \frac{Distance\ (\text{metre})}{Time\ (\text{second})}$$

2. The Porsche travelled at 40 m/s for 2 minutes. How far did it go ?

speed=40m/s

Time = 2 minutes (2×60)= 120 second ← Information

$$Speed = \frac{Distance}{Time} \qquad v = \frac{d}{t}$$ ← Equation

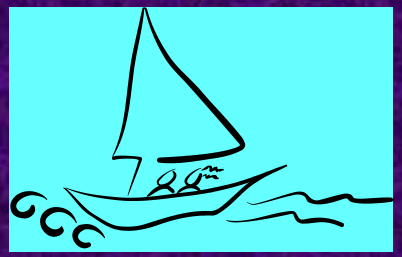
$$40 = \frac{d}{120}$$ ← Substitution

$$= 40\ m/s \times 120\ s$$ ← Solution

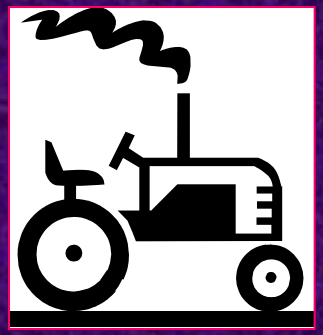
$$= 4800\ \text{m}$$ ← Units, Underline

Let's try some examples

Work out the average speeds for the following journeys. Make sure you set out your working in the same way as the example above.



1. A boat travels 30 km in 3 hours.



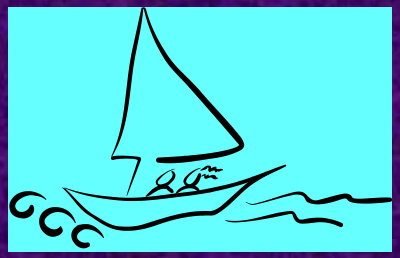
2. A tractor drives 18 km in 6 hours.

3. A frog jumps 25 metres in 5 seconds. (Take care with the units.)

4. A plane flies 600 km in 3 hours.

Let's try some examples

1. A boat travels 30 km in 3 hours.



$$Speed = \frac{Distance}{Time}$$

$$v = \frac{d}{t}$$

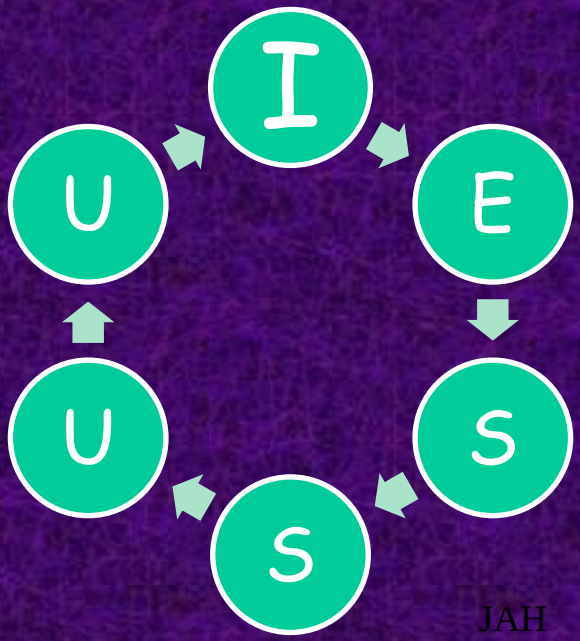
d= 30km

t= 3h

v=?

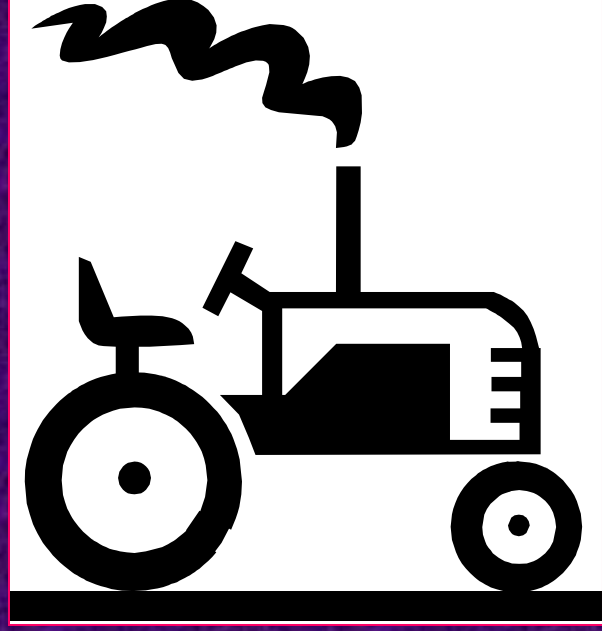
$$v = \frac{30}{3}$$

$$\underline{\underline{v = 10\ km/h}}$$



Let's try some examples

2. A tractor drives 18 km in 6 hours.



$$Speed = \frac{Distance}{Time}$$

d= 18km

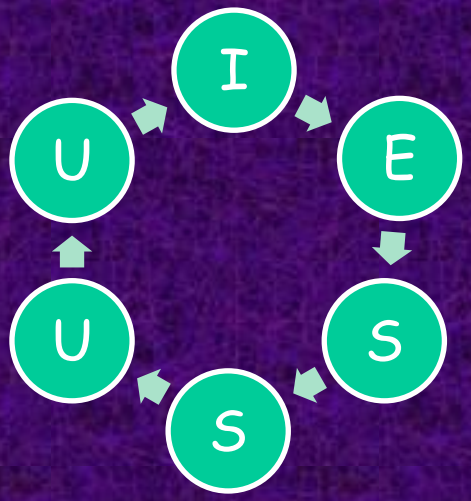
t= 6h

v=?

$$v = \frac{d}{t}$$

$$v = \frac{18}{6}$$

$$\underline{\underline{v = 3\ km/h}}$$



Let's try some examples

3. A frog jumps 25 metres in 5 seconds. (Take care with the units.)

$$Speed = \frac{Distance}{Time}$$

d= 25m

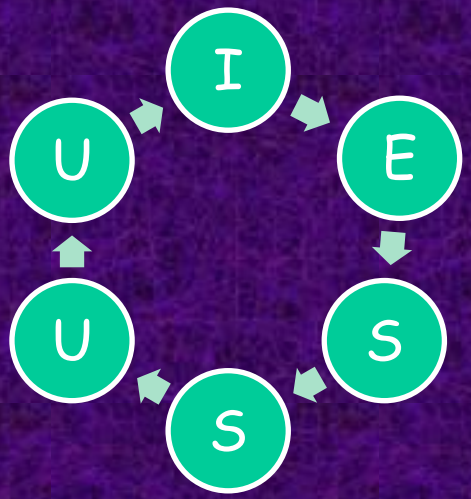
t= 5s

v=?

$$v = \frac{d}{t}$$

$$v = \frac{25}{5}$$

v=5m/s



Let's try some examples

4. A plane flies 600 km in 3 hours.

$$Speed = \frac{Distance}{Time}$$

d= 600km

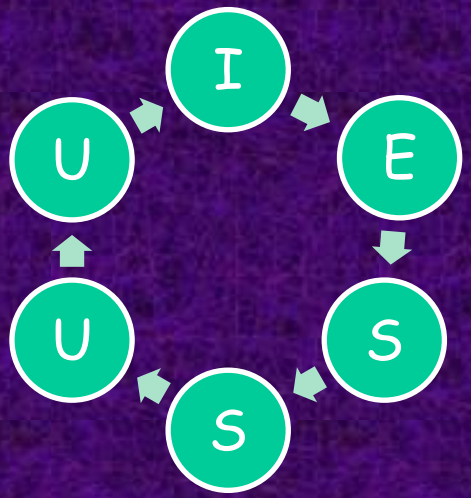
t= 3h

v=?

$$v = \frac{d}{t}$$

$$v = \frac{600}{3}$$

$$\underline{\underline{v = 200\ km/h}}$$



IN YOUR MATHS SECTION WRITE OUT THE FOLLOWING EXAMPLE

- Tony walks 40m in 30s what is his average speed?

v=?, t=30s, d=40m

- speed=distance/time
- speed=40/30 = <u>1m/s</u>

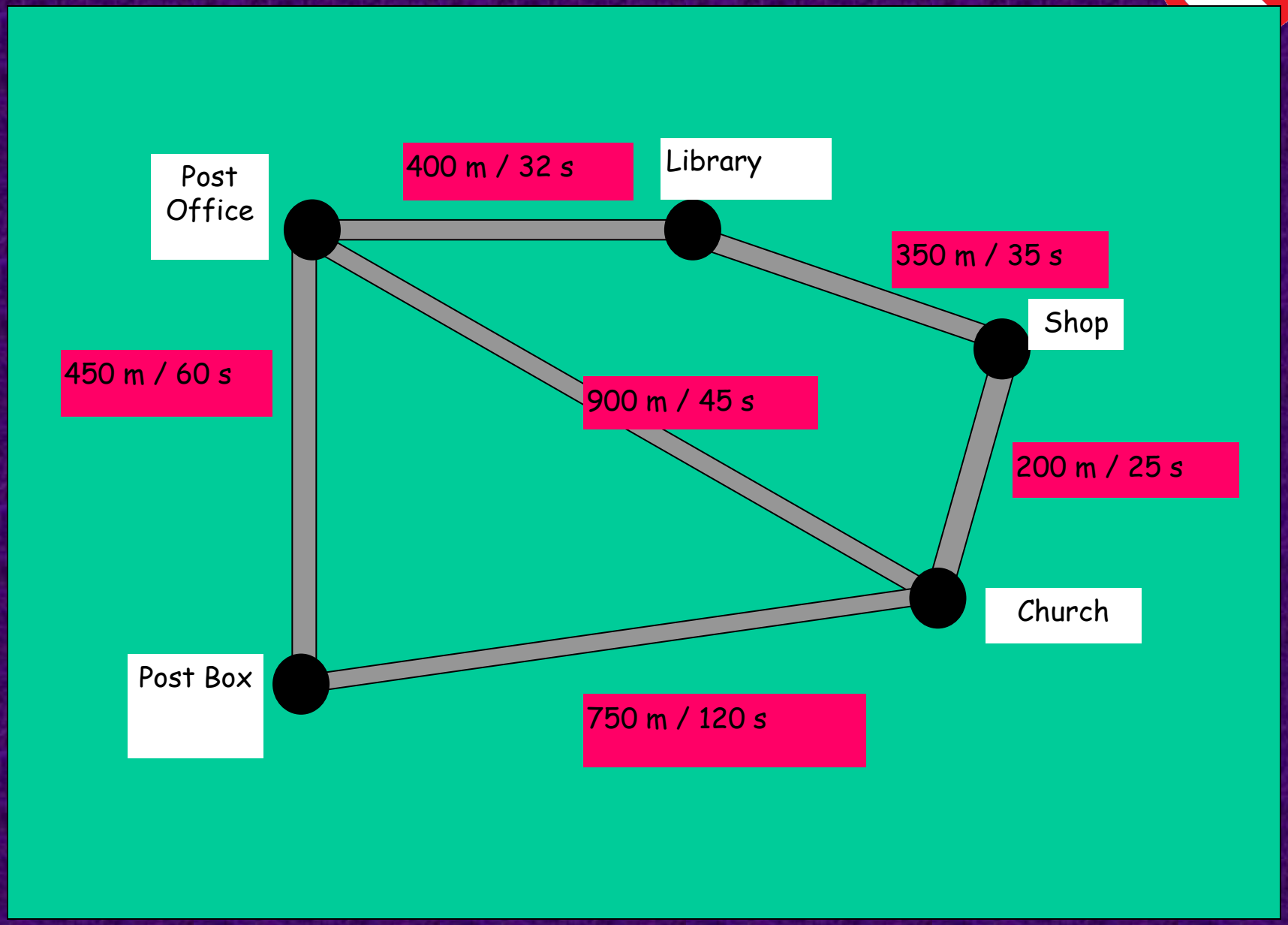
IN YOUR MATHS SECTION WRITE OUT THE FOLLOWING EXAMPLE

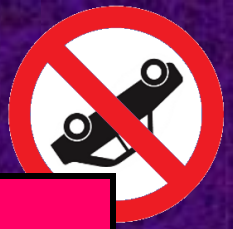
- You could write 1.3m/s, 1.33m/s or 1.333m/s and get the mark. If you write 1.33· m/s or 1 1/3 m/s or 1.333333m/s you lose the mark for the answer! This is because you have used TOO MANY SIGNIFICANT FIGURES.
- Mrs Hargreaves calls this "calculator diarrhoea"! and you can FIX it!!!!

