PHYSICS REVISION

P2

FORMULAE

You may find the following formulae useful

charge = current × time	$Q = I \times t$
potential difference = current × resistance	$V = I \times R$
electrical power = current × potential difference	$P = I \times V$
energy transferred = current × potential difference × time	$E = I \times V \times t$
$\text{speed} = \frac{\text{distance}}{\text{time}}$	
$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}}$	$a = \frac{(v-u)}{t}$
force = mass × acceleration	$F = m \times a$
weight = mass × gravitational field strength	$W = m \times g$
momentum = mass × velocity	
$\text{force} = \frac{\text{change in momentum}}{\text{time}}$	$F = \frac{(mv-mu)}{t}$
work done = force × distance moved in the direction of the force	$E = F \times d$
$\text{power} = \frac{\text{work done}}{\text{time taken}}$	$P = \frac{E}{t}$
gravitational potential energy = mass × gravitational field strength × vertical height	$\text{GPE} = m \times g \times h$
kinetic energy = ½ × mass × velocity^2	$\text{KE} = \frac{1}{2} \times m \times v^2$

This excludes example of calculations . More support material and self-marking tests can be found on

www.physicsinfo.co.uk

Top 10 Tips from the Principal Examiner for Physics

1. Practise **substitution of given numbers into equations.** This can help to score partial marks for a numerical question even if the arithmetical part causes difficulty.

This can be assisted if the student is in the habit of copying the equation from page 2 of the question paper into the question space. There is no mark for this copying but it helps to obtain the correct substitution.

2. A task starting with '**Calculate...**' means that there is, at least some (possibly basic), arithmetic to do.

3. When the **identification of a unit** is asked for as part of a calculation, a specific place is given for this after the space for the numerical answer. This is designed to serve as a reminder.

4. Care should be taken with the **context of multi-meaning words**. Radiation can often be ionising and dangerous but sunlight is also radiation and does not contaminate sea water!

5. It is essential to learn items identified in the specification. These will normally begin with a trigger such as '**State...**'. There are some technical terms such as 'converging', 'nebula', 'alternating' and 'colours of the visible spectrum'.

6. Going one stage further than 'State...', '**Describe...**' can refer, for example, to a list of ideas, to a list of actions in sequence or to a change due to a given cause, an example of which would be to relate changes in image and object distances for a lens.

7. '**Explain...**' items often require a statement/ observation followed by a reason. For example, explaining the effect on a lamp of increasing the speed at which a generator turns implies a statement that the bulb will become brighter (or fuse etc.) BECAUSE the current/voltage/ power will be increased.

8. When asked to '**Compare...**', '**Describe how effects are different...**', '**Distinguish between...**', or '**Describe similarities and differences...**', candidates must make it clear which of their statements apply to which of the things being compared. 'Hedging bets' between descriptors of reflecting telescopes and refracting telescopes did not score and there was much ambiguity over the dangers posed by UV and IR radiations.

9. It is important to **read values from the correct place on a graph**. This can be assisted by drawing vertical and/or horizontal lines. This can also help to score partial marks.

10.A **line of best fit** (straight or curved) will only receive full credit:

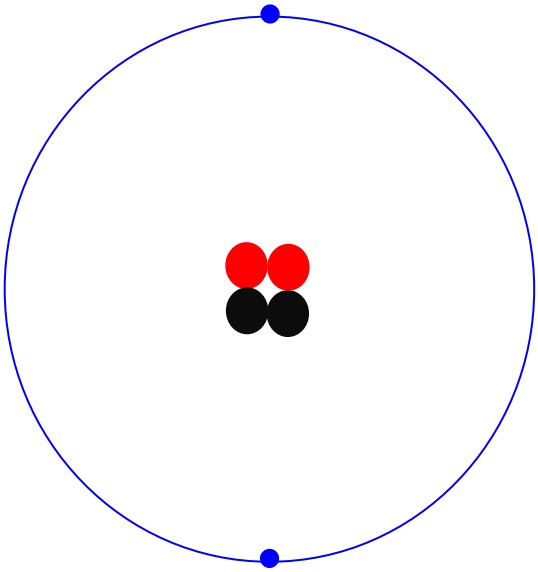
• if there is no tram-lining;

• if it is drawn bearing in mind the majority of plotted points;

• if (for a continuous variation) the points are not joined by a series of straight lines.

