Motion – equations & graphs

Describe an experiment to measure the acceleration of an object down a slope

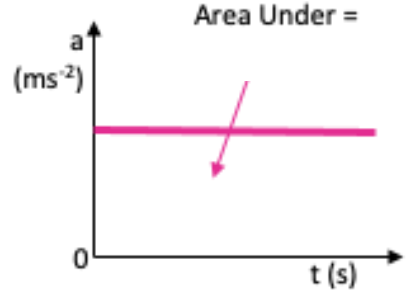
State appropriate relationship to solve problems and find average speed.

State appropriate relationship to solve problems and find average velocity.

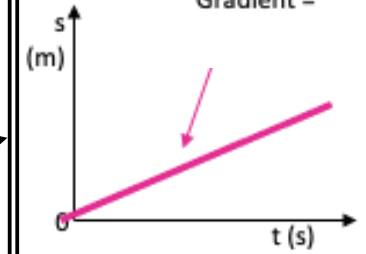
Define terminal velocity.

Describe how to calculate the change in velocity from a a-t graph

Area Under =

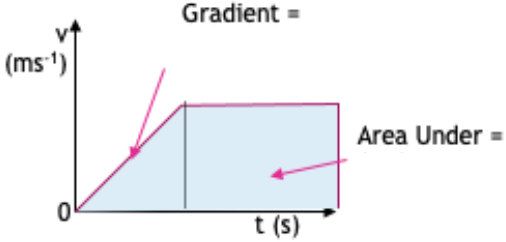


Gradient =



Describe how to calculate velocity from a s-t graph

Gradient =



Area Under =

Describe how to calculate the displacement and acceleration from a v-t graph

Define free fall.

Define apparent weight.

Define and provide an example of vector addition.

suvat equation of motion (no t)

suvat equation of motion (no v)

suvat equation of motion (no s)

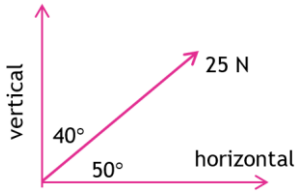
suvat equation of motion (no a)

Horizontal component
(if angle given from the horizontal)

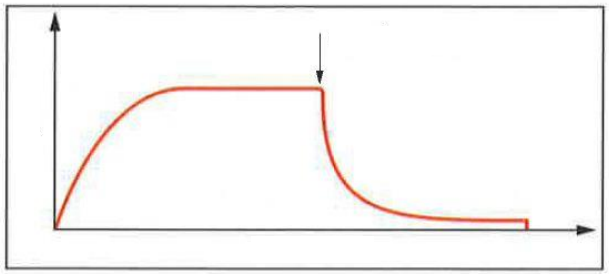
$v_H =$

Vertical component
(if angle given from the horizontal)

$v_v =$



Forces, energy and power



A speed–time graph for a falling parachutist.

Draw a v-t graph to show free fall

State Newton's 1st law.

State Newton's 2nd law.

State Newton's 3rd law.

Show the forces on a free body diagram for an object in tension.

Define free fall.

Define tension.

Define vector addition and label forces on diagram.

Complete the table for apparent weight.

Lift motion	Apparent weight
Stationary	= weight
Constant velocity	= weight
Accelerating upwards	
Accelerating downwards	
Decelerating upwards	
Decelerating upwards	

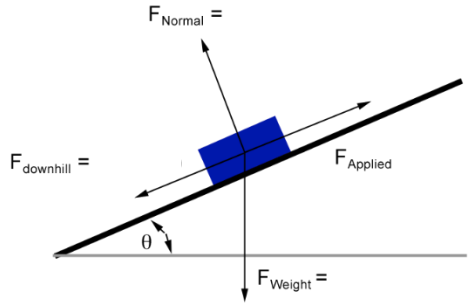
Relationship between force, mass and acceleration.

Relationship between weight, gravitational field strength (g.f.s) and mass.

Relationship between force, work done and distance.

Relationship between mass, energy, g.f.s and height.

Relationship between velocity, mass and energy.



Collisions, explosions and impulse

State principle of conservation of energy.

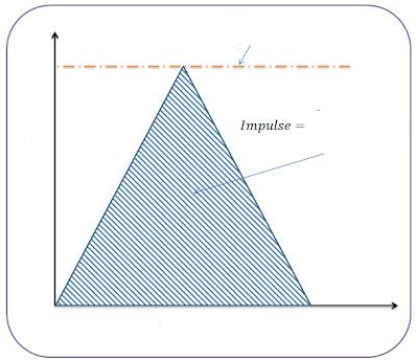
State principle of conservation of momentum.

Use Newton's 3rd law to explain the motion of objects interacting.

Show the energy involved in explosions.

Show the energy interactions in elastic collisions.

Label a force time graph to solve problems involving impulse.



Show the energy interactions in inelastic collisions.

Define momentum.

Provide an example of objects interacting in one dimension and solve problem involving momentum.

Relationship between velocity, mass and momentum.

Relationship between velocity, mass and energy.

Define impulse.

Relationship between force, time, final and initial momentum.

Gravitation and Special relativity

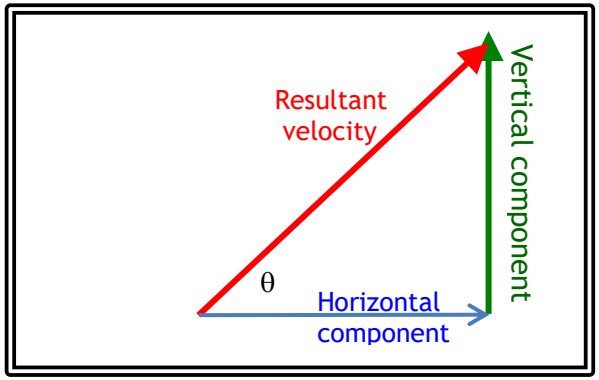
Description of an experiment to measure the acceleration of a falling object.

