TRANSITION TO SIXTH FORM TASK

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TRANSITION TASK

Complete the two worksheets attached and memorise the definitions sheet for a definition test at the start of the year.

KEY PRE-KNOWLEDGE TOPICS

Equations of motion

Definitions in mechanics

KEY TERMS TO LEARN

Attached

RECOMMENDED WEBSITES

http://www.ocr.org.uk/qualifications/as-a-level-gce-physics-a-h156-h556-from-2015/

www.physicsandmathstutor.com

http://www.s-cool.co.uk/a-level/physics

http://physicsnet.co.uk/a-level-physics-as-a2/

PLACES TO VISIT

NECESSARY READING

Read Chapter 2 - 4 from The A Level Physics for OCR A

Oxford press

ISBN:978-0-19-835218-1

BEYOND THE CLASSROOM

Task:

Learn these Mechanics Definitions for a Test at the start of term

Scalar

A scalar is a physical property with magnitude but not direction. Another word for magnitude is size. Examples of scalars include speed, distance, temperature and wavelength.

Vector

This is a quantity that has both size and direction. Another word we can use for size is called magnitude. Examples are velocity, force, acceleration and electric current.

Displacement

This is the distance travelled in a particular direction. The unit for distance is the metre.

Instantaneous Speed

This is the speed of an object at a moment in time. A cars speedometer gives the driver an instantaneous speed.

Average Speed

A measure of the total distance travelled in a unit time. It tells you how far an object has travelled in 1 second.

Velocity

The velocity of a moving object is its displacement per unit time. It is a vector quantity and is measured in metres per second (ms-1).

Acceleration

The acceleration of an object is its rate of change of velocity. It is measured in metres per second squared (ms-2). It is a vector quantity.

The Newton

The Newton is the unit of force. 1 N is the force which gives a mass of 1 Kg an acceleration of 1 ms-2

The Torque of a Couple

This is the turning effect due to a couple. It is measured in Newton metres (Nm).

The moment of a Force

The moment of a force is the turning effect due to a single force. It is calculated by multiplying the force by the perpendicular distance from a given point. The units are Newton metres. (Nm)

Thinking Distance

This is the distance travelled by a vehicle from seeing the need to stop to applying the brakes.

Braking Distance

The distance a vehicle travels while decelerating to a stop. This is the distance travelled after the brakes have been applied.

Stopping Distance

The stopping distance is the thinking distance added to the braking distance.

Work Done

The product (multiplied together) of a Force and the distance moved in the direction of the force gives the work done by the force. It can also be thought of as the energy converted from one form into another. The units for work done are Joules. (J)

The Joule

This is the unit of energy. 1 Joule is the work done when a force of 1 N moves its point of application 1 m in the direction of the force.

Power

Power it the rate at which work is done. It is measured in Watts (W). The WattThis is the unit of power. One watt is equal to one joule per second. 1 W = 1 JS^{-1}

Stress

This is the force per unit cross-sectional area. It is measured in Nm^{-2}or Pascals (Pa). StrainThis is the extension per unit length. It has no units. We say it is dimensionless.

Young Modulus

This is the ratio between stress and strain i.e. the stress divided by the strain. It has the same units as stress namely Newton metres squared (Nm^{-2}) or Pascal (Pa)

Ultimate Tensile Stress (Breaking Stress)

This is the maximum tensile (stretching) force that can be applied to an object before it breaks.

Elastic Deformation

This means that the object will return to its original shape when the deforming force is removed.

Plastic Deformation

This means that the object will not return to its original shape when the deforming force is removed, it becomes permanently deformed.

Motion graphs level assessed task

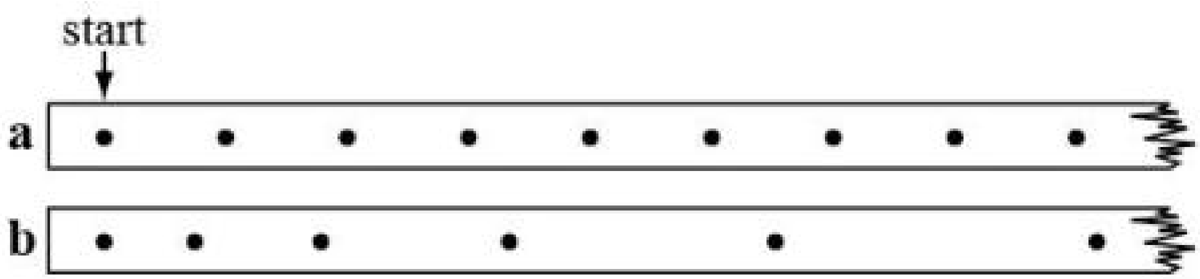
Task: Answer the questions below relating to motion graps in as much detail as you can Max = 27

Grade	**To get this grade you need to….**
C	Recall a range of scientific information from all areas of the specification relating to motion graphs
B	Apply knowledge of a range of scientific information relating to motion graphs and describe scientific processes involved
A	Use detailed scientific knowledge and understanding of a range of applications relating to motion graphs to describe motion with some degree of understanding of the phenomena involved
A*	Use detailed scientific knowledge and understanding of a range of applications relating to motion graphs to describe motion with clear understanding of the phenomena involved and correct use of scientific terms, units and quantities.

