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| **Year 10 AQA GCSE Physics** **Revision Checklist** |

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| **Particle model of matter** |  |  |  |
| **Density of materials - know*** the density of a material is defined by the equation: density = mass/volume - ρ = m/V
* density, ρ, is measured in kilograms per metre cubed, kg/m3
* mass, m, is measured in kilograms, kg
* volume, V, is measured in metres cubed, m3
* How to explain the differences in density between the different states of matter in terms of the arrangement of atoms or molecules.
* How to explain differences in density between the different states
* How to describe practical methods to measure the density of regular and irregular solids and a liquid.
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| **The three states of matter – know*** The states of matter are solid, liquid and gas and how to recognise and draw simple diagrams to model the difference in arrangement of particles between solids, liquids and gases.
* The names of the changes of state (Melting, freezing, boiling, evaporating, condensing, sublimation)
* How to use melting and boiling point data to decide the state of a substance
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| **Changes of state*** Students should be able to describe how and that when substances change state (melt, freeze, boil, evaporate, condense or sublimate) and that mass is conserved.
* Changes of state are physical changes which differ from chemical changes
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| **Internal Energy*** Internal energy is stored inside a system by the particles that make up the system. It is the total kinetic energy and potential energy of all the particles
* Heating changes the energy stored within the system by increasing the energy of the particles that make up the system. This either raises the temperature of the system or produces a change of state.
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| **Temperature changes in a system and specific heat capacity*** If the temperature of the system increases, the increase in temperature depends on the mass of the substance heated, the type of material and the energy input to the system.
* The specific heat capacity of a substance is the amount of energy required to raise the temperature of one kilogram of the substance by one degree Celsius.
* The following equation applies
* change in thermal energy = mass× specific heat capacity x temp change.
* change in thermal energy is measure in joules, J, mass, m, in kilograms, kg
* specific heat capacity, c, is measured in joules per kilogram per degree Celsius, J/kg °C
* temperature change, Δθ, is measured in degrees Celsius, °C.
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| **Particle model of matter continued** |  |  |  |
| **Changes of heat and specific latent heat*** Latent heat is the energy needed for a substance to change state.
* When a change of state occurs, the energy supplied changes the energy stored (internal energy) but not the temperature.
* The specific latent heat of a substance is the amount of energy required to change the state of one kilogram of the substance with no change in temperature.
* energy for a change of state = mass ­x latent heat
* energy, E, is measured in joules, J; mass, m is measured in kilograms, kg
* specific latent heat, L, is measured in joules per kilogram, J/kg
* Specific latent heat of fusion is the change of state from solid to liquid
* Specific latent heat of vaporisation is the change of state from liquid to vapour
* Be able to interpret heating and cooling graphs that include changes of state.
* Be able to distinguish between specific heat capacity (a change in temperature is involved) and specific latent heat (a change of state is involved at constant temperature).
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| **Particle motion in gases*** The molecules of a gas are in constant random motion. The temperature of the gas is related to the average kinetic energy of the molecules.
* Changing the temperature of a gas, held at constant volume, changes the pressure exerted by the gas.
* Be able to explain how the motion of the molecules in a gas is related to both its temperature and its pressure
* Be able to explain qualitatively the relation between the temperature of a gas and its pressure at constant volume.
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| **Pressure in gases*** A gas can be compressed or expanded by pressure changes. The pressure produces a net force at right angles to the wall of the gas container
* Be able to use the particle model to explain how increasing the volume in which a gas is contained, at constant temperature, can lead to a decrease in pressure.
* For a fixed mass of gas held at a constant temperature: pressure × volume = constant
* pV=constant (p1V1 = p2V2)
* pressure, p, is measured in pascals, Pa; volume, V, is measured in metres cubed, m3
* Be able to calculate the change in the pressure of a gas or the volume of a gas (a fixed mass held at constant temperature) when either the pressure or volume is changed.
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| **Increasing the pressure of a gas*** Work is the transfer of energy by a force.
* Doing work on a gas increases the internal energy of the gas and can cause an increase in the temperature of the gas.
* Be able to explain how, in a given situation e.g. a bicycle pump, doing work on an enclosed gas leads to an increase in the temperature of the gas.
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| **Electricity 2** |  |  |  |
| **Mains electricity – know*** Most electrical appliances are connected to the mains using three-core cable
* The insulation covering each wire is colour coded for easy identification. (live wire – brown, neutral wire – blue, earth wire – green and yellow stripes)
* The live wire carries the alternating p.d. from the supply so can be dangerous even when a switch in the mains circuit is open.
* The neutral wire completes the circuit.
* The earth wire is a safety wire to stop the appliance becoming live
* To explain the dangers of providing any connection between the live and earth.
* The p.d. between the live wire and earth is about 230V. The neutral wire is at, or close to, earth potential (0V). The earth wire is at 0V and only carries a current if there is a fault.
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| **Energy Transfers, Power – know*** Explain how the power transfer in any circuit device is related to the potential difference across it and the current through it, and to the energy changes over time:
* Power = potential difference x current