State the relationship used to explain the horizontal range of a projectile.

State the relationships used to explain the vertical component of a projectile.

Define projectile.

Solve vectors for horizontal and vertical components of projectiles



Define time dilation

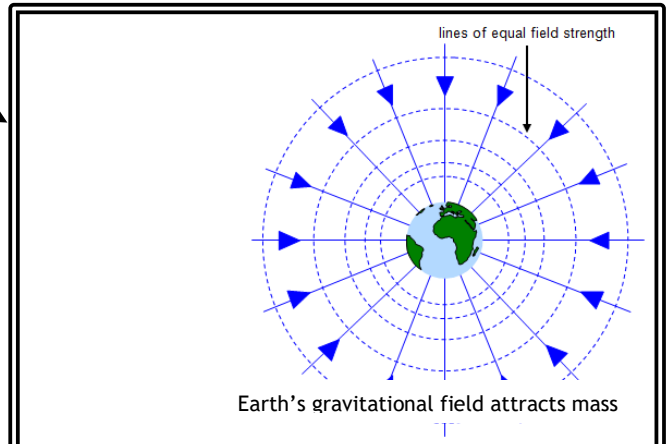
Define length contraction

Universal gravitational constant

Draw a diagram explaining special relativity.

Describe Special Relativity.

Describe and state Newton's law of universal gravitation.



State the relationship for length contraction.

State the relationship for time dilation.

Define satellites in terms of freefall.

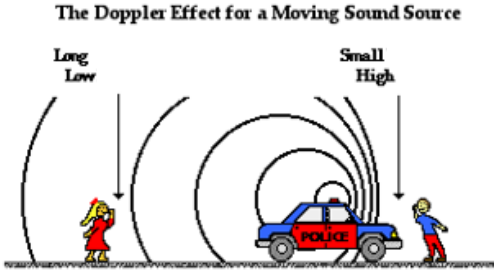
Describe an intertial frame of reference.

https://en.wikipedia.org/wiki/Black_body

John Sharkey Flashlearning

The expanding Universe

https://www.physicsclassroom.com/class/sound/Lesson-3/The-Doppler-Effect-and-Shock-Waves



Fill in the blanks for the Doppler Effect for a moving sound source

State appropriate relationship involving the observed frequency, source frequency, source speed and wave speed.

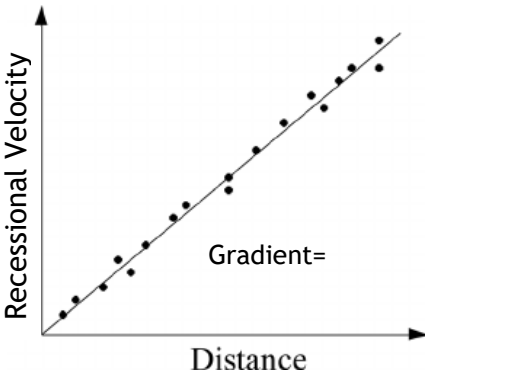
State appropriate relationship involving redshift, observed wavelength, emitted wavelength, and recessional velocity.

Define the Doppler effect.

Describe relevance of Newton's cannon thought experiment

Describe the evidence for the existence of dark matter

What do we use the Hubble-Lemaitre law for?



Hubble's Law and the age of the Universe. Describe the axes and gradient.

https://www.researchgate.net/figure/A-schematic-Hubble-plot-for-a-universe-with-a-constant-Hubble-parameter_fig1_258606466

Evidence for the big bang

1.
2.
3.

Relationship linking axes and gradient of graph

Leads to the theory of.....

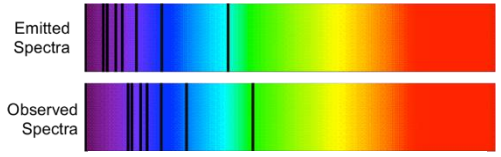
The mass of a galaxy can be estimated by.....

Evidence of dark energy comes from.....

Provide the two definitions of Redshift

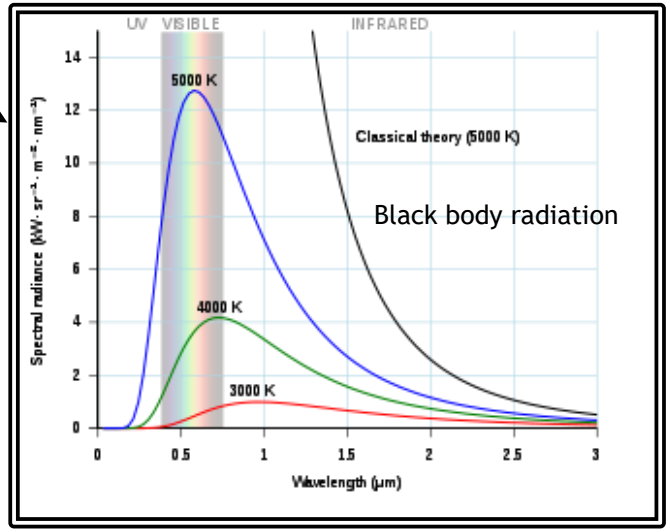
1.