1. (a) Calculate the average velocity of an Olympic sprinter whose time for the 100 m sprint is 9.91 s. (3)

   (b) How far will a snail crawl in 1.5 minutes, if its average speed is 1.5 mm s^{-1}? (3)

   (c) A trolley with a 10 cm long card passed through a light gate. If the time recorded by the digital timer was 0.5 s, calculate the average speed of the trolley in ms^{-1}. (3)



(d) The diagram above shows two ticker-tapes (a) and (b). Describe the motion of the trolleys which produced these tapes. (2)

[Total marks 11]

Example of standard form:

$$9{,}320 = \underbrace{9.32}_{\text{Number between 1 and 10}} \times \underbrace{10^3}_{\text{Power of 10}}$$

Standard Form

1. Copy and complete the table below:

10^{-4}	10^{-3}	10^{-2}	10^{-1}	10^{0}	10^{1}	10^{2}	10^{3}	10^{4}
0.0001		0.01	0.1			100	1,000	

2. Write down the value of each of the following:

a) 3.1×10 b) 3.1×10^2 c) 3.1×10^3 d) 3.1×10^4 e) 3.1×10^5

3. Write down the value of each of the following:

a) 6.5×10^{-1} b) 6.5×10^{-2} c) 6.5×10^{-3} d) 6.5×10^{-4} e) 6.5×10^{-5}

4. Write these numbers, given in standard form, out in full:

a) 2.5×10^2 b) 3.452×10^1 c) 1.323×10^{-3} d) 2.07×10^5

e) 4.12×10^6 f) 5.67×10^{-4} g) 7.6×10^3 h) 2.0789×10^{-2}

i) 9.43×10^4 j) 6×10^7 k) 5×10^{-5} l) 8.221×10^{-1}

5. Write these numbers in standard form:

a) 250 b) 78900 c) 0.002 d) 0.1542 e) 9,020,000

f) 0.000042 g) 98.753 h) 0.1324 i) 221.4 j) 0.31

k) 20,780,000,000 l) 0.000 005 2 m) 0.999 n) 1,100

In questions **6** to **8**, write the numbers given in standard form.

6. One year, 27,797 runners completed the New York marathon.

7. The largest number of dominoes ever toppled by one person is 303,621, although 30 people set up and toppled 4,002,136.

8. The asteroid Phaethon comes within 12,980,000 miles of the sun, whilst the asteroid Pholus, at its furthest point, is a distance of 2997 million miles from the earth. The closest an asteroid ever came to Earth recently was 93,000 miles from the planet.

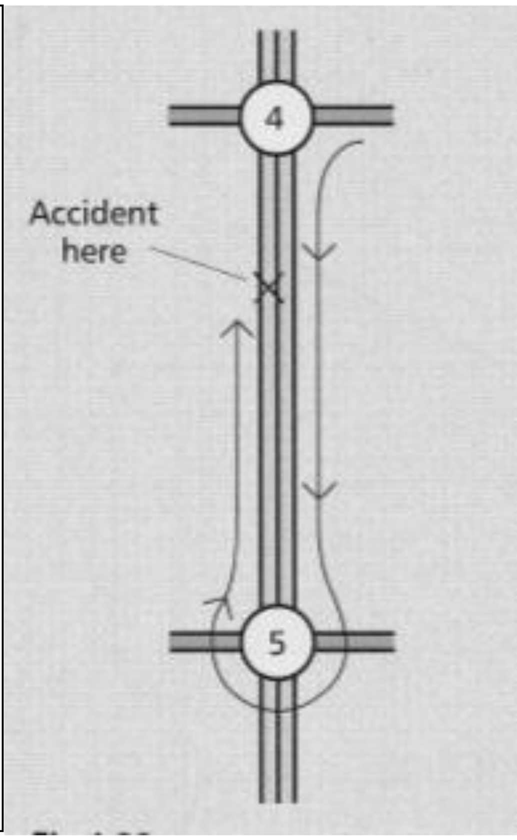
2. (a) A police car joins a straight motorway at Junction 4 and travels for 8.5 km at constant speed for 300 s. It then exits the motorway at Junction 5, rejoins on the opposite side and travels for 6.2 km at constant speed for 280 s to reach the scene of an accident.