SpeedDominoes

Answer = **17.5 m/s**	Space for working	Answer = **5s**	Space for working
average speed = ? distance = 500 metres time = 5 seconds		average speed = ? distance = 15 000 metres time = 25 seconds	
Answer = **45 m/s**	Space for working	Answer = **100 m/s**	Space for working
average speed = ? distance = 10 metres		average speed = ? distance = 45 metres	
Answer = **0.12 m**	Space for working	Answer = **600 m/s**	Space for working
average speed = ? distance = 750 metres time = 500 seconds		average speed = ? distance = 540 metres time = 12 seconds	
Answer = **1.5 m/s**	Space for working	Answer = **18 m/s**	Space for working
average speed = 12 metres per second distance = ? time = 6 seconds		average speed = 0.001 metres per second distance = ? time = 120 seconds	

THE POST VAN AND AVERAGE SPEED.





Journey	Average Speed
Post Office → Post Box	
Post Office → Church	
Post Box → Church	
Library → Shop → Church	
Post Office → Post Box → Church	
Post Office → Church → Shop → Library	

S1 Physics Transport

INSTANTANEOUS Speed

Back to mind map

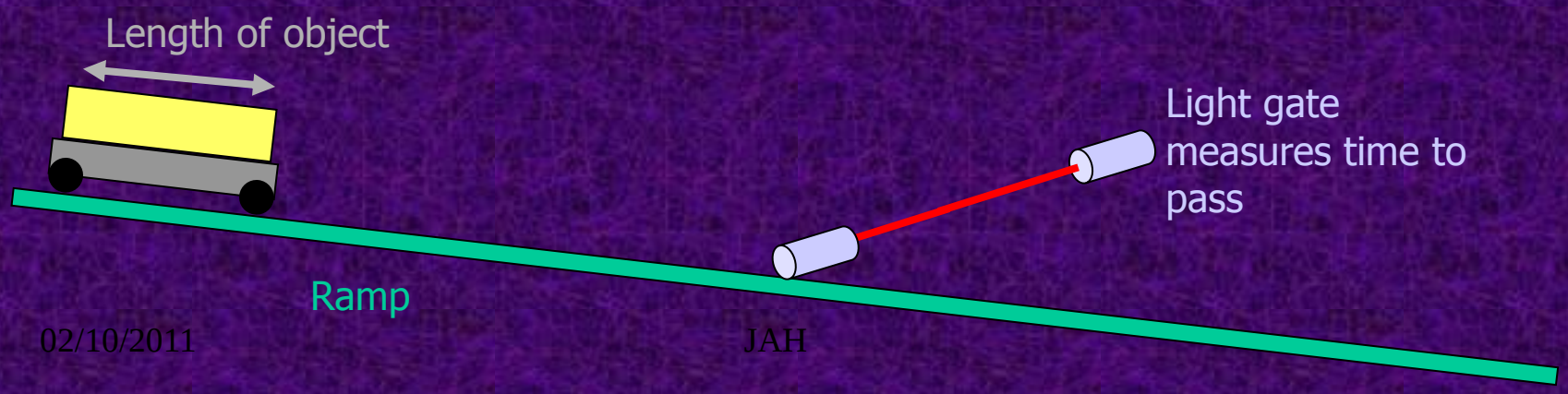
WORDBANK

Instantaneous speed is the speed at which you are travelling over a very short distance. It is measured in metres per second or miles per hour.

Instantaneous Velocity

WORDBANK

The <u>instantaneous speed</u> for an object is its speed at a particular point in time. For example, a police speed camera measures the instantaneous velocity of the car.



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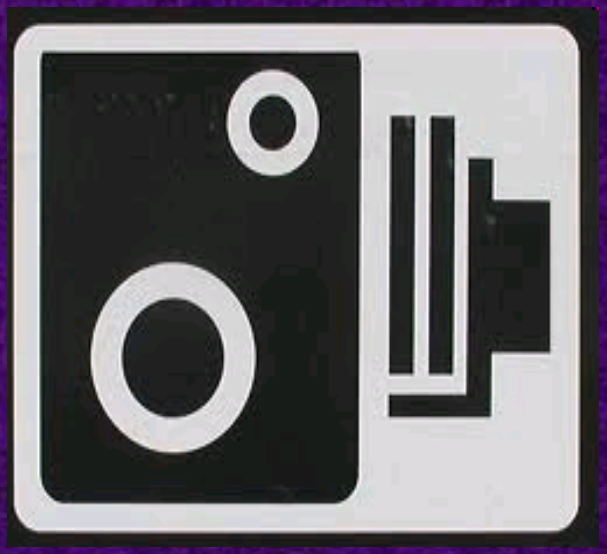
A **speedometer** is a gauge that measures and displays the instantaneous speed of a land vehicle.

INSTANTANEOUS SPEED



Speed Cameras in D&G

Speed cameras

Cameras are used to discourage drivers from exceeding the speed limit.

Using the websites **www.dft.gov.uk** (click on Road Safety and then Safety Cameras) and **www.nationalsafetycameras.co.uk**, find out the rules for placing speed cameras. On a road map, mark the locations of cameras in your area. Why do you think they are where they are?

Write an article describing how cameras work, why they are needed and how effective they are. This could be for a local newspaper. Could you use quotes or statements from family members or friends about their views.

Cars

What features of car design help drivers to control their speed? Do any aspects of car design encourage drivers to go too fast? Also think about how cars are advertised and promoted. What sort of adverts would influence your choice of car and why? What else could manufacturers do to help drivers?

Most speedometers are a dial with numbers around the edge and an arrow pointing towards the speed the vehicle is doing. Is this the best design? Are there other types?

Design a new speedometer. Think about how it tells the driver what speed they are doing and how it could warn him or her if they are going too fast.

	BUILT-UP AREAS * (30)	SINGLE CARRIAGEWAY	DUAL CARRIAGEWAY	MOTORWAY (70)
Cars and motorcycles (including car derived vans up to 2 tonnes maximum laden weight)	30	60	70	70
Cars towing caravans or trailers (including car derived vans and motorcycles)	30	50	60	60
Buses and coaches (not exceeding 12 metres in overall length)	30	50	60	70
Goods vehicles (not exceeding 7.5 tonnes maximum laden weight)	30	50	60	70**
Goods vehicles (exceeding 7.5 tonnes maximum laden weight)	30	40	50	60

These are the national speed limits and apply to all roads unless

These are the national speed limits and apply to all roads unless signs show otherwise.

* The 30 mph limit applies to all traffic on all roads in England and Wales (only Class C and unclassified roads in Scotland) with street lighting unless signs show otherwise.

** 60 if articulated or towing a trailer.

Built up areas generally have roads with street lights. Unless signed otherwise, the speed limit is always 30mph, no matter the number of lanes.

Single carriageway is an undivided road with no centre barrier.

Dual carriageway is a two way divided road with a central barrier that you are able to cross from side roads.

Motorway is a two way divided road with a central barrier containing slip roads. It is only possible to access a motorway via slip roads and there is no crossway traffic.

Instantaneous Velocity

Instantaneous speed is difficult to measure.

WHY?

Let's try it!

An investigation to measure reaction time and calculate stopping distances

Using the Reaction Timer box you will find out:

- Your reaction time.
- How your reaction time changes if you are chatting or texting.
- You will calculate stopping distances for different speeds.

MEASURING INSTANTANEOUS Speed

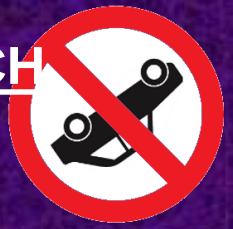
Back to mind map

MEASURING INSTANTANEOUS SPEED- get the instruction sheets

- **USING A STOPWATCH**
  - What you need:

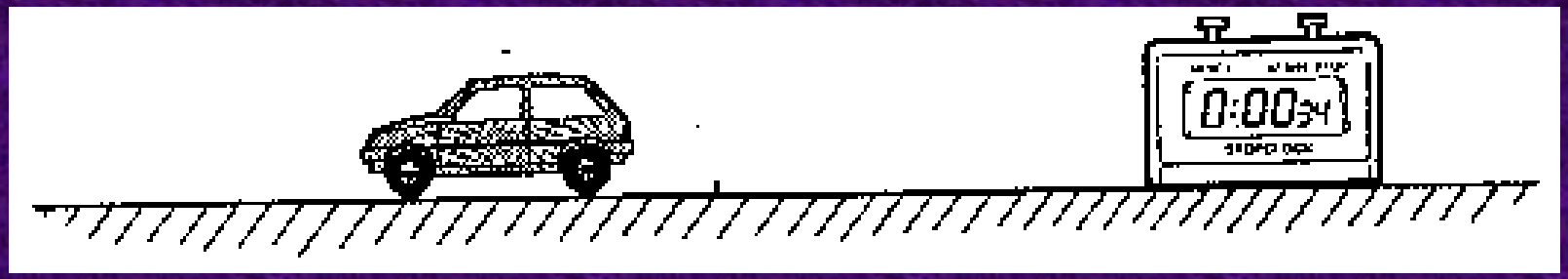
Model vehicle, ruler, chalk, stopclock, instruction sheet

MEASURING INSTANTANEOUS SPEED USING A STOPWATCH



What you need

- Model vehicle, ruler, chalk, stopclock.



What to do

- Mark one chalk line on the bench. (Don't forget to rub it out when you have finished!).
- Measure the length of the model vehicle. Record this in your jotter.

MEASURING INSTANTANEOUS SPEED USING A STOPWATCH

- Start the stopclock when the front edge of the vehicle reaches the chalk line.
- Stop the stopclock when the end of the car reaches the chalk line.
- Note the time from the stopclock in your jotter.
- Calculate the speed using the formula:

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

S1 Physics Transport

MEASURING INSTANTANEOUS Speed

(let's not worry about reaction time!)

Back to mind map

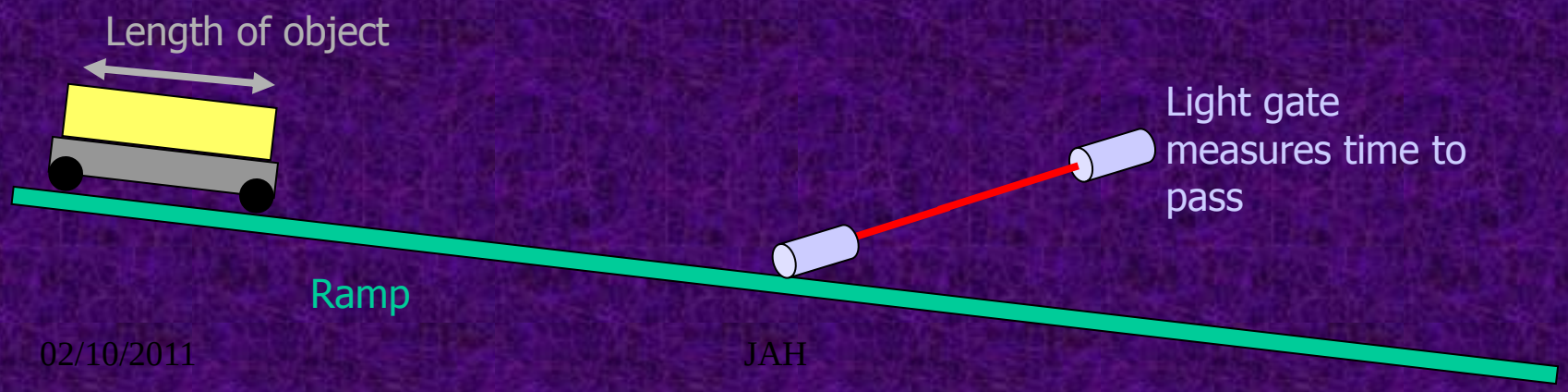
MEASURING INSTANTANEOUS SPEED- get the instruction sheets

- **USING ALBA & LIGHT GATES**
- What you need:

Model vehicle, ruler, mask, lightgates + laptop, instruction sheet

Instantaneous speed

One way is to use a light gate. The **length of the object** divided by the **time it takes to pass** gives its instantaneous speed.



MEASURING YOUR INSTANTANEOUS SPEED

GROUP TASK- back to the PLAYMATS!