2.



http://voyages.sdss.org/preflight/light/redshift/

Stellar temperature, radiation over different wavelengths



https://en.wikipedia.org/wiki/Black_body

The Standard model

Describe what the Standard model is?

Define anti-particles

Define annihilation

Describe Beta decay as first evidence of neutrino

Describe the four force mediating particles

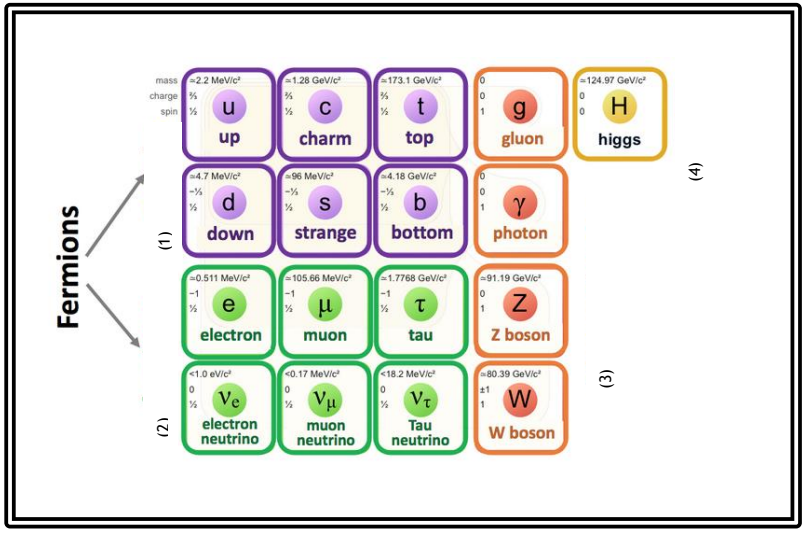
Define Fermions

Define Hadrons

Define Mesons

Define Baryons

Label the standard model (1-4).



Define Quarks

Define Leptons

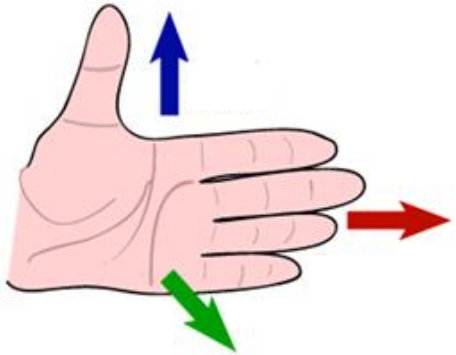
Define the Boson

Examples of sub nuclear orders of magnitude

Examples of very large orders of magnitude

https://physics.stackexchange.com/questions/288172/why-is-electric-field-lines-away-from-and-toward
https://commons.wikimedia.org/wiki/File:Field_lines_parallel_plates.svg
https://courses.lumenlearning.com/boundless-physics/chapter/the-electric-field-revisited/

Forces on charged particles



Use of appropriate relationships to solve problems involving the charge, mass, speed, and energy of a charged particle in an electric field and the potential difference through which it moves.

Knowledge of the basic operation of particle accelerators

Explain the secret sign of the physicist.

Explain the grip rule

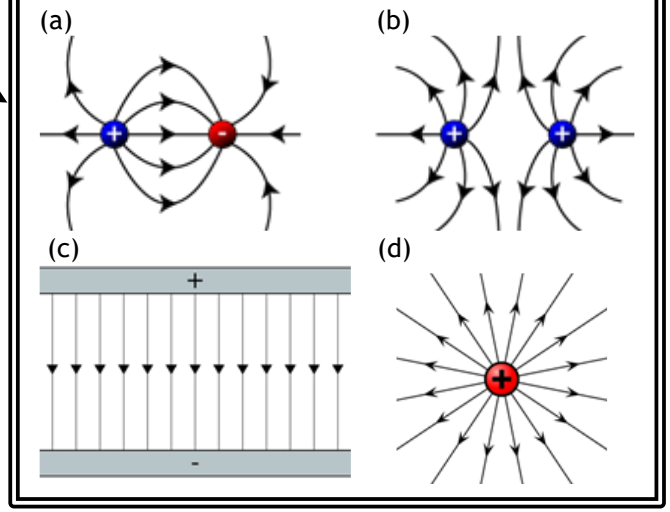
Define an electric field

Draw a diagram explaining the slap rule.

Define the Electronvolt

What will a moving charge produce?

Label the field patterns a-d.



Palm is the direct force on what type of particle.

Backhand is the direct force on what type of particle.

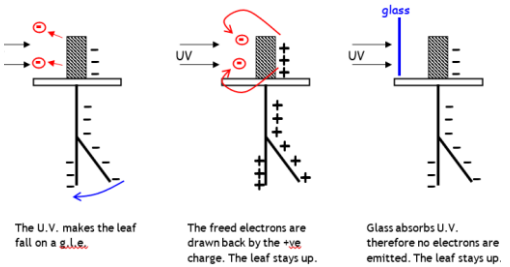
What is this symbol used for?

What is this symbol used for?

Definition of voltage (potential difference) in terms of work done and charge.

https://en.wikipedia.org/wiki/Black_body

Wave-particle duality



Name and describe the effect shown in the diagram

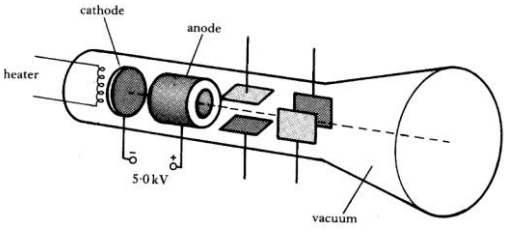
State appropriate relationship to solve problems involving the frequency and energy of a photon.