Calculate :

(i) The displacement from Junction 4 to the accident scene. (1)

(ii) The velocity of the police car on each side of the motorway. (2)

(b) Sketch a displacement/time graph to represent the motion of the police car. (6)

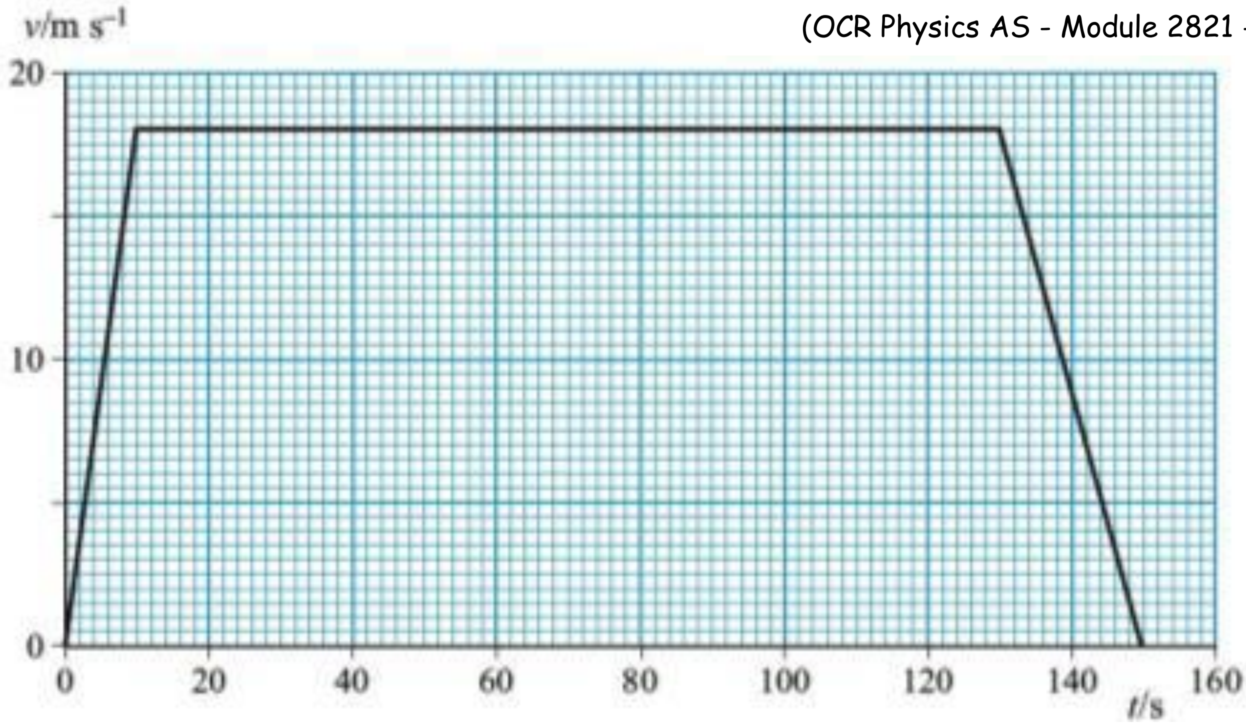


[Total marks 9]

3. (a) Define acceleration. (2)

(b) The graph below shows the variation of velocity (v), with time (t), of a train as it travels from one station to the next.

(OCR Physics AS - Module 2821 - June



Use the graph to calculate:

(i) The acceleration of the train during the first 10.0 s, (2)

(ii) The distance between the two stations. (3)

[total marks 7]

Powers of Ten

Common Name	Billionth	Millionth	Thousandth	Hundred	Thousand	Million	Billion	Trillion
Symbol	n	µ	m	c	k	M	G	T
Prefix	Nano	Micro	Milli	Centi	Kilo	Mega	Giga	Tera
Multiple	10^{-9}	10^{-6}	10^{-3}	10^{-2}	10^{3}	10^{6}	10^{9}	10^{12}

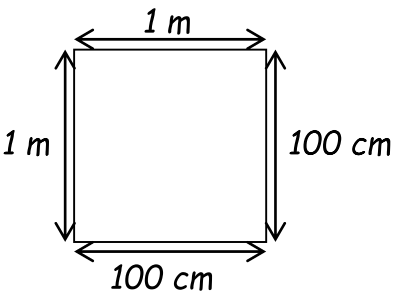
This table shows the names of the most common prefixes we meet in physics. For example 1 kilometre is equal to 1 000 metres, and 1 microgram is equal to $1/1000^{th}$ of a gram. Use the table to convert the following.