We need to know the

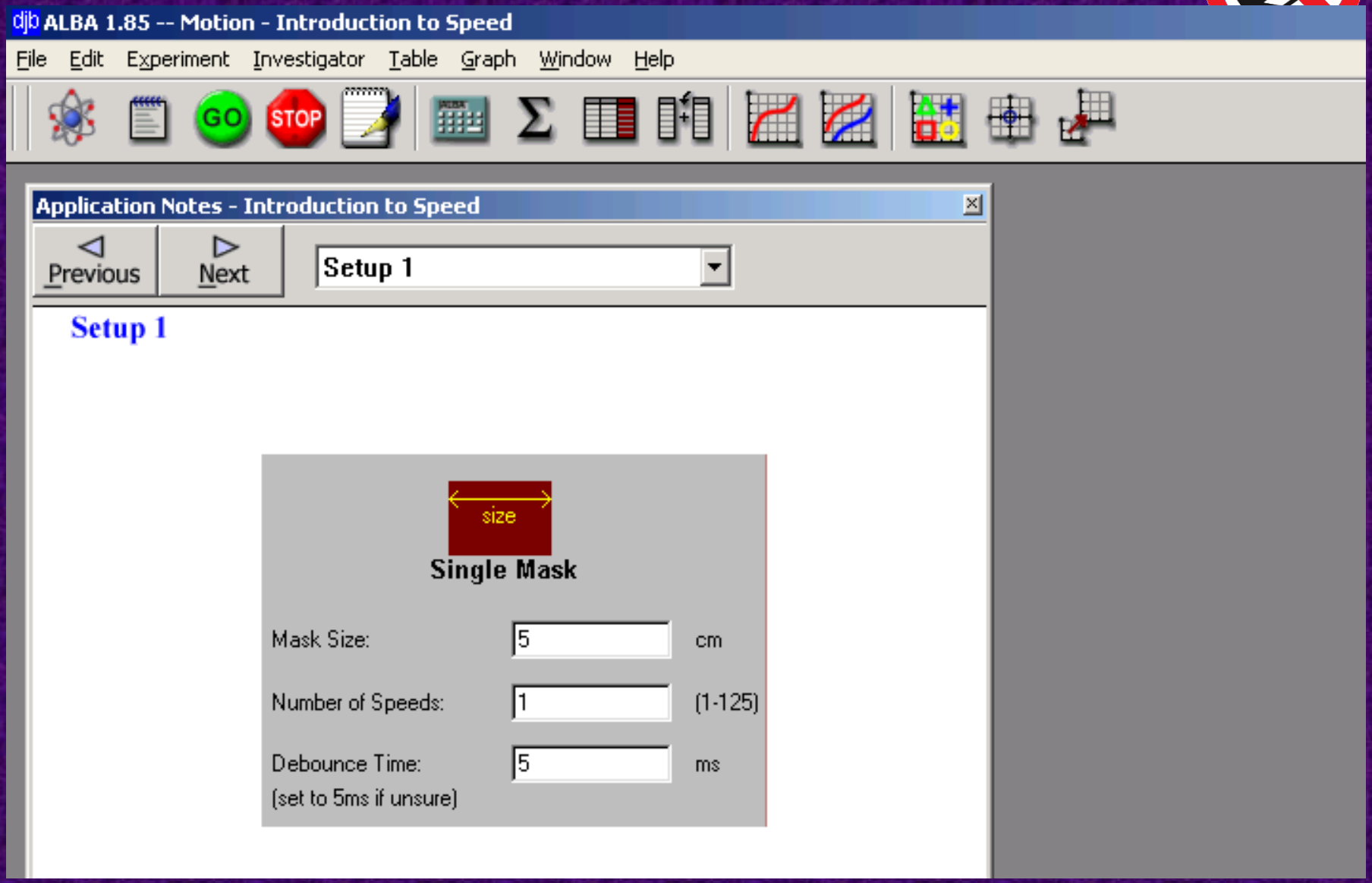
1. length of your vehicle or the mask on top.
2. the time for the vehicle to pass through the light gates
3. the instantaneous speed of the vehicle as it goes round the roundabout (or alternative)

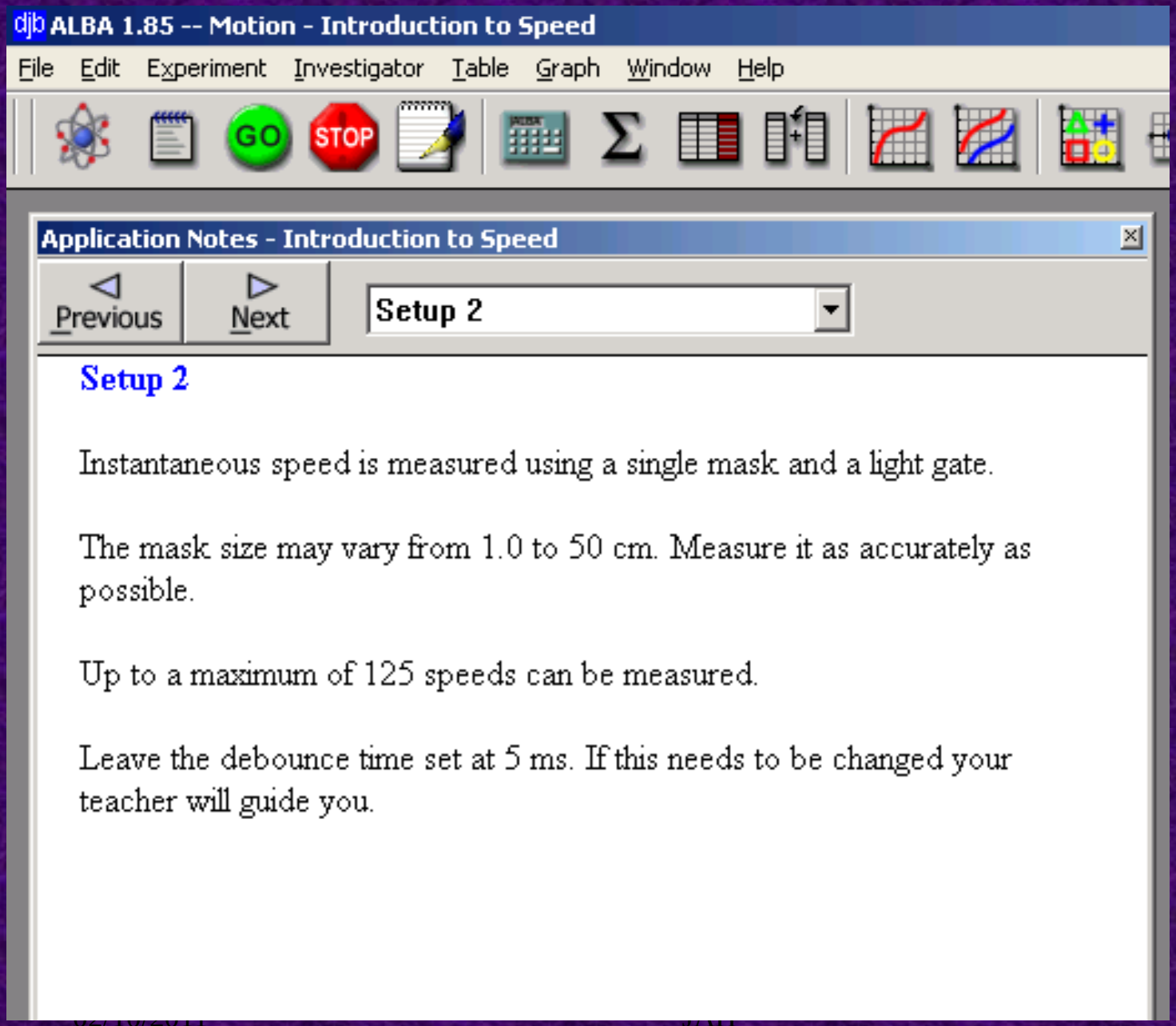
YOUR TASK.

Working in teams you need to:

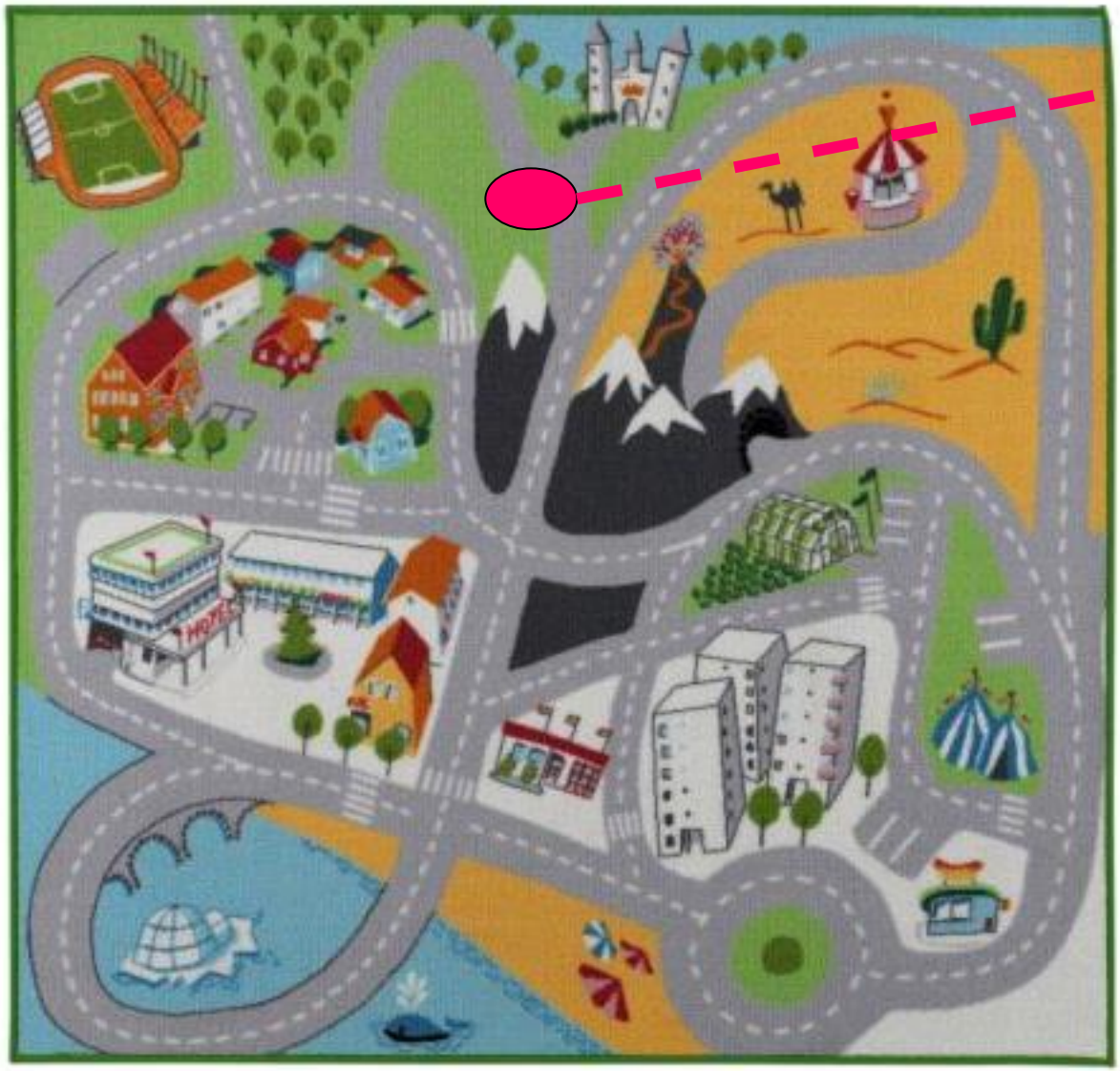
- Using the ALBA package record the instantaneous speed of the vehicle at the specific place in the track (see the additional worksheet)
-

ALBA-MOTION
INTRODUCTION TO SPEED


ALBA 1.85 -- Motion - Introduction to Speed
File Edit Experiment Investigator Table Graph Window Help
GO
STOP
Application Notes - Introduction to Speed
Previous
Next
Setup 1
Setup 1
size
Single Mask
Mask Size: 5 cm
Number of Speeds: 1 (1-125)
Debounce Time: 5 ms
(set to 5ms if unsure)


ALBA 1.85 -- Motion - Introduction to Speed
File Edit Experiment Investigator Table Graph Window Help
GO
STOP
Application Notes - Introduction to Speed
Previous
Next
Setup 2
Setup 2
Instantaneous speed is measured using a single mask and a light gate.
The mask size may vary from 1.0 to 50 cm. Measure it as accurately as possible.
Up to a maximum of 125 speeds can be measured.
Leave the debounce time set at 5 ms. If this needs to be changed your teacher will guide you.