What is the threshold frequency?

The energy supplied by light or other electromagnetic radiation takes the form of photons of energy, ***hf***. When a photon goes into the metal it is wholly absorbed by a single electron.

If ***hf*** ***W***	no electron emission
If ***hf*** ***W*** ***hf_0***	then the photon is just able to release an electron from its surface without it having any E_K (f_0 or THRESHOLD FREQUENCY). ($hf = W = hf_0$)
If ***hf*** ***W***	then excess energy is given to the freed electron as E_K.

Insert >, < or = into the terms in the left hand column to satisfy the result in the right hand column



Calculate: (a) E_k of the electron.

(b) the final speed of the electron.

An electron is accelerated from rest through a potential difference of 200V.

What is the photoelectric effect evidence of?

What is the definition for the work function?

Complete the conclusions below

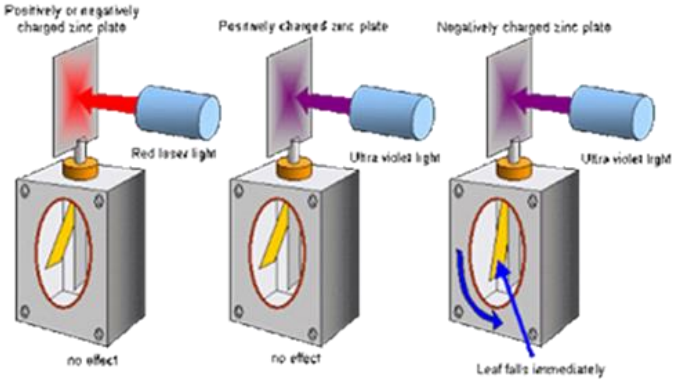
What is the charge of an electron?

What is the work function?

The relationship including velocity, frequency and wavelength?

The relationship including velocity, energy and mass?

Evidence	Conclusion
UV discharges the zinc plate of an electro-scope which is negatively charged.	
Visible radiation, however bright, doesn't produce the same effect.	

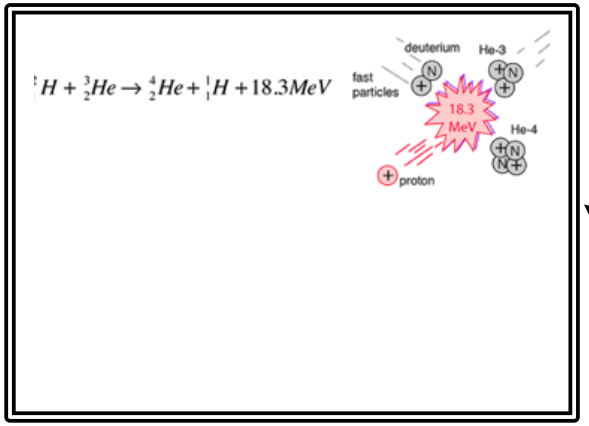


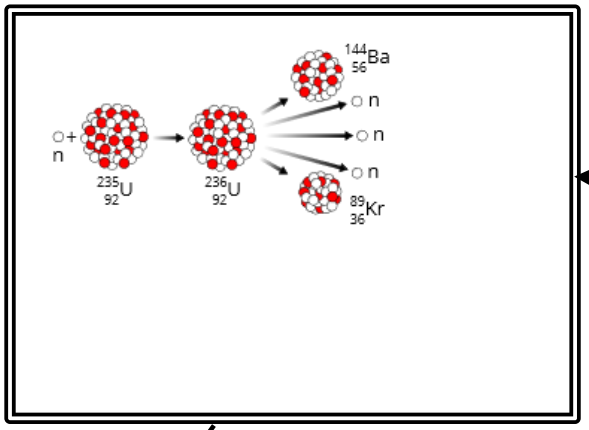
http://schoolphysics.org/age16-19/quantum%20physics/text/Photoelectric_effect/index.html

https://en.wikipedia.org/wiki/Discovery_of_nuclear_fission

http://hyperphysics.phy-astr.gsu.edu/hbase/NucEne/fusion.html

Nuclear reactions



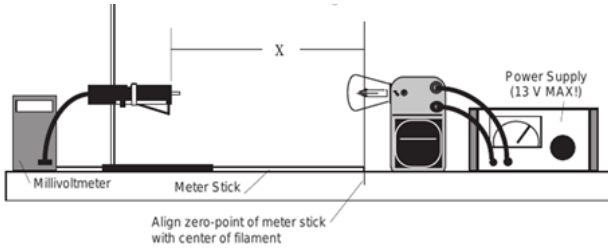


$^{1}_{0}n + {}^{235}_{92}U \rightarrow {}^{98}_{42}Mo + {}^{136}_{54}Xe + 2\,{}^{1}_{0}n + 4\,{}^{0}_{-1}e$

- Name and describe the nuclear reaction in the diagram
- State appropriate relationship to solve problems involving the mass loss and energy released by a nuclear reaction.
- Explain plasma and how it is contained in nuclear fusion reactors.
- Name the type of reaction given above and how you would calculate the energy released
- Name and describe the nuclear reaction in the diagram
- What is the definition of Beta decay?
- The evidence for the existence of what is provided by Beta decay?
- Calculate the energy released from the mass loss provided.
- What is the mass and atomic number of U above?
- What is the mass of a proton?
- The mass of an electron is?
- The mass of a neutron is?