Topic 1 & 2 **Electricity P2 (2011)**

Atoms:



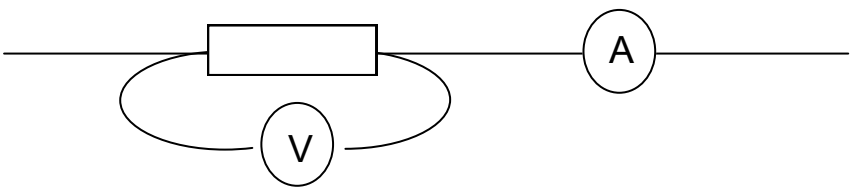
Electrons:	negative	1/2000 a.m.u.
Protons:	positive	1 a.m.u.
Neutrons	no charge	1 a.m.u.

Static electricity

- Insulators can be charged by friction (an example might be liquid flowing in a plastic pipe)
- Gaining electrons results in an overall negative charge
- Loosing electrons results in an overall positive charge
- Like charges repel
- Unlike charges attract
- A build up of static charge can result in a spark, which might cause an explosion or other problem
- Built up charge can 'escape' down a conductor
- Static charge is the basis for electrostatic sprays in agriculture or painting (the benefit is an even cover and that the spray will reach the underside of back of the object)

Current electricity

- Current is the rate of flow of charge
- Direct Current is the flow of charges (electrons) in one direction
- Batteries are a source of direct current
- Ammeters measure current flowing through a component
- Voltmeters measure the potential difference (volts) across a component



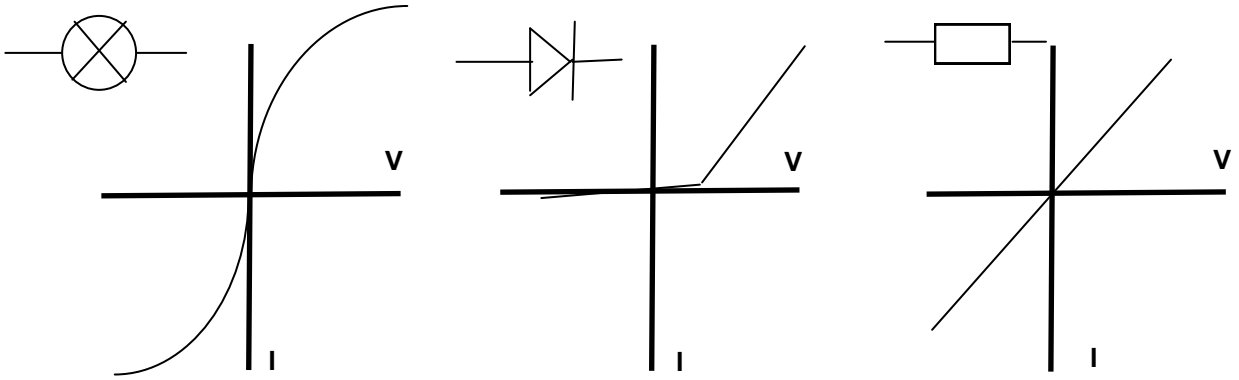
Potential Difference (V) is the energy transferred per unit charge:

$$V = J / C$$

Topic 1 & 2 **Electricity P2 (2011)**

Resistance:

- The greater the resistance in a circuit, the less the current
- You need to know the characteristics of these three components:

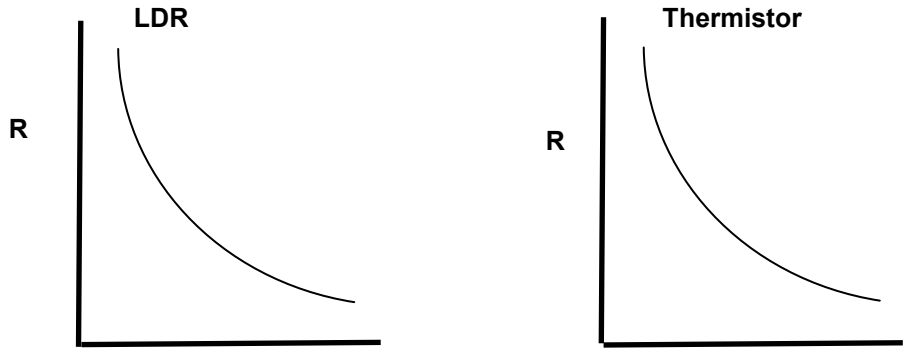


Lamp **Diode** **Resistor**

Lamps: Lamps get hot, their resistance increases. The graph shows that as the voltage increases, the current increases but at a decreasing rate. (Electrons passing through collide with the metal ions, increasing their energy/ temperature)

Diodes: Diodes only allow current to flow in one direction (the direction shown by the arrow for 'conventional' current

Resistor: As the voltage across a resistor increases, the current passing through increases proportionally.



Brighter Light **Increasing Temp**

* Resistance decreases with increasing light / temperature

Equations:

There are a number of equations in this Topic. You should be familiar with them but they will be given to you at the front of the question paper.

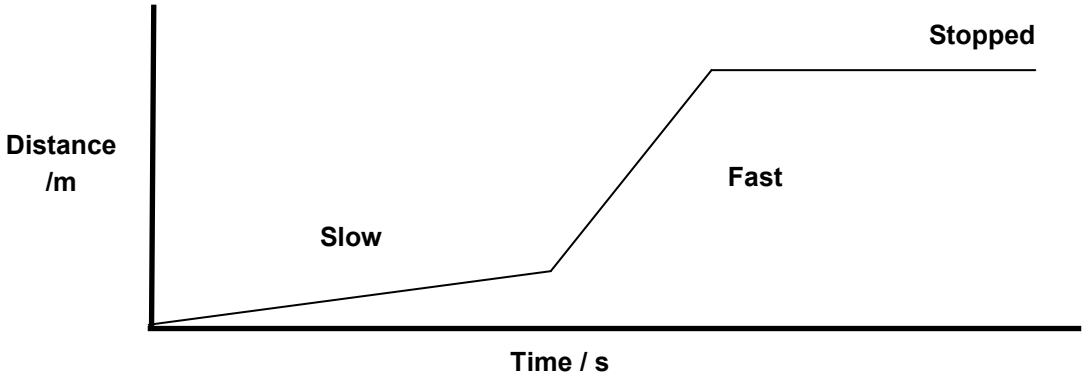
- Identify the equation from the front and write it down
- Rearrange the equation and write it down
- Substitute the numbers and write them down. Write down the answer and the appropriate unit.
- Don't take short cuts

Topic 3 Motion and Forces P2 (2011)

Scalars have magnitude but Vectors have magnitude <u>and direction</u>:

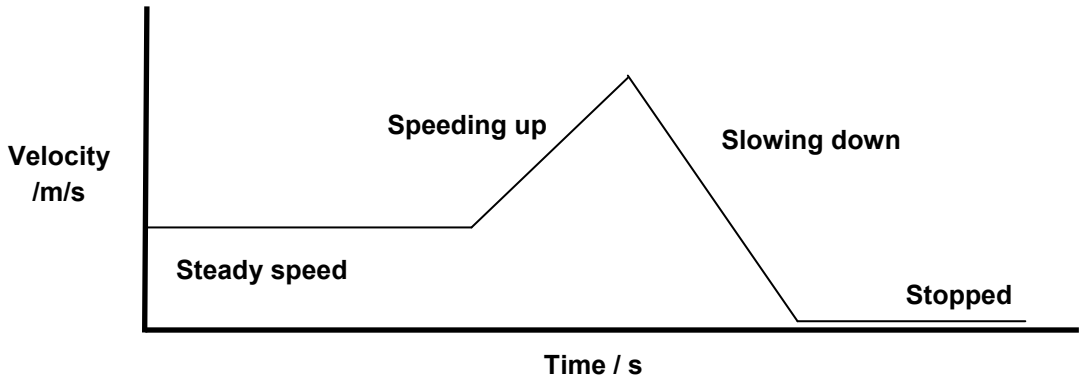
SCALAR	VECTOR	Units
Distance	Displacement	m
Speed	Velocity	m/s
	Acceleration	m/s/s
	Force	kg m/s/s