*P = IV** Power = (current)2 x Resistance

*P = I2R*Power P in Watts, Wp.d. V in volts, VCurrent I, in amps, AResistance R, in ohms Ω |  |  |  |
| **Energy transfers in everyday appliances*** Everyday electrical appliances are designed to bring about energy transfers.
* The amount of energy an appliance transfers depends on how long the appliance is switched on for and the power of the appliance.
* Describe how different domestic appliances transfer energy from batteries or ac mains to the kinetic energy of electric motors or the energy of heating devices.
* Work is done when charge flows in a circuit.
* The amount of energy transferred by electrical work can be calculated using the equation:
* Energy transferred = power x time

*E = Pt** Energy transferred = charge flow x potential difference

*E = QV* |  |  |  |
| **Electricity - continued** |  |  |  |
| **Energy transfers in everyday appliances*** Energy transferred = current x p.d. x time

*E = VIt*Energy transferred E in joules JPower P in watts WTime t, in seconds, sCharge flow Q in coulombsPotential difference V in volts VCurrent I in amps A* Explain how the power of a circuit device is related to the p.d across it and the current through it
* Explain how the power of a circuit device is related to the energy transferred over a given time.

Describe, with examples, the relationship between the power ratings for domestic electrical appliances and the changes in stored energy when they are in use. |  |  |  |
| **The National Grid*** The National grid is a system of cables and transformers linking power stations to consumers.
* Electrical power is transferred from power stations to consumers using the National grid.
* Step up transformers are used to increase the potential difference from the power station to the transmission cables then step-down transformers are used to decrease, to a much lower value, the potential difference for domestic use.
* Explain why the National Grid system is an efficient way to transfer energy.
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| **Energy** |  |  |  |
| **Energy stores and systems*** A system is an object or group of objects.
* There are changes in the way energy is stored when a system changes
* Describe all the changes involved in the way energy is stored when a system changes for common situations. For example:
* An object projected upwards,
* A moving object hitting an obstacle
* An object accelerated by a constant force
* A vehicle slowing down
* Bringing water to a boil in an electric kettle.
* Be able to calculate changes in energy involved when a system is changed by heating, work done by force, work done when current flows
* Use calculations to show on a commons scale how the overall energy in a system is redistributed when the system is changed (e.g. Sankey diagram)
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| **Changes in Energy*** Be able to calculate the amount of energy associated with a moving object, a stretched spring and an object raised above ground level.
* The kinetic energy of a moving object can be calculated using the equation:
* *Kinetic Energy = 0.5 x mass x (speed)2*

*Ek= ½ mv2*Kinetic energy Ek in joules, JMass, m in kilograms, kgSpeed, v, in metres per second, m/s* The amount of elastic potential energy stored in a stretched spring can be calculated using the equation:
* *Elastic potential Energy = 0.5 x spring constant x (extension)2*

*Ee= ½ ke2*(assuming the limit of proportionality has not been exceeded)Elastic potential energy in joules, JSpring constant k, in newtons per metre, N/mExtension, e, in metres, m* *Gravitational Potential Energy = Maxx x gravitational field strength x height*