Mass Before		Mass after	
$^{235}_{92}U$	3.90088×10^{-25} kg	$^{98}_{42}Mo$	1.6249×10^{-25} kg
$^{1}_{0}n$	1.6749×10^{-27} kg	$^{136}_{54}Xe$	2.2556×10^{-25} kg
Total 3.917629×10^{-25} kg		$2\,{}^{1}_{0}n$	3.3498×10^{-27} kg
		$4\,{}^{0}_{-1}e$	3.32×10^{-30} kg
		Total 3.914031×10^{-25} kg	

$I=Nhf$



Name and describe the units in the relationship

State appropriate relationship to solve problems involving the irradiance, power, and area.

What is irradiance?

Describe the experiment to verify the inverse square law for a point source of light

Demonstrate the use of an appropriate relationship to solve problems involving irradiance and distance from a point source of light.

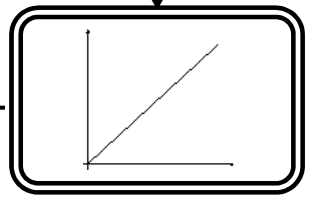
Inverse square law

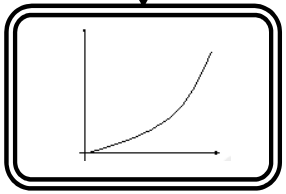
Label the inverse square law graph axes?

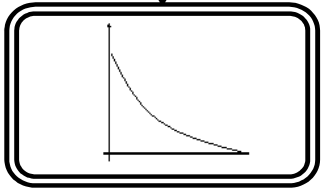
Label the inverse square law graph axes?

Label the inverse square law graph axes?

Explain the relationship in the graph



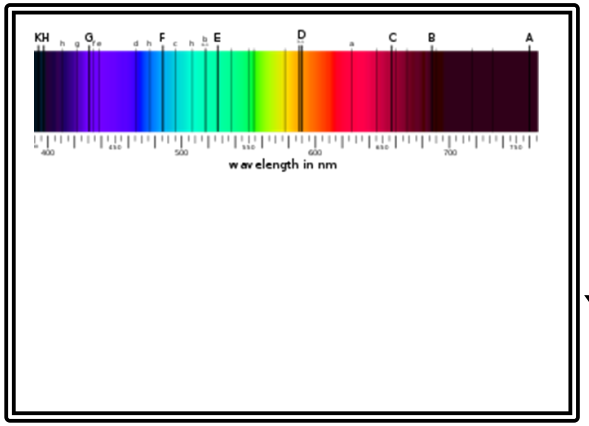


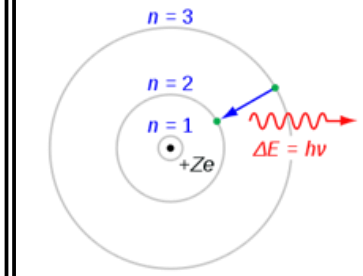


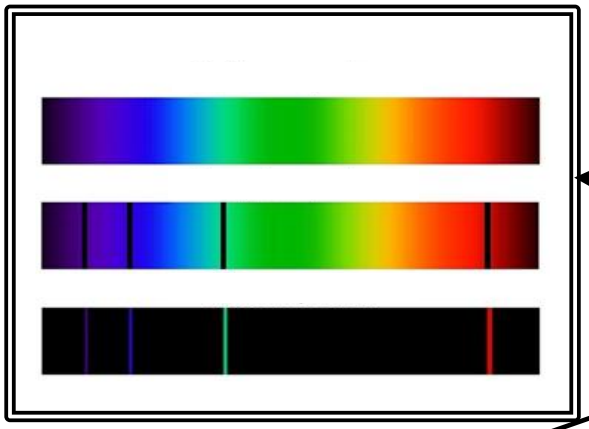
PASCO TD-8555 THERMAL RADIATION SYSTEM - Manual (Page 13). [online] manualsdir.com. Available at: <https://www.manualsdir.com/manuals/340664/pasco-td-8555-thermal-radiation-system-td-8554a-thermal-radiation-system-td-8553-thermal-radiation-system-td-8555-radiation-sensor-td-8554a-radiation-sensor-td-8553-radiation-sensor.html?page=13&original=1>

https://en.wikipedia.org/wiki/Bohr_model
https://physics.stackexchange.com/questions/65812/why-do-prisms-work-why-is-refraction-frequency-dependent
https://www.pinterest.co.uk/pin/764486105473144689/
https://en.wikipedia.org/wiki/Fraunhofer_lines

Spectra







Define and name the lines on this absorption spectrum?

Define spectra

What is the name of this model?

Define energy levels

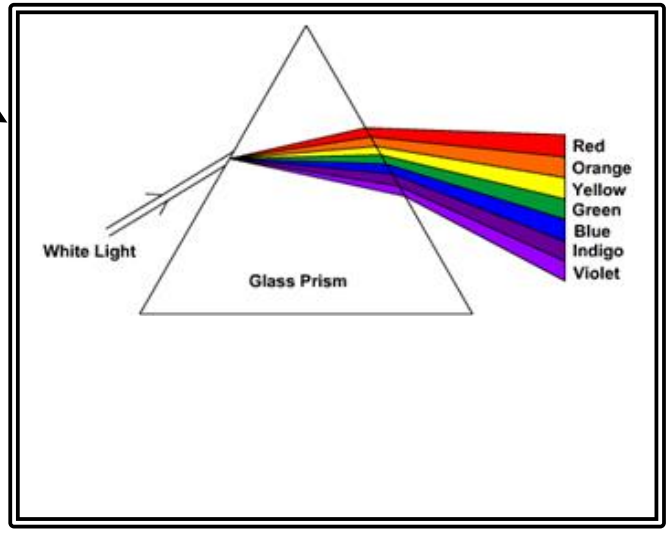
What is ionisation energy?