<u>Distance vs. time graph</u>

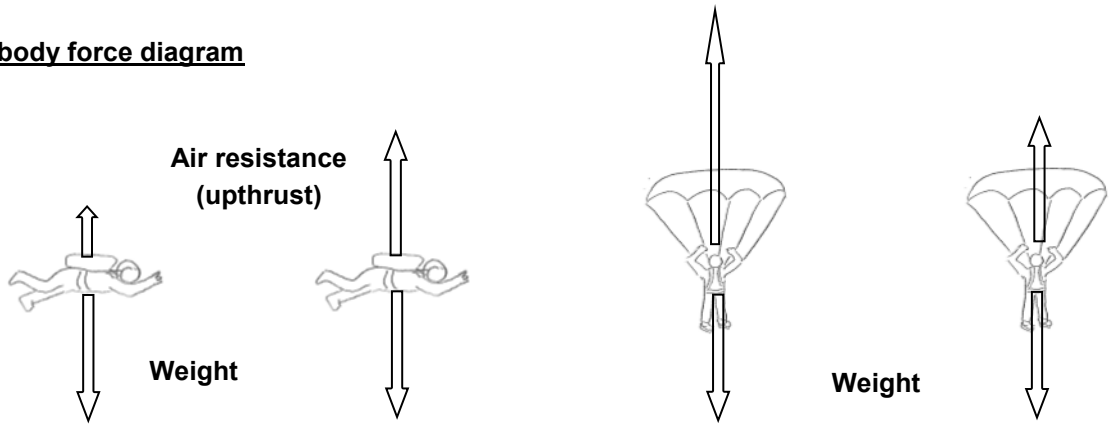


The speed can be found from the **gradient** of the Distance vs. Time graph

<u>Velocity vs. time graph</u>



<u>Free-body force diagram</u>

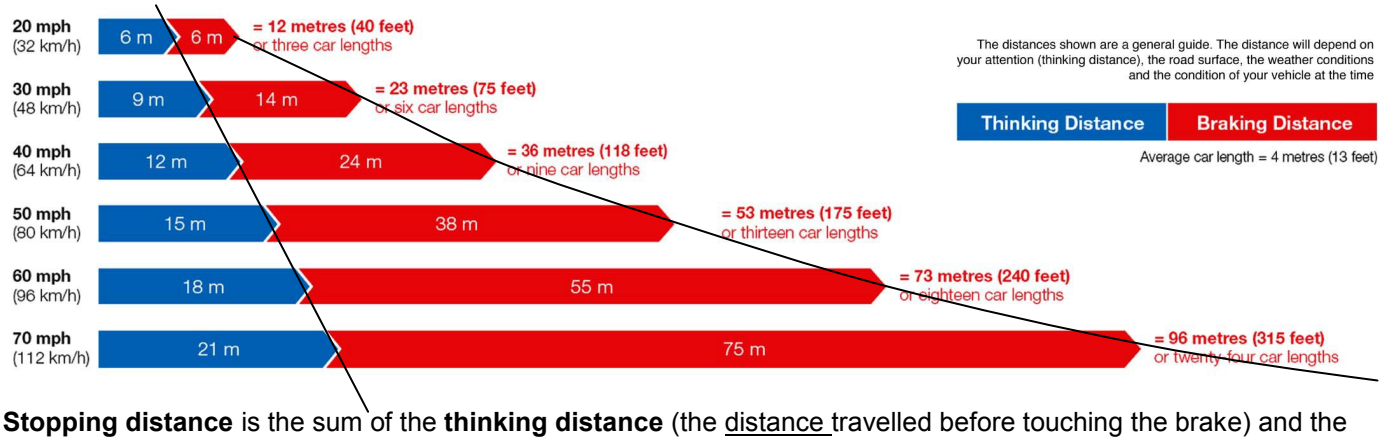


Accelerating | Terminal velocity | Slow down | On the ground

Remember that in a vacuum all falling bodies accelerate at the same rate but in air, air resistance increases with increasing speed.