RT UNIT



"Speed camera"
Measure instantaneous speed here

RT UNIT

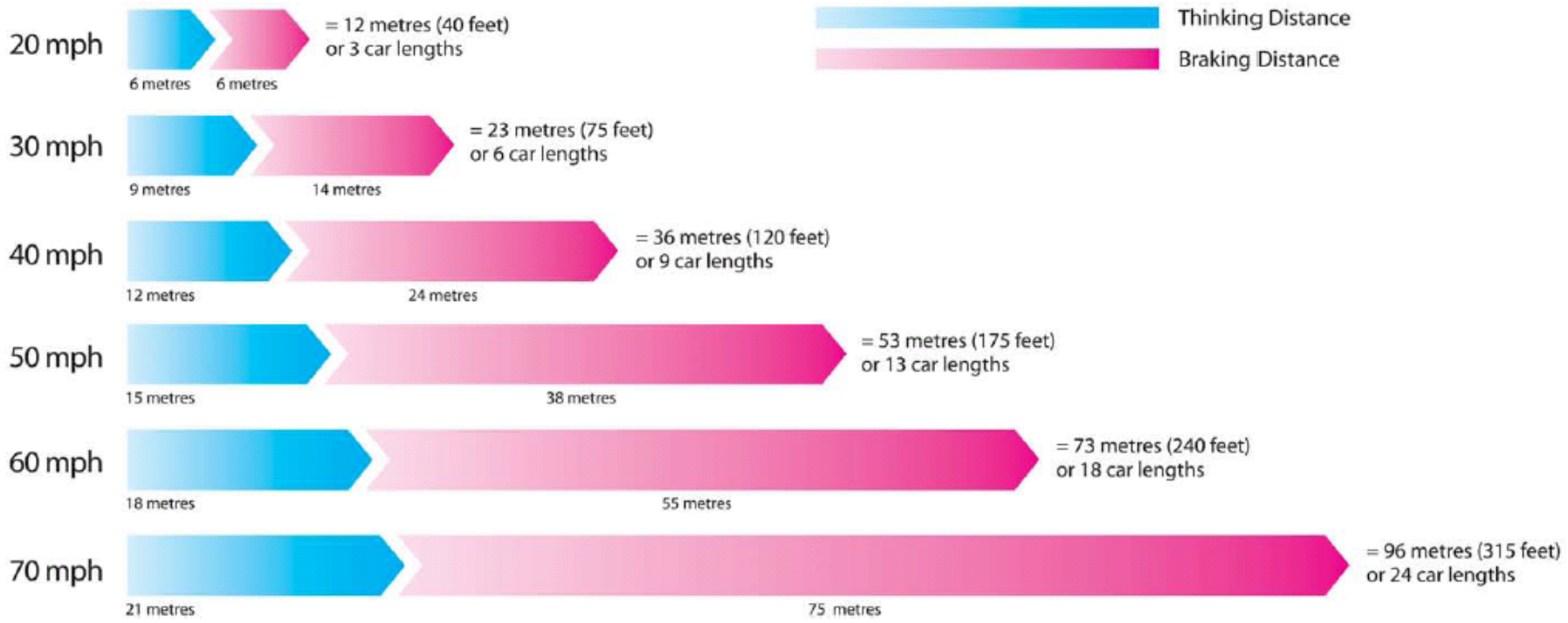
"Speed camera"
Measure
instantaneous
speed here


Bunsens
Gauzes
Tripods

Did you know? A pedestrian hit by a car at:

- 20 mph, has a 97% chance of surviving (almost all live)
- 30 mph, has a 80% chance of surviving (most live)
- 35 mph, has a 50% chance of surviving (half live, half die)
- 40 mph, has only a 10% chance of surviving (almost all die).

Small increases in speed have massive effects



Activities

There are many reasons and excuses for speeding (such as "I was late", "everyone else does it" and "I enjoy driving fast").

In a pair:

- Make a list of all the reasons you can think of
- Create a questionnaire (example opposite)
- Ask people you know who drive (parents, their friends, teachers, etc) to complete the questionnaire
- Keep the questionnaires anonymous, but record whether the respondents are male or female and their age
- Collate all the responses together.

Speeding Questionnaire

Produce a report analysing the results and identifying the most common reasons for speeding and any differences between men and women and between age groups.

Respondent 1	Male	Female	Age	
Reason for Speeding	Never	Sometimes	Often	Always
Late				
Other drivers speeding				
I think it's safe to speed				

Discussion Points

In small groups:

- Brainstorm the best ways of raising awareness about the dangers of speeding.
- What methods would you use e.g. TV adverts, posters, something else?
- Where would you target publicity? (locations/events)

Activities

Design an awareness raising campaign to include a leaflet, poster and press release.

Who do you think are the key target groups? Think about age, sex, and also social activities. Also take into consideration those locations and times where speeding is more common. Decide whether to cover all drivers or a specific group (does your decision change the method you would use, your target group or where you would locate the campaign?)

Think about campaigns used by other groups and try to make yours effective for your target audience. Run your campaign either in school or in your local community, make sure that you establish a way to evaluate the success of the campaign. Set a time limit for the campaign, this could be a couple of days or a week or more. You will need to draw up a plan of action to ensure the smooth running of the campaign and source all the materials that you need to set it up. Have you ever been a passenger in a car and been concerned that the driver is going too fast? Look at **www.brag.org.uk** to see how one group of young people have dealt with this issue.

Take it further...

Did you know?

In 2004 a survey of vehicle speeds in Britain:

- 53% of car drivers exceed the speed limit on 30 mph roads in built-up areas
- On 40 mph roads, 27% of car drivers exceed the speed limit
- On motorways, 56% of car drivers exceed the speed limit
- On dual carriageways in non-built up areas, 49% of car drivers exceed the speed limit
- 48% of motorcyclists exceed the speed limit on 30 mph roads in built up areas.

Activities

In the future, cars may not be able to exceed the speed limit. Using the Useful Links section, find out about Intelligent Speed Adaptation (ISA). Organise a class debate. Have one or two people to speak for and against the motion "This class calls for all cars to be fitted with technology to stop them exceeding the speed limit". Think about the advantages and disadvantages of taking the control away from the driver. What is best for society?

S1 Physics Transport

REACTION TIME

Back to mind map

Let's measure YOUR REACTIONS

MEASURING REACTION TIME USING A COMPUTER

Sheep Dash 5 min road test Red dot yellow dot

- On the internet try some of the experiments for finding your reaction time.

MEASURING REACTION TIME USING A RULER

Collect the helpsheet for the instructions on how to find REACTION TIME using a RULER.

MEASURING REACTION TIME USING A RULER

- To measure your reaction time you will need a 30 cm ruler, an instruction sheet and a partner.

WORDBANK

- At rest- in Physics we use this term to mean not moving. We can also say the object is stationary.

- *It is not the same word as pens and pencils which are stationery!*

STOPPING DISTANCE

- The STOPPING DISTANCE of a car is made up of TWO parts

•THINKING DISTANCE

Thinking distance is the distance a car will travel in the time it takes you to react to the situation.

•BRAKING DISTANCE

The distance the car will travel as the brakes are applied

WORDBANK

Stopping distance = thinking + braking
distance distance

Stopping distance the distance it takes a car to stop.

WORDBANK

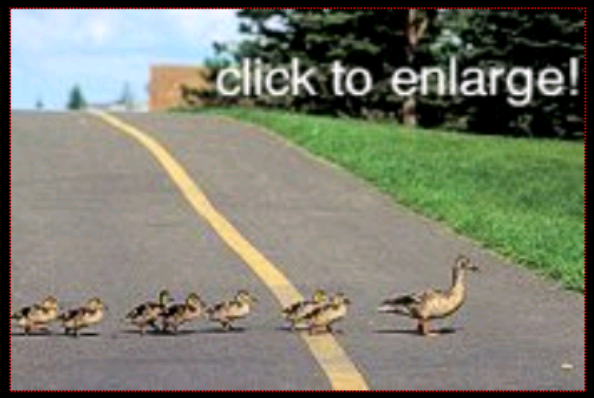
thinking distance

the distance moved whilst you are reacting to the hazard.

braking distance

the distance that the car moves whilst braking.

Stopping Times Example



Here's a good example. A car driver sees a **family of ducks** crossing the road in front of her. She brakes for 1·5 s and took 1·8 s to stop. *What is her reaction time?*

The total stopping time was 1·8 s. This is made of two parts: thinking and braking. The braking time was 1·5 s, so the thinking (reaction) time was 0·3 s.

By the way, she stopped in time - lucky she wasn't driving too fast!

Cute photo credit: Sherwood Park & District Chamber of Commerce

An investigation to measure reaction time and calculate stopping distances

Using the Reaction Timer box you will find out:

- Your reaction time.
- How your reaction time changes if you are chatting or texting.
- You will calculate stopping distances for different speeds.

[Original photo credit: lonecellotheory]

Chicken run...

By, Hannah, Charlotte, Robert and Kieran + Emma, Sophie, Phoebe, Sweez & Faye edited by Mrs H

What chicken is for?

- To get you to learn about the stopping distances of cars and lorries
- To be aware of road safety.
- To appreciate stopping distances.
- Braking in different weather conditions.

Equipment

- Car controls (reaction timer)
- A driver
- Measuring tape
- Mario kart wheel
- People to be chickens

What is it.

Chicken run is an experiment that tests your reaction time and people's appreciation of stopping distances.

You choose

- **weather condition**
- **speed**
- **driver ability**
- **driver distracti**

The Winner

is the person closest to stopping position of "the car" without being "hit"

Rules

- Drive carefully
- Do not break Mario kart wheel
- Don't have your hand hovering over the stop button
- Don't look at the light whilst you're driving
- Think of the control box as a proper car

DO NOT GET HURT


Kristy - 1809m
Adam - 1801m
KRISTY
ADAM R
900m
950m
Kirsty - 810m
Adam - 814 m


Kirsty - 1809m
Adam - 1801m
KRESTY
ADAM R
900m
950m
Kirsty - 810m
Adam - 814 m

Cross Curricular Links

Literacy

- Q: Why did the chicken run across the road?
  A: There was a car coming.
  Q: Why did the chicken cross the road halfway?
  A: She wanted to lay it on the line.
  Q: Why did the rubber chicken cross the road?
  A: She wanted to stretch her legs.
  Q: Why did the Roman chicken cross the road?
  A: She was afraid someone would caesar!
  Q: Why did the chicken cross the road?
  A: To prove to the possum it could actually be done!

Cross Curricular Links

- Literacy
- http://www.mikethehead lesschicken.org/story.php
- Numeracy
- Speed, distance, measuring, unit conversions
- H&W

S1 Physics Transport

UNIFORM Speed

Back to mind map

Uniform Speed

Sometimes through the whole journey your speed will not change. This could be because you have cruise controls on. We would say that your speed is UNIFORM when your speed isn't changing. It remains constant.

WORDBANK

<u>Uniform Speed</u>

When your speed is uniform we mean that your speed isn't changing. It remains constant.

Uniform speed

Do you think people often travel at a uniform speed?

Discuss times when the speed might be uniform and when it might not be uniform.

WHY?