What is excitation energy?

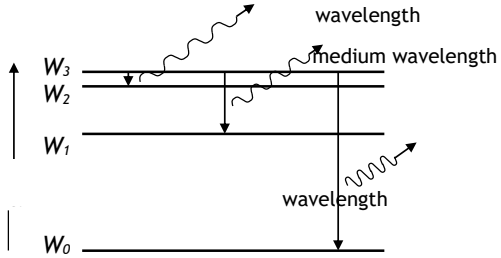
What is ground state?

Name the three types of spectra?

In the diagram showing dispersion give the wavelengths of R, G, B.



Label and describe the diagram

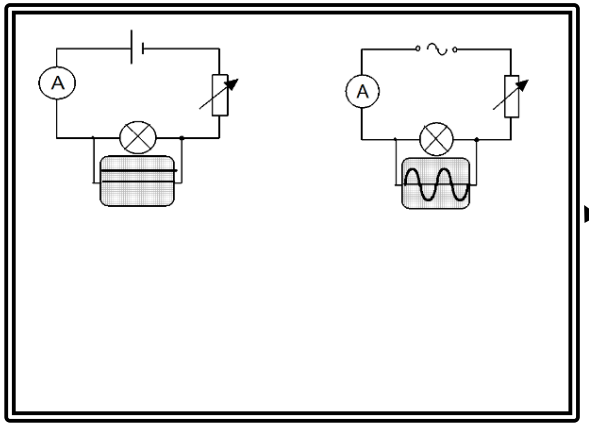


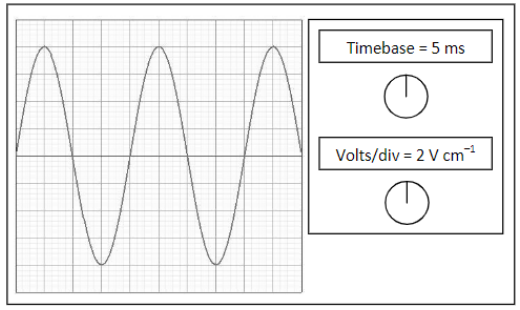
The energy in the bound electrons is QUANTISED, or comes in specific quantities (QUANTA). This means that the electrons of an atom can have certain quantities of energy and no other.

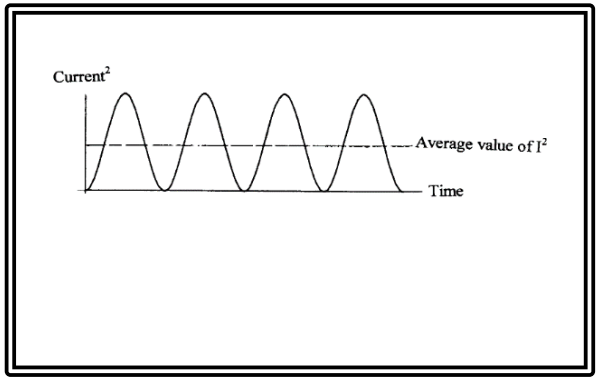
Define ionisation

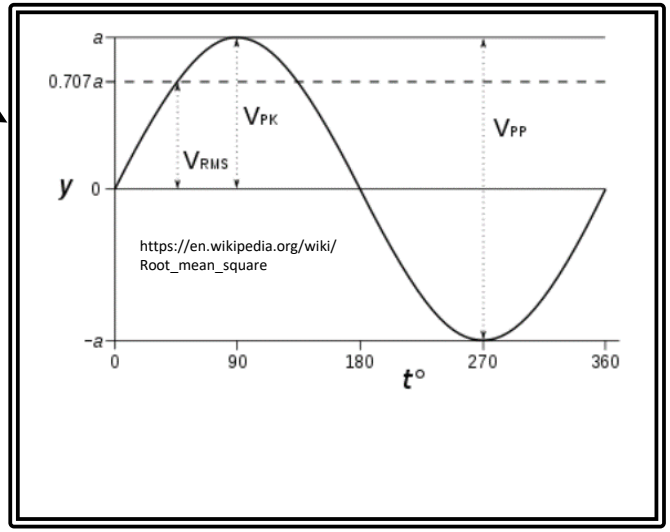
Which colour refracts most?

Monitoring and measuring AC









AC or DC, label the circuits

A power supply is quoted as 6V so it gives a fair comparison between AC & DC. Provide the V_{rms} and V_{peak} values.

What relationship do we use to calculate AC power from I_{rms}

Explain this graph

What type of readings are on a multimeter?

Definition of frequency ac signal

Define DC

Cathode Ray Oscilloscope (CRO)

Calculate the frequency from f = 1/T

Calculate the peak voltage from the trace.

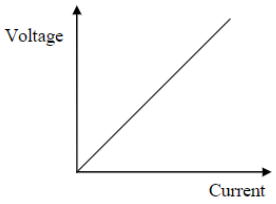
What is relationship for V_{rms}

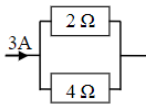
What is relationship for I_{rms}

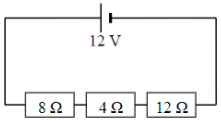
Definition of AC

Explain root mean square.