*Ep= m g h*Gravitational potential energy, Ep, in joules, JMass, m, in kilograms, kgGravitational field strength, g, in newtons per kilogram, N/kg (in any calculation the value of the gravitational field strength (g) will be given.)Height, h, in metres, m |  |  |  |
| **Energy changes in systems*** The amount of energy stored in or released from a system as its temperature changes can be calculated using the equation (which will be given in the physics equation sheet):
* *Change in thermal energy = mass x specific heat capacity x temperature change*

Δ*E = m c Δθ*Change in thermal energy, ΔE, in joules, JMass, m, in kilograms, kgSpecific heat capacity, c in joules per kilogram per degree Celsius, J/(kgoC)Temperature change, Δθ, in degrees Celsius, oC* The specific heat capacity of a substance is the amount of energy required to raise the temperature of one kilogram of the substance by one degree Celsius.
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| **Energy - continued** |  |  |  |
| **Energy changes in systems - continued*** Be able to explain the required practical to determine the specific heat capacity of one (or more) materials by linking the decrease of one energy store (or work done) to the increase in temperature and subsequent increase in thermal energy stored. For example the gain in thermal energy by a known mass of water will equal the loss in thermal energy of a known mass of metal, this can be used to determine the specific heat capacity of the metal.
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| **Power*** Power is defined as the rate at which energy is transferred or the rate at which work is done.
* *Power = energy transferred/time (this equation must be recalled)*
* *P = E/t*
* *Power = work done / time (this equation must be recalled)*
* *P = W/t*