Topic 4 Momentum, energy, work and power P2(2011)

Typical stopping distances:



Stopping distance is the sum of the **thinking distance** (the distance travelled before touching the brake) and the **Braking distance** (the distance travelled after touching the brake).

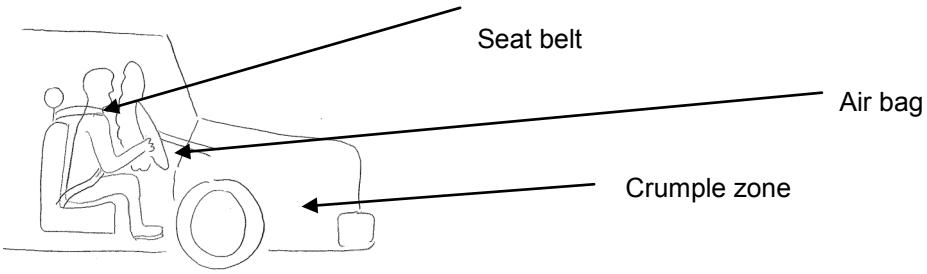
The factors that affects the thinking distance is the driver's reaction time (drugs, alcohol, distractions can all impact on this).

Factors affecting braking distance are:

- Mass of the vehicle
- Speed of the vehicle
- State of the brakes
- State of the road
- The friction between the tyre and the road (oil, water etc)

Be able to calculate the momentum of a moving object, from the given formula, and know that momentum is a vector quantity.

Momentum:



Crumple zones, seat belts and air bags extend the time over which a collision occurs (rate of change of momentum) and hence the forces in a collision. Bubble wrap does the same job in packaging.

- The energy transferred in a collision is equal to the work done.
- Power is the rate of doing work and measured in Watts. (one watt is equal to one joule per second)
- Remember that energy is conserved so you need to get to grips with the various forms of energy

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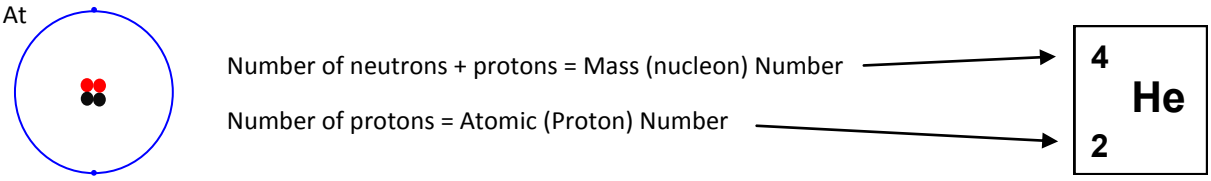
Topic 5 Fission and Fusion P2 (2011)



Ions:

- Atoms that gain electrons form negative ions
- Atoms that loose electrons form positive ions
- Ionising radiation is dangerous
- Alpha particles, Beta particles and gamma waves are example of ionising radiations - all three coming from the nucleus of an unstable atom.

Ionising radiations:

Radiation	What is it ?	Penetration	Ionising ability	Uses (in addition to detecting and treating cancer)
Alpha	Helium nuclei	Low	High	Smoke detectors
Beta	Nuclear electron	Med	Med	Gauging thickness
Gamma	Electromagnetic wave	High	Low	Sterilising equipment and food.