Current, potential difference, power, and resistance







	Chemical energy drives the current (eg battery)
	Heat energy drives the current (eg temperature sensor in an oven)
	Mechanical vibrations drive the current (eg acoustic guitar pickup)
	Light energy drives the current (eg solar panels on a house)
	Changes in magnetic field drive the current (eg power stations)

	Series	Parallel
Current		
Voltage		
Resistance		

Explain Ohms law

Calculate the current in the parallel circuit and voltage in the series circuit

Definition of power and the three relationships used to calculate power

Complete sources of emf

Definition of electromotive force

$\frac{V_1}{V_2} =$

Definition of potential difference

Complete the circuit rules

Definition of current

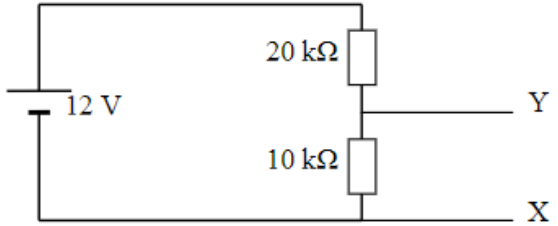
Definition of resistance

What is relationship R_{total} in series circuits

What is relationship R_{total} in parallel circuits

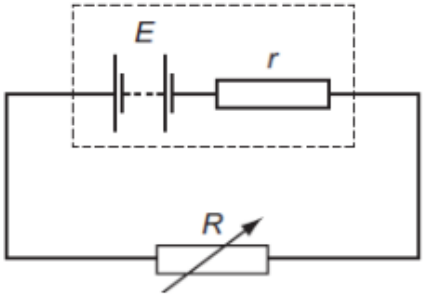
What is relationship to solve problems in potential divider circuits.

Calculate V across point XY



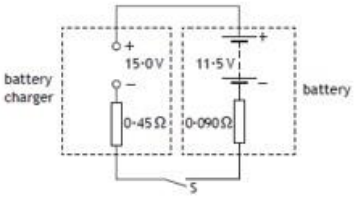
http://physics-ref.blogspot.com/2019/03/a-battery-with-emf-e-and-internal.html

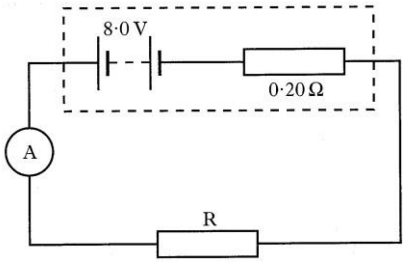
Electrical sources and internal resistance



V=

E=





Use of appropriate relationships to solve problems involving EMF, lost volts, t.p.d., current, external resistance, and internal resistance.

Calculate charging current

Reading on ammeter is 4A, calculate R

Describe an experiment to measure the EMF and internal resistance of a cell

Define an ideal supply

Define lost volts

Define internal resistance

Where do you place the ammeter?

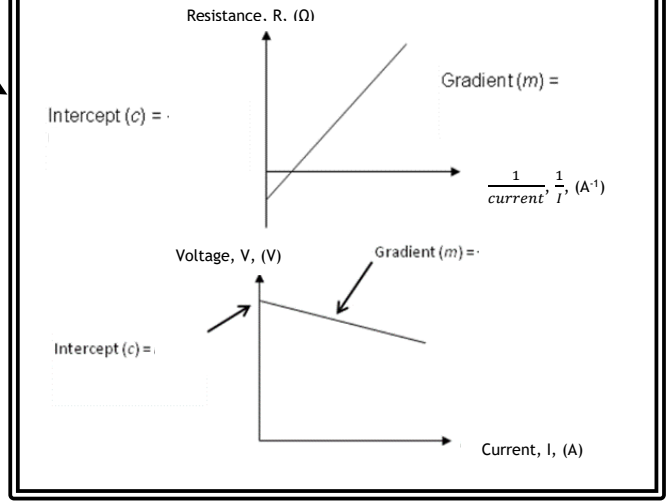
Where do you place the voltmeter?

Describe short circuit

Describe an open circuit

Define terminal potential difference

Determine EMF, r and I_{sc} using graphical methods



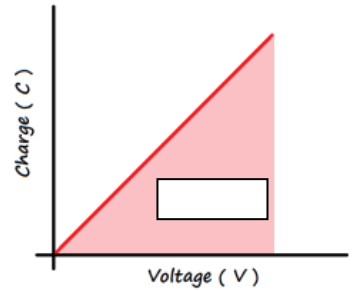
Capacitors

C=

V=

E=

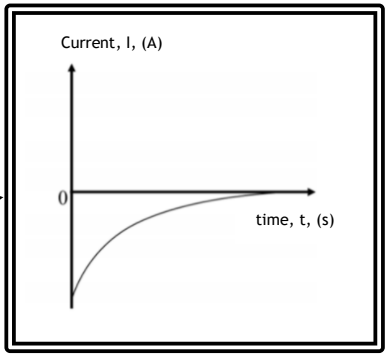
https://www.physicsscotland.co.uk/classes/higher-physics-cfe/capacitors



Use of an appropriate relationship to solve problems involving capacitance, charge and potential difference

Three relationships to calculate energy

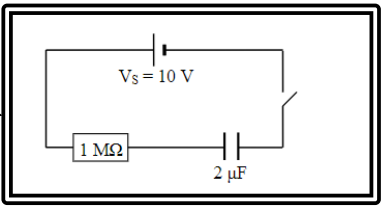
Area under the graph is?