LOCKERBIE ACADEMY

TRANSPORT UNIT

Speed is given as the MAIN cause of FATAL ACCIDENTS on Scotland's Roads

Road Accident Report

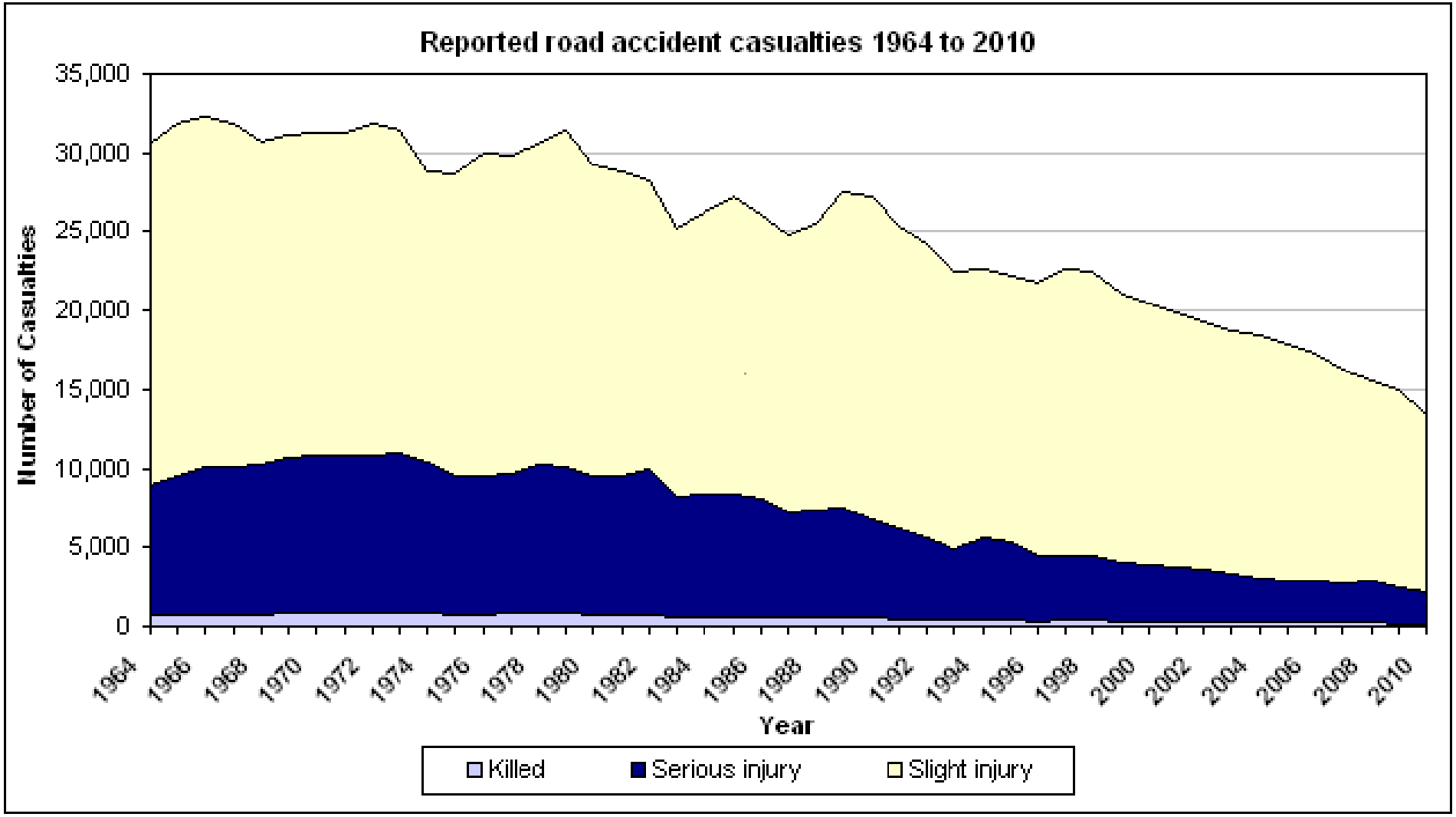
Causes of road traffic accidents

In Great Britain, data collected[6] about road traffic accidents in 1999 to 2002 examined the factors involved in each accident. Excessive speed was the most common contributory factor in fatal accidents, playing a part in 28% of all fatal accidents examined in the trial. Careless, thoughtless or reckless behaviour was next, being a contributory factor in 21% of all fatal accidents examined.

In accidents resulting in any severity of casualty, inattention was the most common contributory factor, found in 25% of all accidents examined in the trial. Failing to judge another person's path or speed was the next most common contributory factor, playing a part in 23% of all accidents examined.

road_traffic_accident.html

THINKING TASK!- More CARS less deaths- WHY?



Crash Figures


STOP
100 yds

ADVANCED QUESTIONS

Questions – Speed

1. What is the speed of a motorbike if it travels 100 metres in 2.5 seconds?
2. what is the speed of a rocket if it can move 32 kilometres in 4 seconds?
3. At what speed in m/s is a skateboarder moving if he can skate 6 kilometres in 10 minutes?
4. A red Ferrari zooms over 500 metres in 4 seconds. What is its speed?
5. How long would it take a snail to slither 20 metres at 5 metres per hour?

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TRANSPORT UNIT

Part 2- Scalars Vectors and examples

S1-S3 Road Safety & PHYSICS

WORDBANK

Scalar

- A quantity that is fully described by a value and unit

Vector

- A quantity that is fully described by a value, a direction and unit.

Scalars and Vectors

We'll explain all of these terms in the next few lessons.

Scalars	Vectors

1. Distance

4. Acceleration

2. Speed

8. Displacement

3. Force

5. Time

6. Resistance

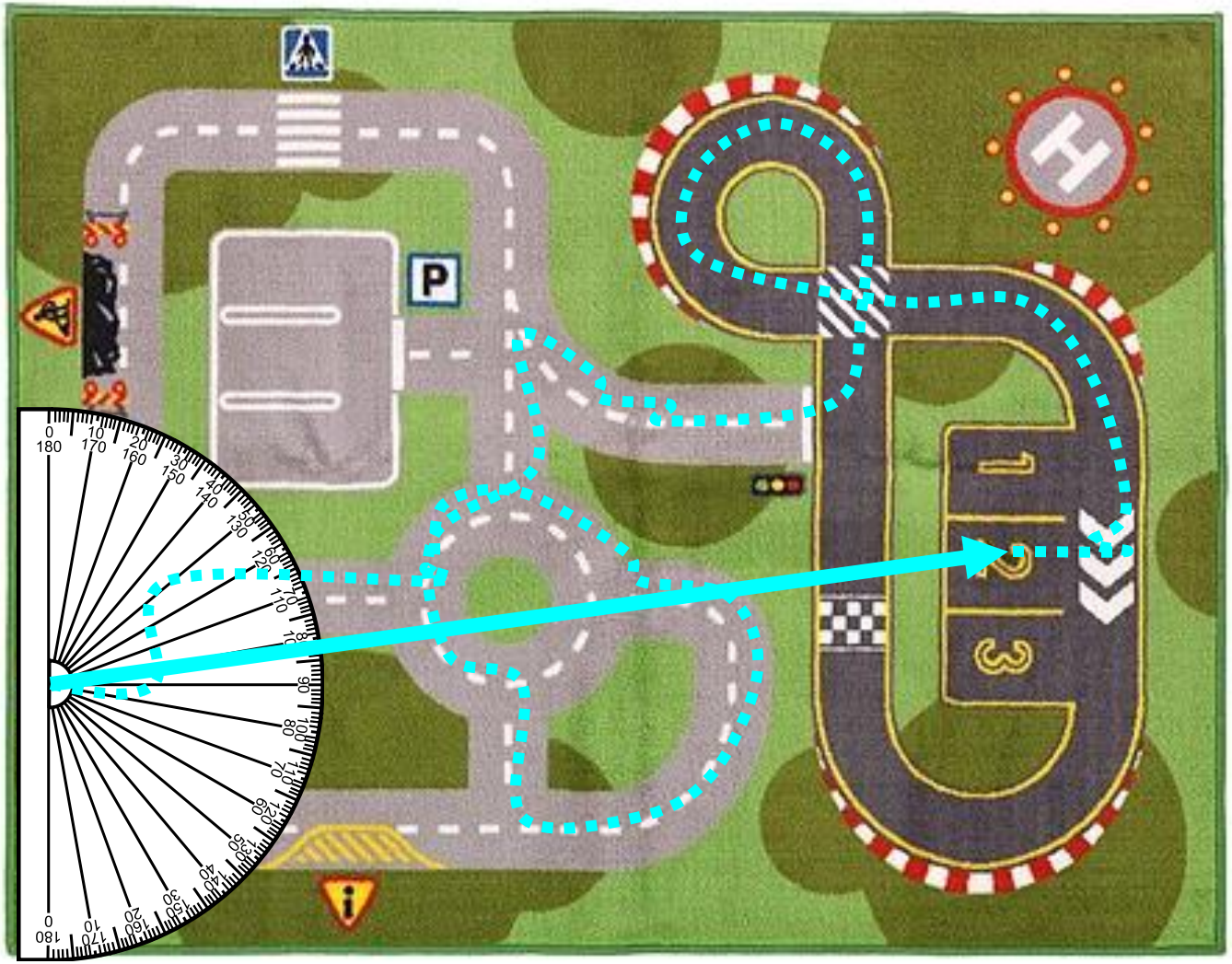
7. Velocity

S1 Physics Transport

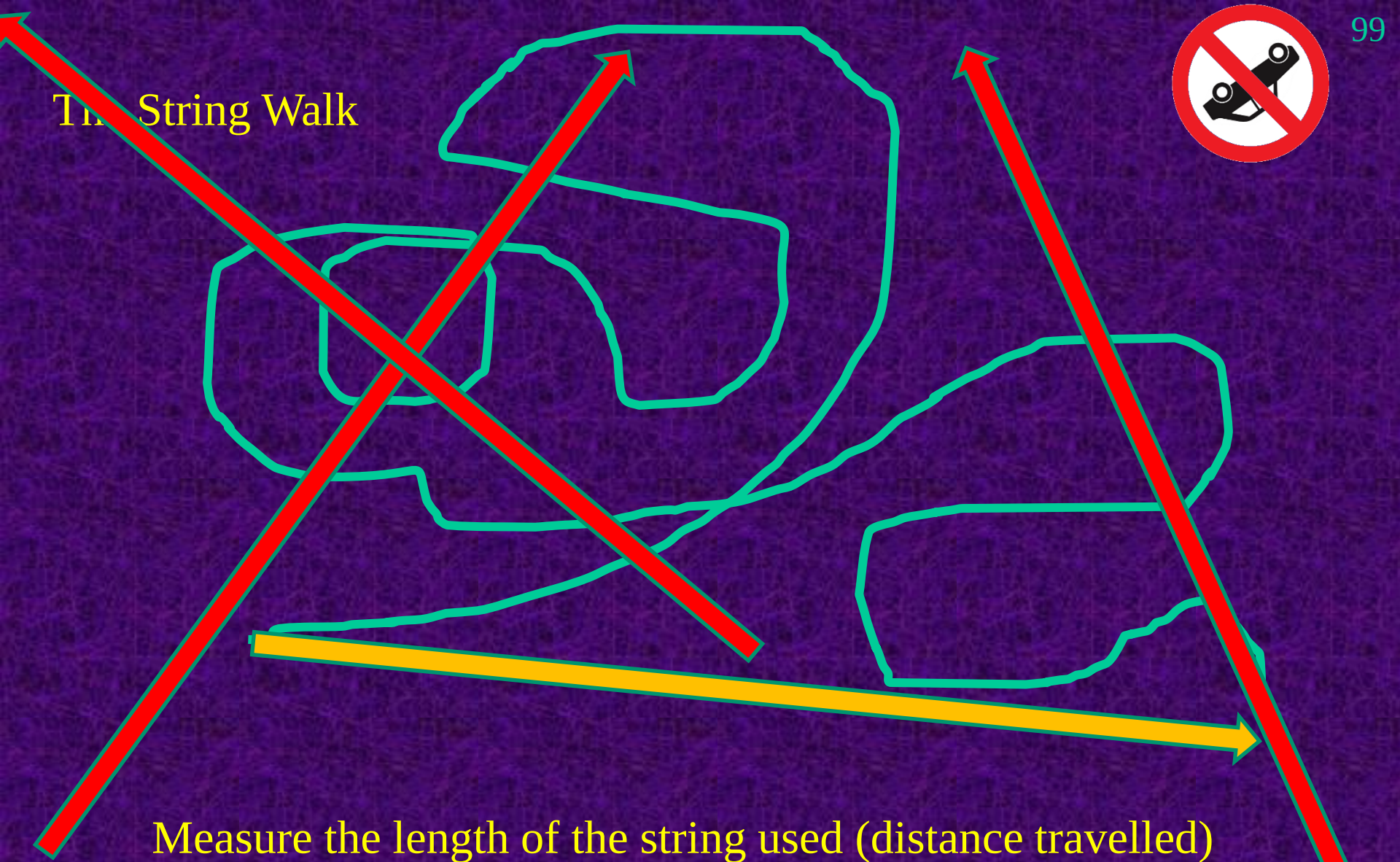
So what's this DISPLACEMENT thing physicists love?

