Physics 3 Revision Tick List

The 4 main parts you need to learn are

1. **Electromagnetic Induction**
   - Electromagnetic Inductors and Generators
   - Transformers

2. **Waves**
   - Refraction of Plane Waves
   - Ultrasonic Waves
   - Seismic Waves

3. **Motion**
   - Motion

4. **Nuclear Physics**
   - Atomic Structure
   - Nuclear Fission
   - Nuclear Fusion

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1. Electromagnetic Induction & Generators	Tick	Tick
a) I know that a current is induced (created) in a wire when it is moved up and down between the poles of a magnet (the wire has to be at 90° to the magnetic field lines)		
b) I know that a current is induced because the wire cuts across magnetic field lines		
c) I know that the current is greater when the wire moves more quickly, there are more turns of wire or the magnet is stronger		
d) I know that the current is made greater because more magnetic field lines are broken per second		
e) I can predict which way the current will flow using Flemings Right Hand rule (**f**irst finger points in direction of magnetic **f**ield – N to S ; se**c**ond finger points in direction of **c**urrent - + to - ; thu**m**b points in direction of motion)		
f) I know that simple ac generators have commutators and bushes to allow the coil to turn without tangling but this makes the direction of the current alternate hence alternating current (ac)		
g) I know that real generators have multiple coils, use an electromagnet instead of magnets and have a radial magnetic field, and that the electromagnet turns instead of the coil to prevent overheating due to friction		
2. Transformers		
I know that a transformer with more turns in the secondary (second) coil makes the voltage bigger (step-up) ; and if there are fewer turns in the secondary then the voltage is smaller (step-down)		

b) I can select and use the equation: $\frac{V_1}{V_2} = \frac{N_1}{N_2}$ **V_1 voltage across primary coil ; V_2 voltage across secondary coil** **N_1 number of turns in primary coil ; N_2 number of turns in secondary coil**		
3. Refraction of Plane Waves		
a) I know that a transverse wave is one where the medium/material vibrates at right angles to the direction of the wave		
b) I know that a longitudinal wave is one where the medium/material vibrates in the same direction the wave is travelling		
c) I know that water waves travel more quickly in deep water than shallow; light waves travel more quickly in less dense material than more dense material; in both these cases refraction happens and the wave changes direction		
d) I know how a diagram of plane (straight) waves looks when the waves are reflecting		
e) I know how a diagram of plane (straight) waves looks when the waves are refracting		
f) I know that when water waves travel into shallower water the frequency stays the same; the wavelength decreases; the speed decreases (opposite is true when travelling into deeper water)		
4. Ultrasonic Waves		
a) I know that ultrasonic waves are sound waves with frequencies higher than 20 000Hz and that we cannot hear them		

b) I know that ultrasound waves are reflected at boundaries between materials of different densities		
C) I know that in order to get detailed ultrasound images a very short wavelength has to be used ; since the speed stays the same (so long as the density stays the same) then the frequency has to be very large about 1 to 10 megahertz (million hertz)		
d) I know about some uses of ultrasound eg., medical scanning, industrial scanning (ie looking for cracks in welds or metal castings) , cleaning jewellery or teeth		
e) I can select and use the equation wavespeed (m/s) = frequency (Hz) x wavelength (m) for ultrasound/ultrasonic waves		
f) I can re-arrange the equation to find frequency (wavespeed/wavelength) or wavelength (wavespeed/frequency)		
5. Seismic Waves		
a) I know that P waves (primary waves) travel faster; are longitudinal waves; travel through liquids and solids		
b) I know that S waves (secondary waves) travel slower; are transverse waves and only travel through solids (NOT LIQUIDS)		
c) I know that when an earthquake occurs the size of the gap between P and S waves on a seismogram tells us how far away it was; the bigger the gap the further away the centre of the earthquake was		
d) I know that the absence of S waves on seismograms on the opposite side of the Earth to the earthquake tells us that the Earth must have a liquid core that the waves are unable to travel through		

e) I know that studies of where P and S waves are detected on seismograms around the Earth from the epicentre (where the earthquake occurred) tells peo-physicists that the Earth has a layered structure ; a liquid core with a solid mantle around it		
f) I know that as the density of the layers of the Earth changes this causes the P and S waves to change speed and direction ie., refract		
g) I can use the equation $$\textbf{speed} = \frac{\textbf{distance}}{\textbf{time}}$$ **for seismic waves**		
6. Motion		
a) I know that velocity is speed in a given direction and that if the object is travelling the opposite way then a negative sign is used		
b) I know that the area under a velocity-time graph gives the distance travelled by the object (if the graph has a triangular shape use 1/2 base times height; if its rectangular then use base times height)		
c) I can select and use the equations of motion: $v = u + at$ — s = distance in m $\mathbf{v^2 = u^2 + 2as}$ — u = starting velocity in m/s $\mathbf{s = ut + 1/2at^2}$ — v = final velocity in m/s $s = 1/2 (u + v)t$ — a = acceleration in m/s^2 t = time in s		