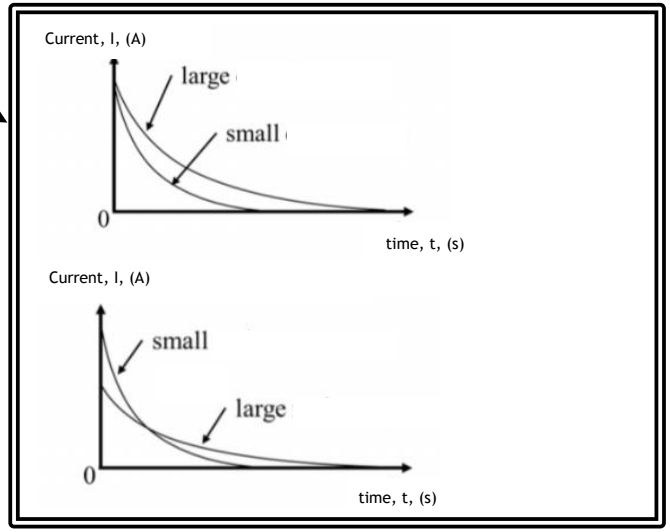
Description of experiments to investigate the variation of current in a capacitor and voltage across a capacitor with time.

Charging or discharging?

Show that the current through the resistor $I = 1 \times 10^{-5}$ A



Label graphs appropriately



Define capacitance.

Relationship to determine charge for a constant charging current.

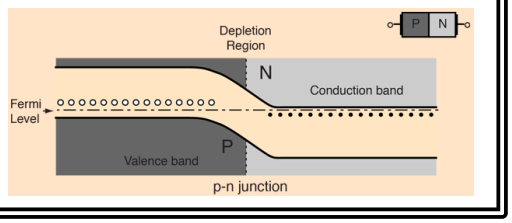
Practical uses of capacitors include?

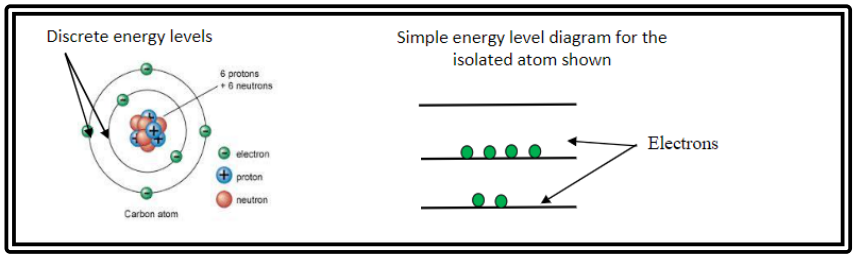
Area under a current-time graph represents.

Definition and purpose of a capacitor.

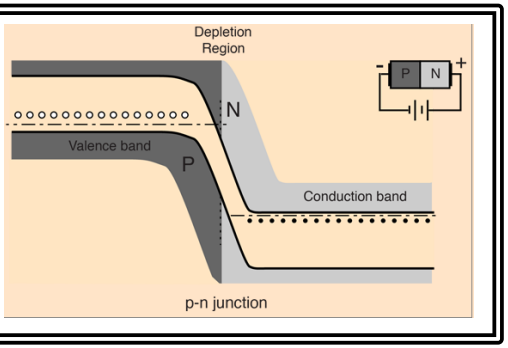
http://hyperphysics.phy-astr.gsu.edu/hbase/Solids/pnjun2.html

Semiconductors and p-n junctions





Material	Electrical properties
	Materials with many free electrons. These electrons can easily b made to flow through the material. Examples: all metals, semi-metals like carbon- graphite, antimony and arsenic.
	Materials that have very few free electrons. Examples: plastic, glass and wood.
	Materials that behave like insulators when pure, but will conduct when an impurity is added and/ or in response to light, heat, voltage etc. Examples: Elements: silicon, germanium, selenium Compounds: gallium arsenide and indium antimonide.



Identify whether the p-n junctions are forward or reverse biased and how this effects the electric field.

Label the band theory diagram of the atom

Identify the materials

Explain the LED p-n junction

Explain doping and describe examples of n and p type semiconductors.

Explain solar cell p-n junctions

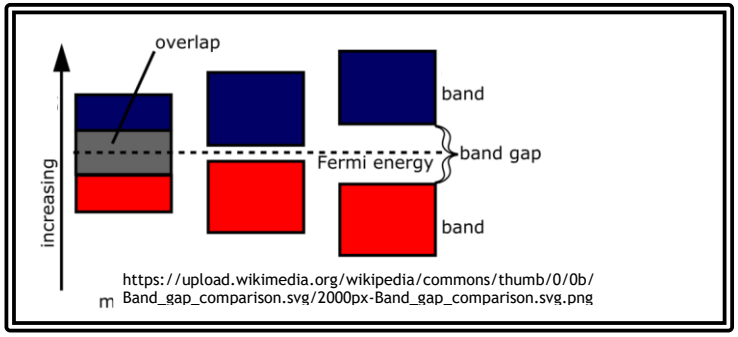
What potential difference forms across the depletion layer when conducting?

What is the valence band and how is it described in an insulator?

What is the conduction band and what do we call electrons free to move?

Label the diagram

Identify the junction and semiconductor types



https://upload.wikimedia.org/wikipedia/commons/thumb/0/0b/Band_gap_comparison.svg/2000px-Band_gap_comparison.svg.png

https://www.physicsscotland.co.uk/classes/higher-physics-cfe/semiconductors