Back to mind map


HOTEL

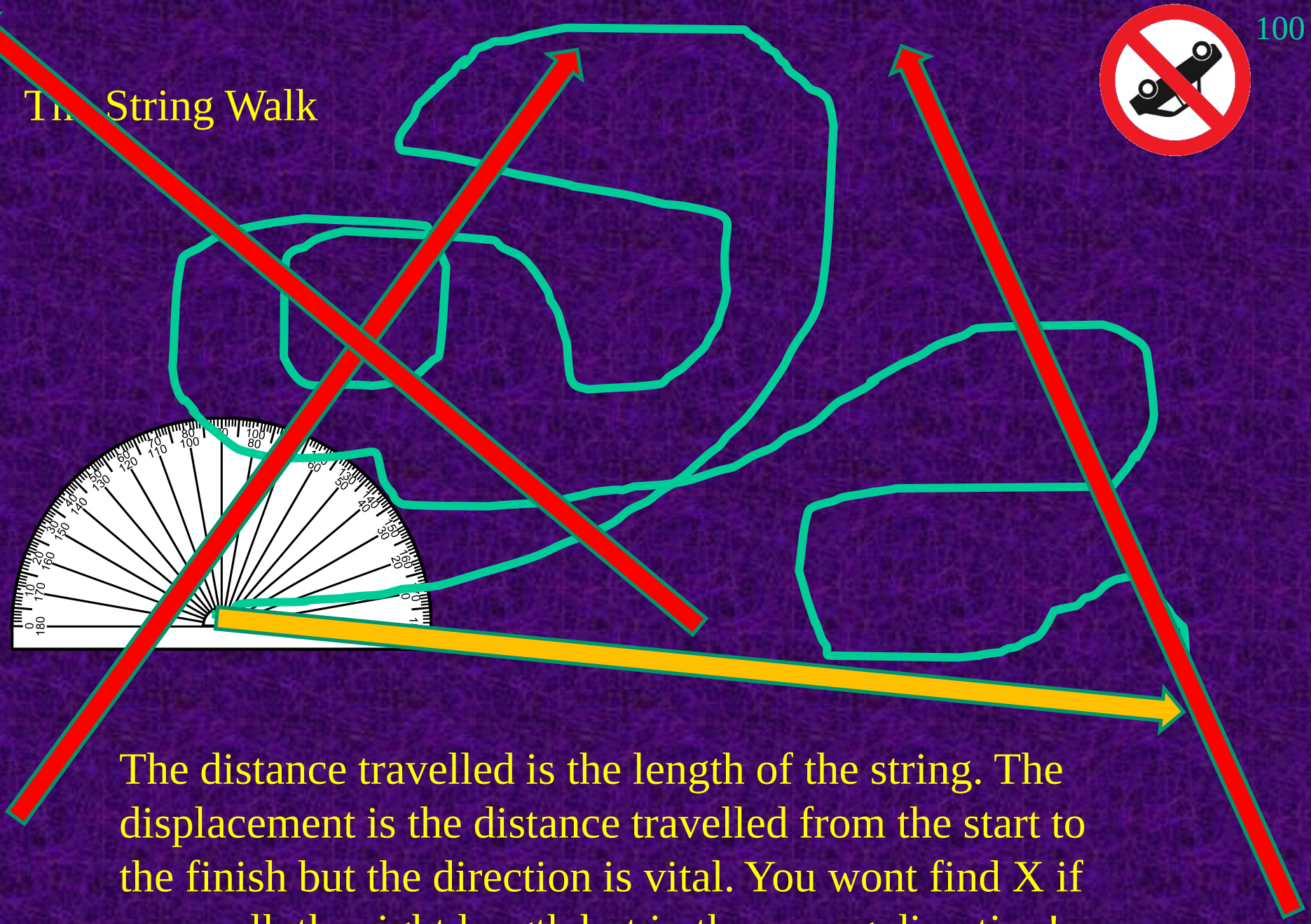

P
H
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180

The String Walk



Measure the length of the string used (distance travelled)
Use a steel tape measure to find out how far you are from the start(displacement). Here though your direction matters! It is a VECTOR quantity.

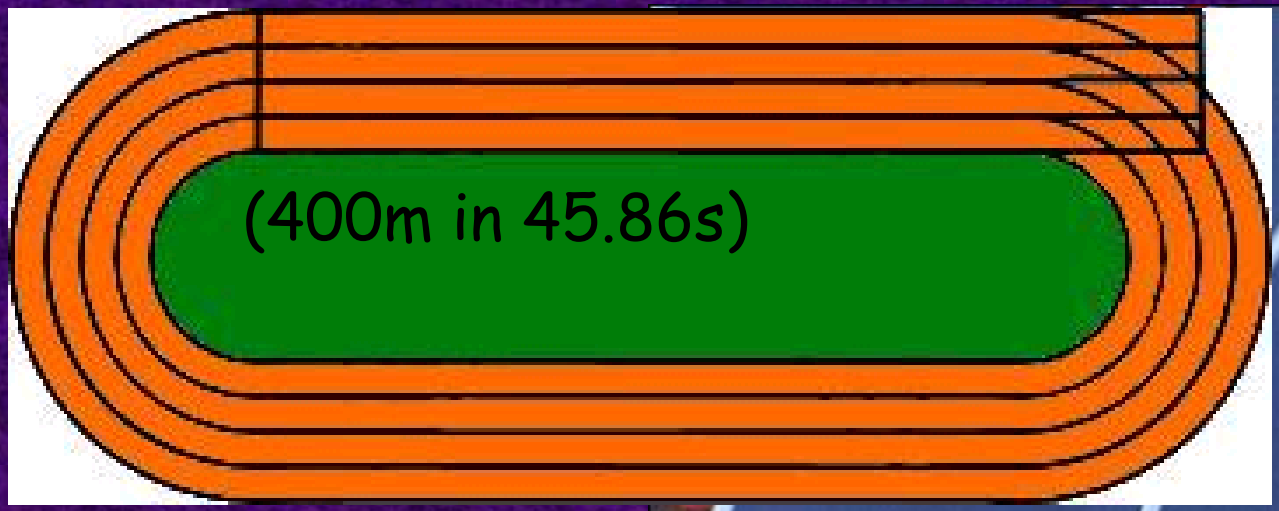
The String Walk



The distance travelled is the length of the string. The displacement is the distance travelled from the start to the finish but the direction is vital. You wont find X if you walk the right length but in the wrong direction!

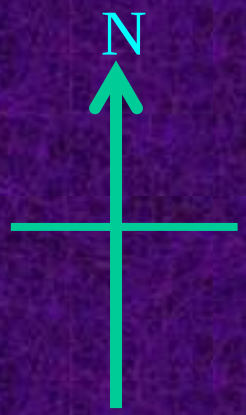
- Displacement is how far you have travelled in a straight line. We would say "as the crow flies"

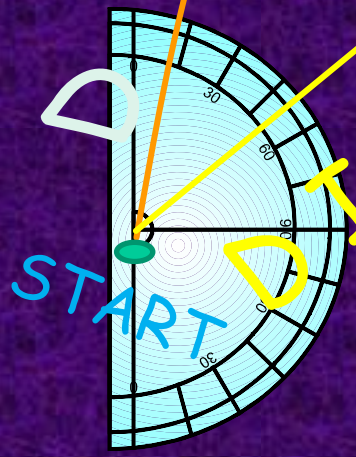
- Displacement is how far you have travelled in a straight line. We would say "as the crow flies"



http://news.bbc.co.uk/sport1/hi/athletics/8210700.stm

http://www.telegraph.co.uk/sport/sportvideo/7236169/Usain-Bolt-blasts-to-400m-victory.html





START

DISTANCE

DISPLACEMENT

end

Distance = "how far we've travelled"

⇒ symbol *d*

⇒ units metres, *m*

And later we'll show distance is….

⇒ (scalar quantity)

Displacement = "how far we've travelled in a straight line (from A to B)" (include your direction)

⇒ symbol *s*

⇒ units, metres, *m*

⇒ Vector quantity

⇒ Must quote the direction

LOCKERBIE ACADEMY

TRANSPORT UNIT

velocity

S1-S3 Road Safety & PHYSICS

S1 Physics Transport

VELOCITY, Displacement & Time

Back to mind map

S1 Physics Transport

So what's this VELOCITY thing physicists love?

Back to mind map

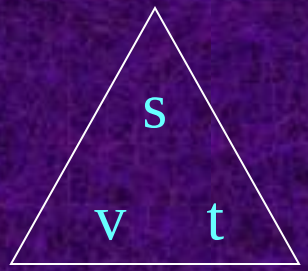
S1 Physics Transport

$$\text{VELOCITY} = \frac{\text{Displacement}}{\text{Time}}$$

- But what the heck is velocity?

Back to mind map

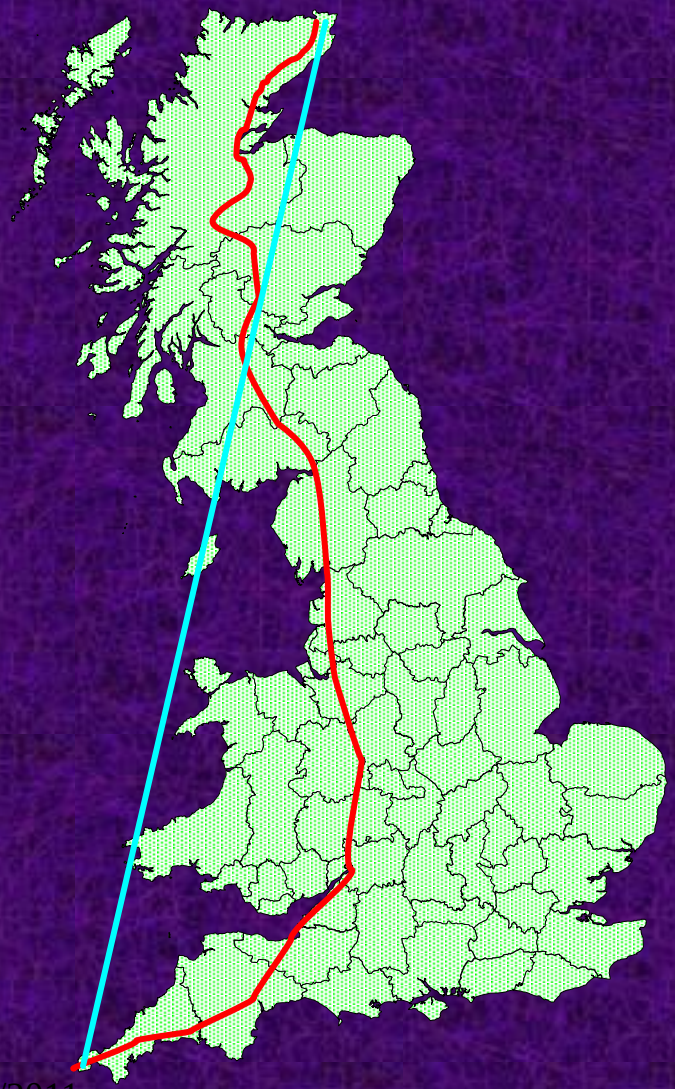
Velocity



$$Velocity\ (\text{metres/second}) = \frac{Displacement\ (\text{metres})}{Time\ (\text{second})}$$

$$Velocity = \frac{Displacement}{Time}$$

$$v = \frac{s}{t}$$



1193 miles

$26\frac{1}{2}$ hours

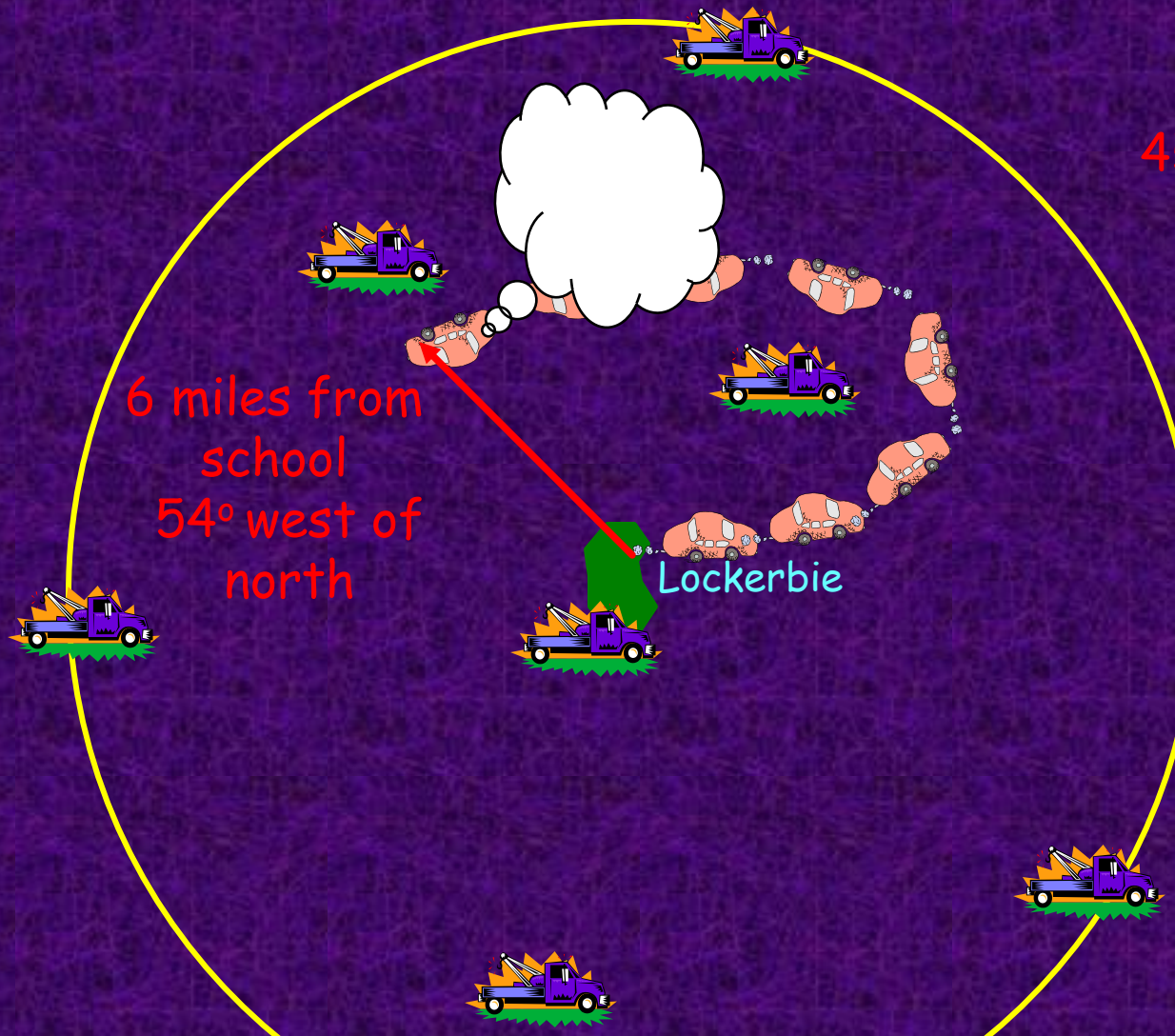
What was the average speed for the journey?