Fission & Fusion:

- Both are a source of energy
- Heat generated by the reaction is used to create steam to drive a turbine and then a generator in either power station
- Fission is the splitting of nuclei (like uranium) to release energy
- Fusion is the joining of nuclei (like isotopes of hydrogen) to release energy

Fission (splitting):

- A Uranium nucleus captures a slow neutron and splits into 2 x daughter nuclei and two more (fast) neutrons
- Fast neutrons are slowed by moderators to slow (thermal) neutrons which go on to combine with more Uranium to make more daughter nuclei and release more neutrons (1 > 2 > 4 > 8 > 16 >32 is a chain reaction)
- The chain reaction is controlled by control rods which capture neutrons preventing them from combining with more Uranium fuel.
- The products of fission are radioactive and can be for thousands of years.

Fusion (joining):

- The creation of larger nuclei from smaller nuclei. Fusion is the source of energy in the stars
- H + H > He (plus energy)
- Requires very high temperature and pressure to overcome the fact that the nuclei will try to repel each other (electrostatic repulsion) and to split the atoms up into their constituent parts (plasma)

Remember that new ideas, such as cold fusion, need to be tested and validated by the scientific community

Topic 6 Radioactive materials P2 (2011)

Nuclear fission - problems

- Long-term storage and disposal. Materials remain radioactive for thousands of years
- Transport. Concerns about the risks of transporting radioactive materials
- There is a high public perception of risk to public health and the environment.
- Terrorism

Nuclear power - benefits

- Lack of Carbon dioxide emissions
- Can be used where, say, wind, solar or other energies may not be readily available

Fusion - future additional benefits

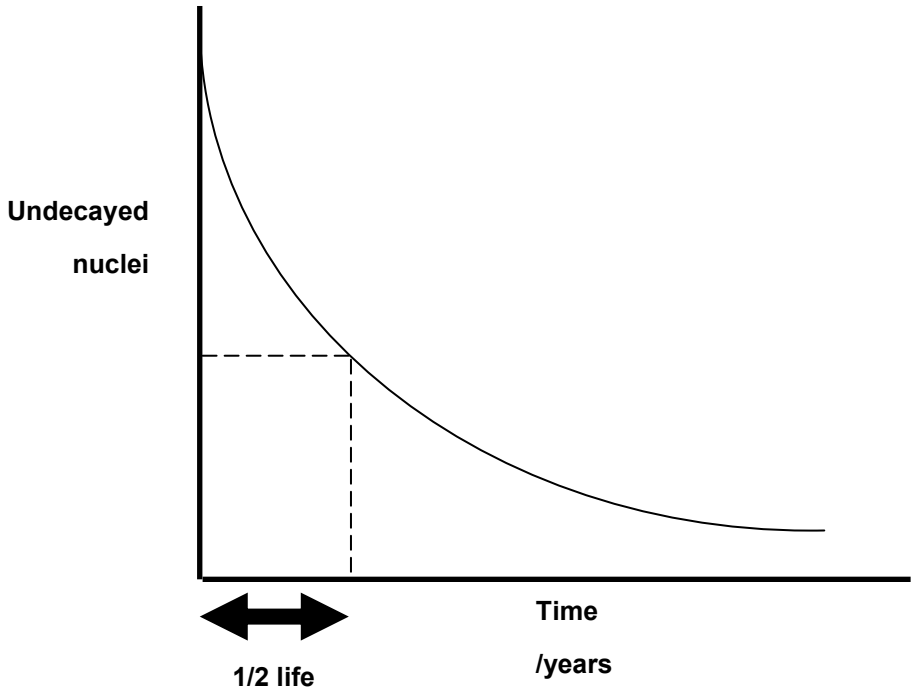
- Short-term waste problems (less than 20 years)
- Endless supply of fuel

Half-life

This is the time taken for the activity of a sample to reduce to half of its starting value. Or; The time taken for half the undecayed nuclei to decay.

*

Activity is measure in Becquerel (Bq)



Background radiation:

Background counts must be excluded from experiments, these come from a variety of sources, such as cosmic rays from the Sun, growing things and even hospitals, but the main source to consider is radon gas (which gives of Alpha particles) coming from rocks.

Remember:

Ionising radiation can cause tissue damage and possible mutations. Precautions need to be taken