d) I can select and use momentum (kgm/s) = mass (kg) x velocity (m/s)		
e) I understand that the longer a force is applied to an object then the greater its change in momentum and that this is how crumple zones and air bags work. The change in momentum is the same when a car crashes whether or not the car is fitted with these devices, however these devices increase the time the force is applied and this reduces the forces acting on the passengers.		
f) I know that the law of conservation of momentum says: **the total momentum before = the total momentum after** **and I can use this to calculate velocities of objects before and after collisions / explosions**		
g) I can use: **kinetic energy = $\frac{mv^2}{2}$** **to compare kinetic energy before and after collisions**		
h) I can select and use: **force = $\frac{\text{change in momentum}}{\text{time}}$** **to find force, change in momentum or time**		
i) I know that for an object to change direction a resultant force needs to be applied. If the object is travelling in a circle then the resultant force acts towards the centre of the circle.		

j) I understand that space scientists use ideas of conservation of energy and momentum in working out energy-saving sling-shots orbits. In this type of orbit the space craft accelerates towards the planet under the pull of the planet's gravity. The space craft goes past the planet and although the pull of gravity now decelerates the space craft (by the same amount as it speeded up) it has had to use no fuel for this part of its journey and so saves energy.		
7. Atomic Structure		
a) I know that Thompson used a plum pudding model to explain how atoms could have both positive and negative charge and be neutral. Electrons were embedded in a mass of positive charge just like plums in a pudding.		
b) I know that Rutherford's alpha particle experiment showed that atoms had to be mostly empty space with a very tiny nucleus that contained all the positive charge. He suggested atoms had to have a nucleus with a positive charge with electrons orbiting around it to make it neutral.		
c) Bohr further developed Rutherford's model by saying that electrons could only orbit in fixed orbits determined by the atom.		
d) I understand the terms mass number A (total number of particles nucleus), atomic number Z (number of protons) and isotope (atoms with the same number of protons but different numbers of neutrons, in other words same atomic number but different mass numbers). Also for a neutral atom there will be the same number of electrons as protons.		
e) I can use $^{A}_{Z}\mathrm{X}$ to show radioactive decay, nuclear fission and nuclear fusion		

f) I can use nuclear symbols in decay equations which I can balance.		
g) I can recall and use the symbols $^{4}_{2}\alpha$, $^{4}_{2}He$, $^{0}_{-1}\beta$, $^{0}_{-1}e$ for alpha and beta particles		
f) I can use tables of isotopes to investigate nuclear decay series and appreciate the significance of these to investigations into the age of rocks and the age of the Earth and Solar System		
8. Nuclear fission		
a) I know that processes which result in the splitting of heavy nuclei into lighter fragments (nuclear fission) release energy		
b) I can recall recall that $^{235}_{92}U$ and $^{239}_{94}Pu$ can lead to an uncontrolled chain reaction in which very large amounts of energy are released in nuclear explosions, and I can recall that in nuclear power stations control rods, usually of Boron, are used to control the rate of reaction (by absorbing neutrons)		
c) I know that the products of nuclear fission (controlled and uncontrolled) have a wide range of half lives		

9. Nuclear fusion		
a) I understand that when light nuclei such as hydrogen and helium combine to make a heavier nuclei that massive amounts of energy are released and that this is called nuclear fusion		
b) I can describe nuclear fusion as 2 hydrogen nuclei combining to produce helium, and that this process needs very high temperatures and pressures like those found in stars and the sun		
c) I know that this has been difficult to replicate here on Earth because only nuclear fission can produce high enough temperatures. If we can carry out nuclear fusion then there will be a huge supply of fuel (called deuterium , a heavy form of hydrogen) in the oceans and there will be no pollution $\left({}_{1}^{2}\mathrm{H}\right)$		
d) I can recognise and discuss the nuclear fusion equation shown as a potential source of energy ${}_{1}^{2}\mathrm{H}+{}_{1}^{3}\mathrm{H}\rightarrow{}_{2}^{4}\mathrm{He}+{}_{0}^{1}\mathrm{n}$		