Power, P, in watts, WEnergy transferred, E, in joules, JTime, t, in seconds, sWork done, W, in joules, J* An energy transfer of 1 joule per second is equal to a power of 1 watt.
* Be able to give examples that illustrate the definition of power e.g. comparing two electric motors that both lift the same weight through the same height but one does it faster than the other.
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| **Conservation and dissipation of energy – Energy transfers in a system*** Energy can be transferred usefully, stored or dissipated, but cannot be created or destroyed.
* Be able to describe with examples where there are energy transfers in a closed system, that there is no net change to the total energy.
* Be able to describe, with examples, how in all system changes energy is dissipated, so that it is stored in less useful ways. This energy is often described as being ‘wasted’.
* Explain ways of reducing unwanted energy transfers, for example through lubrication and the use of thermal insulation.
* The higher the thermal conductivity of a material the higher the rate of energy transfer by conduction across the material. The different thermal conductivity of metals can be shown by sticking drawing pins onto a strip of metal using wax, heating one end of the strip and monitoring the time for pins to drop (when heating several different metals at once)
* Be able to describe how the rate of cooling of a building is affected by the thickness and thermal conductivity of its walls.
* Required practical to investigate the effectiveness of different materials as thermal insulators and the factors that may affect the thermal insulation properties of a material.
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| **Efficiency*** The energy efficiency for any energy transfer can be calculated using the equation:
* *Efficiency = useful output energy transfer / total input energy transfer (learn this)*
* Efficiency may also be calculated using the equation:
* *Efficiency = useful power output/total power input*
* Be able to use efficiency values as either a percentage or a decimal
* Describe ways to increase the efficiency of an intended energy transfer.
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| **Energy - continued** |  |  |  |
| **National and Global Energy Resources*** The main energy resources available for use on Earth include: Fossil fuels (coal, oil and gas), nuclear fuel, bio-fuel, wind, hydro-electricity, geothermal, the tides, the Sun and water waves.
* A renewable energy resources is one that is being (or can be) replenished as it is used.
* The uses of energy resources include transport, electricity generation and heating.
* Be able to describe the main energy sources available
* Distinguish between energy resources that are renewable and energy resources that are non-renewable
* Compare ways that different energy resources are used, the uses to include transport, electricity generation and heating
* To understand why some energy resources are more reliable than others.
* Describe the environmental impact arising from the use of different energy resources
* Explain patterns and trends in the use of energy resources.
* Be able to consider environmental issues that may arise from the use of different energy resources.
* Show that science has the ability to identify environmental issues arising from the use of energy resources but not always the power to deal with the issues because of political, social, ethical or economic considerations.
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| **Space Physics** |  |  |  |
| **Red-shift – know that*** There is an observed increase in wavelength of light from most distant galaxies. The further away the galaxy, the faster they are moving and the bigger the observed increase in wavelength. This effect is called red-shift.
* The observed red-shift provides evidence that space itself (the universe) is expanding and supports the Big Bang Theory.
* The Big Bang Theory suggests the universe began from a very small region that was extremely hot and dense.
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| **Red-shift – continued*** Since 1998 onwards, observations of supernovae suggest that distant galaxies are receding ever faster.
* Explain qualitatively the red shift of light from galaxies that are receding
* Explain the change of each galaxy’s speed with distance is evidence of an expanding universe
* Explain how red-shift provides evidence for the Big Bang model
* Explain how scientists are able to use observations to arrive at theories such as the Big Bang Theory.
* Explain that there is still much about the universe that is not understood for example dark mass and dark energy.
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| **Waves** |  |  |  |
| **Transverse and longitudinal waves*** Be able to describe the difference between longitudinal and transverse waves including examples of each (e.g. ripples / light for transverse & sound (compression waves) for longitudinal.
* Describe evidence that, for both ripples on a water surface and sound waves in air, it is not the wave and not the water or air itself that travels.
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| **Properties of waves*** Be able to describe wave motion in terms of their amplitude, wavelength, frequency and period.
* Amplitude – maximum displacement of a point on a wave away from its undisturbed position.
* Wavelength – distance from a point on one wave to the equivalent point on the adjacent wave.
* Frequency – number of waves passing a point each second.
* *Period – 1/frequency [T= 1/f](equation on the physics equation sheet)*
* Period, T, in seconds, s
* Frequency, f, in hertz, Hz
* The wave speed is the speed at which the energy is transferred (or the wave moves) through the medium. All waves obey the wave equation:
* *Wave speed – frequency x wavelength [v=f λ] (learn this equation)*
* Wave speed, v, in metres per second, m/s
* Frequency f, in hertz, Hz, Wavelength, λ, in metres, m
* Be able to identify amplitude and wavelength from given diagrams
* Describe a method to measure the speed of sound waves in air and describe a method to measure the speed of ripples on a water surface.
* Be able to show how changes in velocity, frequency and wavelength, in transmission of sound waves from one medium to another are inter-related.
* Required practical – be able to identify the suitability of apparatus to measure the frequency, wavelength and speed of waves in a ripple tank and waves in a solid and take appropriate measurements.
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| **Reflection of waves*** Be able to construct ray diagrams to illustrate the reflection of a wave at a surface
* Be able to describe the effects of reflection, transmission and absorption of waves at material interfaces
* Required practical – investigate the reflection of light by different types of surfaces and the refraction of light by different substances.
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| **Waves continued** |  |  |  |
| **Sound waves*** Sound waves can travel through solids causing vibrations in the solid.
* Within the ear, sound waves cause the ear drum and other parts to vibrate which causes the sensation of sound. The conversion of sound waves to vibrations of solids works over a limited frequency range. This restricts the limits of human hearing.
* Explain why the conversion of sound waves to vibrations only works over a limited frequency range
* Know the range of normal human hearing is from 20Hz to 20kHz
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| **Waves for detection and exploration*** Be able to explain in qualitative terms, how the differences in velocity, absorption and reflection between different types of wave in solids and liquids can be used both for detection and exploration of structures which are hidden from direct observation.
* Ultrasound – frequency higher than upper limit of human hearing. Ultrasound is partially reflected when it meets a boundary between two different media. The time taken for reflections to reach a detector can be used to determine how far away such a boundary is. Ultrasound can therefore be used for both medical and industrial imaging.
* Seismic waves are produced by earthquakes. P-waves are longitudinal, seismic waves. P- waves travel at different speeds in solids and liquids. S-waves are transverse, s-waves cannot travel through a liquid. P-waves and S-waves provide evidence for the structure and size of the Earth’s core. The study of seismic waves produced new evidence leading to discoveries about parts of the earth which are not directly observable.
* Echo sounding, using high frequency sound waves is used to detect objects in deep water and measure depth
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| **Electromagnetic waves – Types*** EM waves are transverse waves that transfer energy from the source of the waves to an absorber.
* EM waves form a continuous spectrum and all travel at the same velocity through a vacuum or air.
* Waves are grouped in terms of wavelength and frequency. From long to short wavelength (low to high frequency) the groups are:
* Radiowaves, microwaves, infrared, visible light, ultraviolet, x-rays, gamma rays.
* Our eyes detect only visible light
* Be able to give examples that illustrate the transfer of energy by electromagnetic waves. E.g. heating effect of sunlight – IR radiation
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| **Properties of electromagnetic waves*** Different substances may absorb, transmit, refract or reflect EM waves in ways that vary with wavelength.
* Some effects e.g. refraction, are due to the difference in velocity of the waves in different substances.
* Be able to construct ray diagrams to illustrate the refraction of a wave at the boundary between two media.
* Be able to use wave front diagrams to explain refraction in terms of the change of speed that happens when a wave travels from one medium to a different medium.
* Required practical – investigate how the amount of IR radiation absorbed or radiated by a surface depends on the nature of that surface
* Radio waves can be produced by oscillations in electrical circuits.
* When radio waves are absorbed they may create an alternating current with the same frequency as the radio wave itself, so radio waves can themselves induce oscillations in an electrical circuit.
* Changes in atoms and the nuclei of atoms can result in electromagnetic waves being generated or absorbed over a wide frequency range. Gamma rays originate from changes in the nucleus of an atom.
* UV, X-rays and gamma rays can have hazardous effects on human body tissue. Effects depend on the type and size of the dose. Radiation dose (in Sieverts – you will be given the unit) is a measure of the risk of harm resulting from an exposure of the body to the radiation. UV can cause skin to age prematurely and increase the risk of skin cancer. X-rays and gamma rays are ionising radiation that can cause the mutation of genes and cancer.
* Be able to draw conclusions from given data about the risks and consequences of exposure to radiation.
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| **Uses and applications of EM waves*** Be able to quote examples and give brief explanations why each type of EM wave is suitable for the practical application.
* Radio waves – television and radio
* Microwaves – satellite communications, cooking food.
* Infrared – Electrical heaters, cooking food, infrared cameras
* Visible light – fibre optic communications
* Ultraviolet – energy efficient lamps, sun tanning
* X-rays and gamma rays – medical imaging and treatments.
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| **Lenses*** Be able to explain how lenses form an image by refracting light.
* Draw ray diagrams to illustrate similarities and differences between convex and concave lenses.
* Be able to identify and describe (or draw on a diagram) the principal focus (where parallel rays of light are brought to a focus) and the focal length.
* Recall that the image produced by a convex lens can be either real or virtual but the image produced by a concave lens is always virtual.
* The magnification produced by a lens can be calculated using the equation:
* *Magnification – image height / object height (this equation is on the Physics equation sheet)*
* Magnification is a ratio and has no units.
* Image height **and** object height should both be measured in the same unit either both in mm or both in cm.