615 miles

$26\frac{1}{2}$ hours

What was the average velocity for the journey?

452 miles^2



S1 Physics Transport

Adding VECTORS

Back to mind map

When scalar quantities are added it is just the sum of all the individual parts. For example when I run 3 miles and 4 miles I have run a total distance of 7 miles

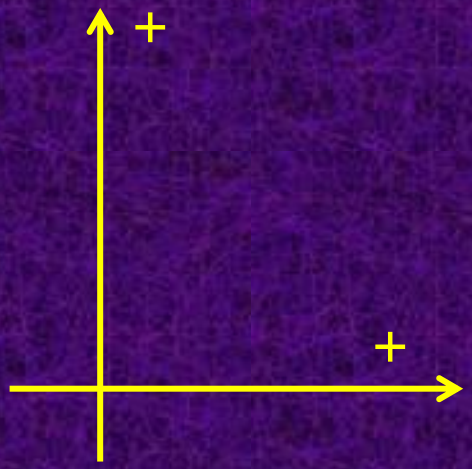
Adding vectors together is much more difficult.
If they act in the same direction then we can add them like scalar quantities. For example a force of 4N to the right is added to 3N to the right giving a RESULTANT of 7N to the right.

This can be represented by scale lines. For example a line of 4cm is added to one of 3cm. The total is 7cm to the right

This is a little more tricky is the vectors are in opposite directions, for example a force of 4N to the right is added to one of 3N to the left.

If we represent this as a line and we know that vectors have direction. This is like adding a line in one direction to the line in the other.
Decide which way you will call positive.

4cm 3cm 1cm to the right



4N + (-3N) = +1N
The + means to the right

The DIRECTION of the line MUST be parallel to the vector direction AND point in the correct DIRECTION. In the previous case the -3N vector is shown as an arrow to the left.

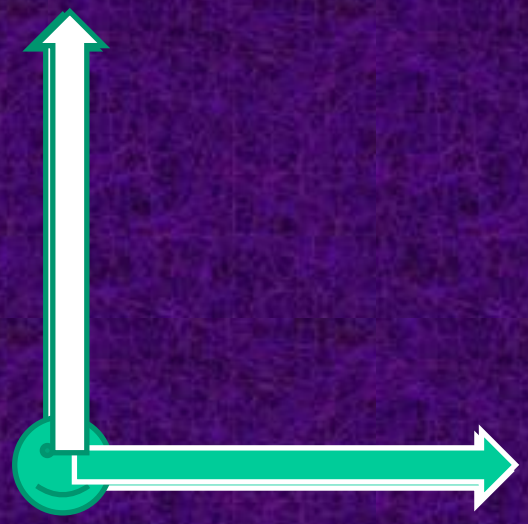
When giving the answer to a vector problem you MUST give a size, unit AND a DIRECTION

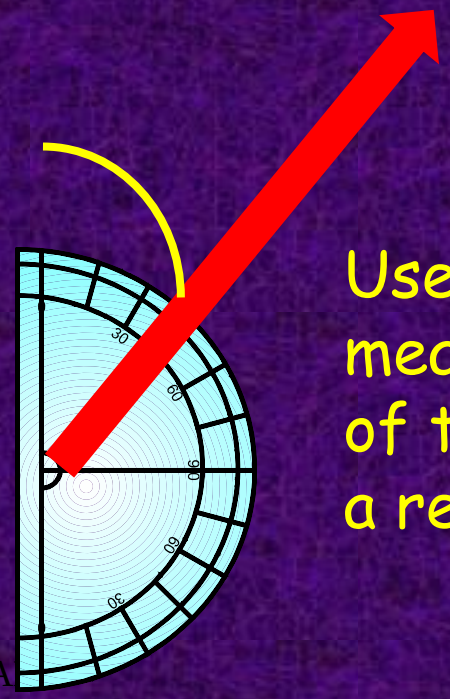
Adding Vectors

- The resultant of two or more forces which act at an angle can be found by drawing vectors. Consider the example below where two forces act on an object as shown.

A vector diagram is drawn by taking each of the vectors in turn and joining them head to tail

The line from the tail of the first vector to the head of the last vector is the resultant (or final vector)

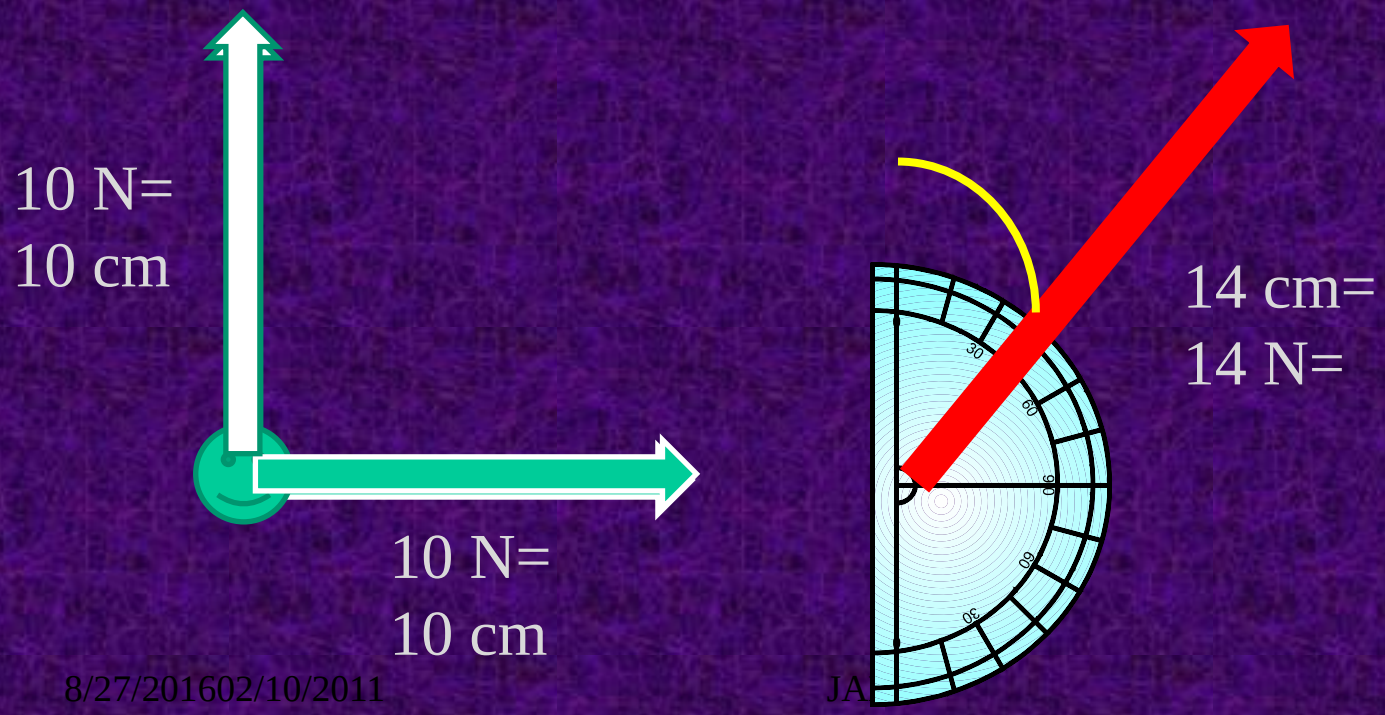




Use a protractor to measure the angle of the vector from a reference point

Adding Vectors

The size and direction of the resultant can be found by drawing vectors to scale, for example 1N can be represented by a line 1cm long. The size of the resultant can be measured with a rules and measure the angle with a protractor.



The VELOCITY OF MY CAR

TASK- Find the average velocity during your playmat journery.

We need to know the

1. displacement of your vehicle.
2. the time for the whole journey
3 the AVERAGE VELOCITY of the vehicle for the journey

YOUR TASK.

Working in teams you need to:

1. Measure the DISPLACEMENT that the car will travel following the pre-defined course.
2. Record this value on your worksheet.
3. Time how long each person in the group takes to complete the course.
4. Record this value on your worksheet
5. Time how long your journey takes and note down
6. Record as tally marks on your worksheet every time each person in the group leaves the track
7. Find the DIRECTION of travel from START to FINISH.

CHECK OUT MORE ON VELOCITY & VECTORS

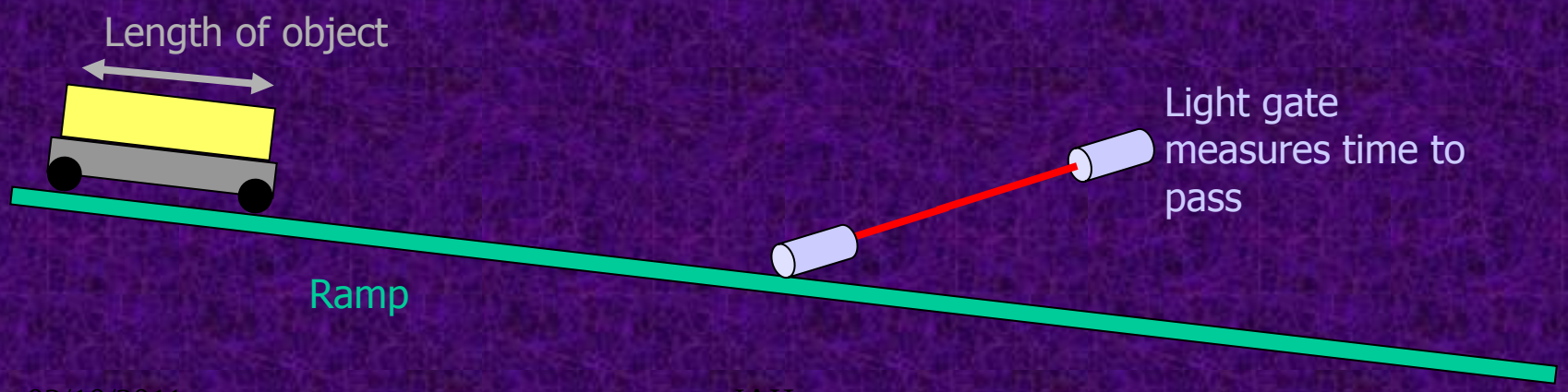
- http://www.physicsclassroom.com/class/1dkin/U1L1a.cfm

Check out the material in DESK TOOLS ->Physics -> Virtual Nat 5 or Virtual Int 2 for more on Scalars and Vectors

Instantaneous Velocity

The <u>instantaneous velocity</u> of an object is its velocity at a particular instant. For example, a police speed camera measures the instantaneous velocity of the car.

Instantaneous velocity is difficult to measure. One way is to use a light gate. The **length of the object** divided by the **time it takes to pass** gives its instantaneous speed.