1. Convert the following into metres:
   a. 10 cm ____________________
   b. 5 mm ____________________
   c. 1 Mm ____________________
2. Convert the following into kilograms:
   a. 2000 g ____________________
   b. 1 µg ____________________
   c. 3 mg ____________________
3. Convert the following into newtons:
   a. 2.3 kN ____________________
   b. 20 GN ____________________
   c. 300 mN ____________________
4. Convert the following into watts:
   a. 60 kW ____________________
   b. 45 MW ____________________
   c. 0.1 GW ____________________
5. Convert the following:
   a. 0.3 kJ into joules. ____________________
   b. 90 mA into amps. ____________________
   c. 800 kHz into hertz. ____________________
   d. 1 nC into coulombs. ____________________

Squares and Cubes

The above method works perfectly for most of the situations we come across in physics. When we meet squares and cubes, however, we have to be careful.

Example: How many square centimetres are there in one square metre?

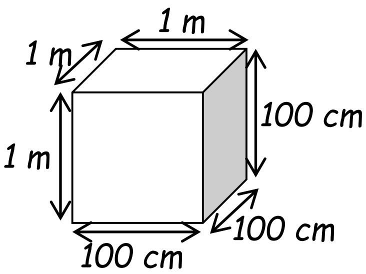


The box shows a 1 m x 1 m square, i.e. 1 m^2.
We know 1 m is equal to 100 cm, so the box is also 100 cm x 100 cm, i.e. 10 000 cm^2.

Therefore, 1 m^2 is equal to 10 000 cm^2.

6. Convert the following into square centimetres:
    a. 5 m^2 ____________________
    b. 0.5 m^2 ____________________
7. Convert the following into square metres:
    a. 100 cm^2 ____________________
    b. 30 cm^2 ____________________

Example: How many cubic centimetres are there in one cubic metre?



The box shows a 1 m x 1 m x 1 m cube, i.e. 1 m^3.
We know 1 m is equal to 100 cm, so the box is also 100 cm x 100 cm x 100 cm, i.e. 1 000 000 cm^3.

Therefore, 1 m^3 is equal to 1 000 000 cm^3.

8. Convert the following into cubic centimetres:
    a. 2 m^3 ____________________
    b. 50 m^3 ____________________
9. Convert the following into cubic metres:
    a. 500 cm^3 ____________________
    b. 1 cm^3 ____________________
10. How many cubic millimetres would fit in 1 m^3?

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1. Convert the following into metres:
   a. 10 cm 0.1 m
   b. 5 mm 0.005 m or 5×10^{-3} m
   c. 1 Mm 1 000 000 m or 1×10^{6} m
2. Convert the following into kilograms:
   a. 2000 g 2 kg
   b. 1 μg 0.000001 kg or 1×10^{-6} kg
   c. 3 mg 0.003 kg or 3×10^{-3} kg
3. Convert the following into newtons:
   a. 2.3 kN 2300 N
   b. 20 GN 20 000 000 000 N or 20×10^{9} N
   c. 300 mN 0.3 N or 300×10^{-3} N
4. Convert the following into watts:
   a. 60 kW 60 000 W or 60×10^{3} W
   b. 45 MW 45 000 000 W or 45×10^{6} W
   c. 0.1 GW 100 000 000 W or 1.0×10^{8} W
5. Convert the following:
   a. 0.3 kJ into joules. 300 J
   b. 90 mA into amps. 0.090 A or 90×10^{-3} A
   c. 800 kHz into hertz. 800 000 Hz or 800×10^{3} Hz
   d. 1 nC into coulombs. 0.000 000 001 C or 1.0×10^{-9} C

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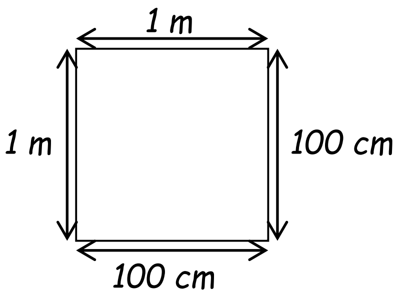
Example: How many square centimetres are there in one square metre?



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    a. 5 m^2 50 000 cm^2
    b. 0.5 m^2 5 000 cm^2
7. Convert the following into square metres:
    a. 100 cm^2 0.01 m^2
    b. 30 cm^2 0.003 m^2

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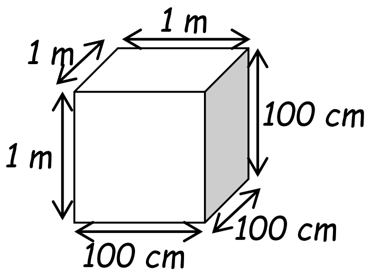

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    a. 2 m^3 2 000 000 m^3
    b. 50 m^3 50 000 000 m^3
9. Convert the following into cubic metres:
    a. 500 cm^3 0.0005 m^3 or 5×10^{-4} m^3
    b. 1 cm^3 0.000 001 m^3 or 1×10^{-6} m^3
10. How many cubic millimetres would fit in 1 m^3? 1000 x 1000 x 1000
    = 1 000 000 000 mm^3