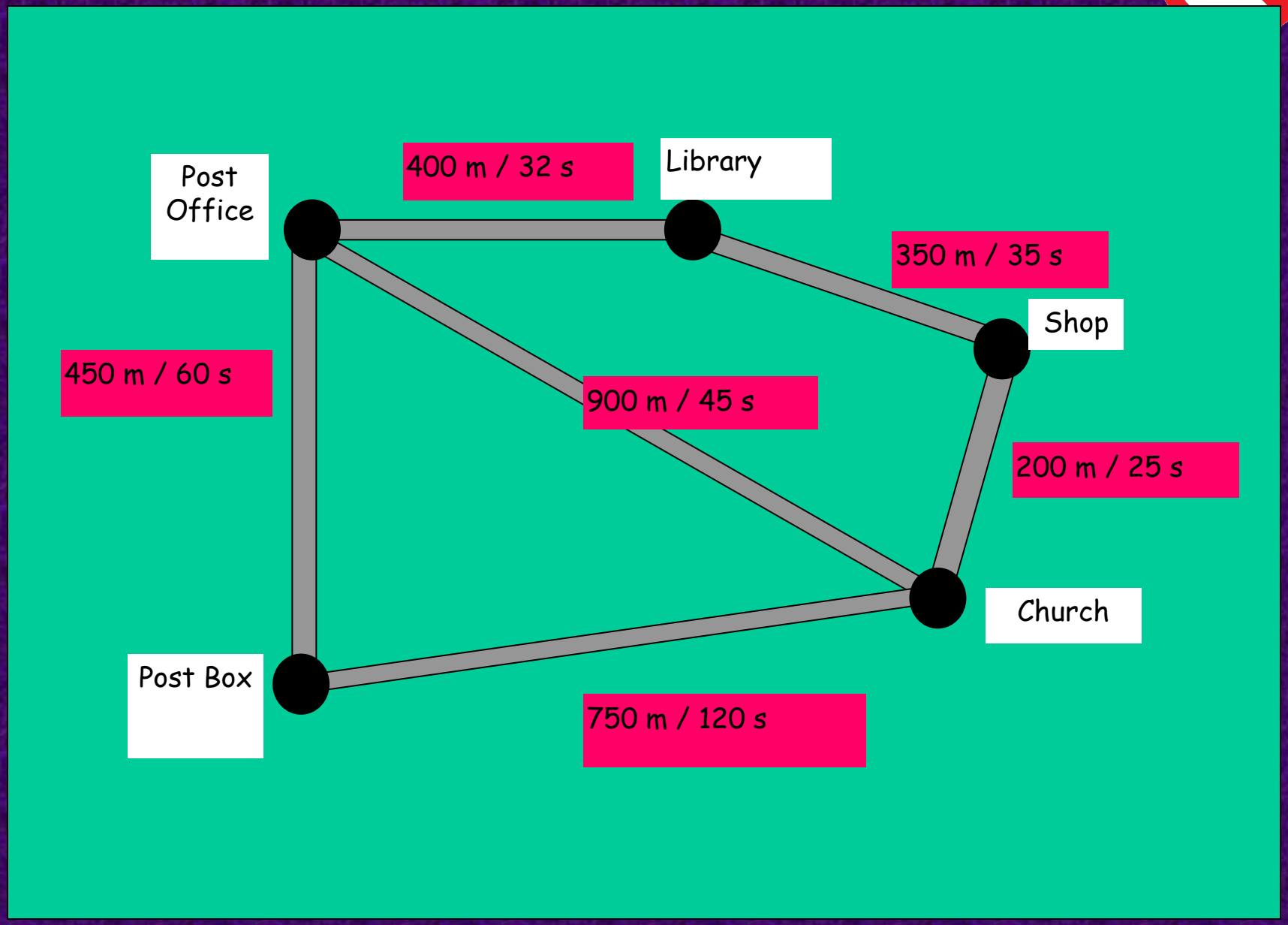
S1 Physics Transport

Task

Answer the speed and velocity questions from the sheet and from the Postman Pat task

Back to mind map

THE POST VAN AND AVERAGE SPEED.



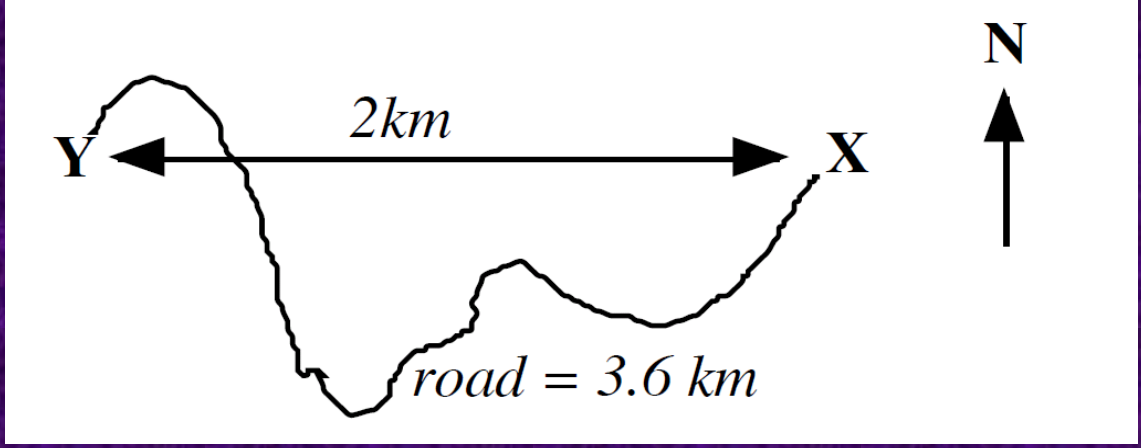
Postman Pat travels from the Post Office to the church via the library and shops.

1. What is the distance Pat has travelled?
2. What is Pat's displacement?
3. What was Pat's average speed during this journey?
4. What was Pat's average velocity during this journey?

On his way back Pat drives directly to the Post Office from the church

5. What is the distance Pat has travelled?
6. What is Pat's displacement?
7. What was Pat's average speed during this journey?
8. What was Pat's average velocity during this journey?

Vectors and Scalars



1. A man walks from X to Y along a winding road.

a) What is his displacement at the end of his walk?

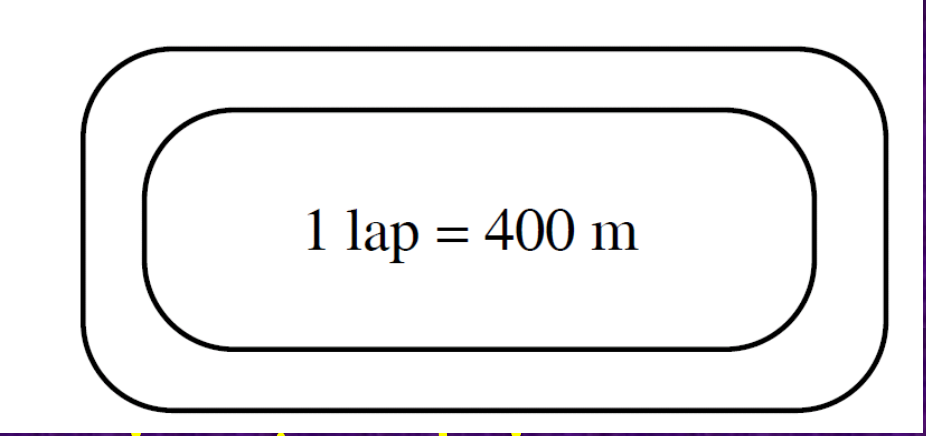
b) What distance has he walked?

2. If the walker in question 1 above took 40 minutes for his walk, what was

a) his average speed

b) his average velocity?

Repeat this question for a runner in the 800 m race whose winning time was 1 min 54 s.



One complete lap of a running track is 400m.

An athlete completes one lap in 48 s in the 400 m race. What is his

- a) distance travelled
- b) displacement
- c) average speed
- d) average velocity.

S1 Physics Transport

REVIEW

Back to mind map

DYNAMIC WORD BINGO- REVISION

Distance	Scalar	Mechanics
Displacement	At rest	Vehicle
Average Speed	Velocity	Time
Inst. Speed	stationary	Speed
kinematics	uniform speed	Instantaneous speed
dynamics	m/s	metres
second	Vector	

REVIEW

WHAT ARE DISTANCE AND DISPLACEMENT?

- Distance is length. How far you've travelled (e.g. 100 metres)
- Displacement is direct distance in a particular direction (e.g. 100 metres to the right)

- *WHAT ARE SPEED AND VELOCITY?*
- Speed is the rate of covering a distance (e.g. 50km/h)
- Velocity is rate of displacement in a particular direction (e.g. 50 km/h north)

- Work out the average speeds for the following journeys. Make sure you set out your working in the same way as the example above.
- 1. A boat travels 30 km in 3 hours.
- 2. A tractor drives 18 km in 6 hours.
- 3. A frog jumps 25 metres in 5 seconds.
- (Take care with the units.)
- 4. A plane flies 600 km in 3 hours.
-
- Now attempt the average speed tutorial.

SCALAR QUANTITY

(metres per second) Speed = $\frac{\text{distance}}{\text{time}}$ $\left(\frac{metres}{seconds}\right)$

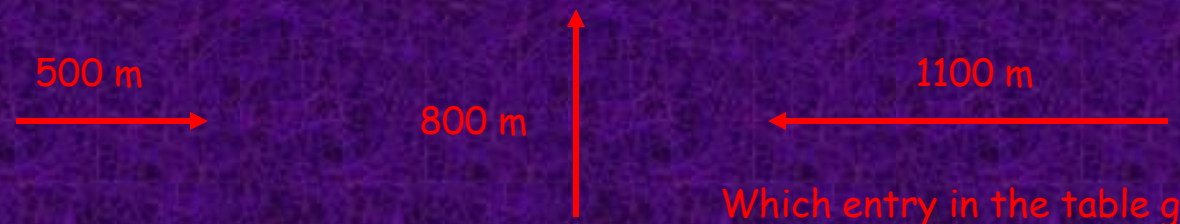
VECTOR QUANTITY

(metres per second) Velocity = $\frac{\text{displacement}}{\text{time}}$ $\left(\frac{metres}{seconds}\right)$

QUOTE DIRECTION

1992 Higher Paper 1, Q 4

A competitor completes the following sequence of displacements in 10 minutes during part of an orienteering event.

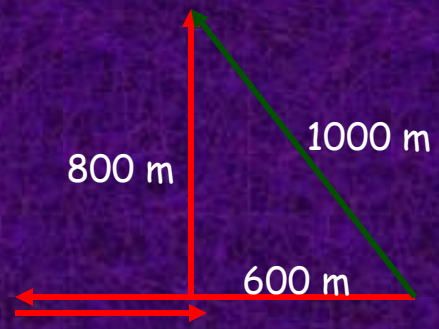


	Total displacement (m)	Average speed ($m\ s^{-1}$)	Average velocity ($m\ s^{-1}$)
A	1000	1.7	4.0
B	1000	1.7	1.7
C	1000	4.0	1.7
D	2400	4.0	4.0
E	1000	10	10

Which entry in the table gives the competitor's total displacement, average speed and average velocity for this part of the event?

$$\text{average speed} = \frac{\text{distance}}{\text{time}} = \frac{2400}{10 \times 60} = 4.0\,s$$

$$\text{velocity} = \frac{\text{distance}}{\text{time}} = \frac{1000}{600} = 1.7\,m\,s^{-1}$$



Vectors and Scalars

1. What is the difference between a vector quantity and a scalar quantity?
2. Use your answer to question 1 to explain the difference between distance and displacement.

Average speed Questions

A car travels 40 km north, then turns back south for 10 km. The journey takes 1 hour.

What is

a) the displacement of the car

b) the distance the car has travelled

c) the average velocity of the car }use km h-1

d) the average speed of the car? }

Average speed Questions

A car drives 60 km north, then 80 km east, as shown in the diagram. The journey takes 2 hours.

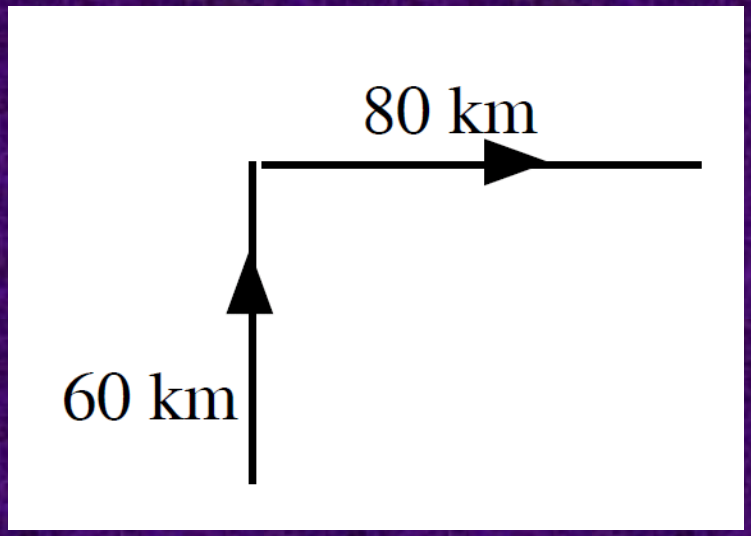
Calculate the

a) distance travelled

b) displacement

c) average speed

d) average velocity.



WORDBANK

- At rest- in Physics we use this term to mean not moving. We can also say the object is stationary.

- *It is not the same word as pens and pencils which are stationery!*