* You should be able to describe an experiment to investigate the magnification produced by a range of convex lenses.
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| **Visible light*** Be able to describe and explain specular and diffuse reflection
* Each colour within the visible light spectrum has its own narrow band of wavelength and frequency.
* Colour filters work by absorbing certain wavelengths (and colour) and transmitting other wavelengths (and colour).
* The colour of an opaque object is determined by which wavelengths are more strongly reflected. Wavelengths not reflected are absorbed. If all wavelengths are reflected equally object looks white, if all wavelengths are absorbed, object appears black.
* Be able to describe the above and explain the effect of viewing objects through filters.
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| **Black body radiation – emission and absorption of IR radiation*** All bodies (objects), no matter what temperature, emit and absorb infrared radiation. The hotter the body, the more infrared radiation it radiates in a given time.
* A perfect black body is an object that absorbs all of the radiation incident on it. A black body does not reflect or transmit any radiation. Since a good absorber is also a good emitter, a perfect black body would be the best possible emitter.
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| **Perfect black bodies and radiation*** Be able to explain that all bodies emit radiation
* That the intensity and distribution of any emission depends on the temperature of the body.
* Be able to explain how the temperature is related to the balance between incoming radiation absorbed and radiation emitted, using everyday examples which illustrate this balance and the example of the factors which determine the temperature of the Earth.
* Use information or draw/interpret diagrams to show how radiation affects the temperature of the Earth’s surface and atmosphere.
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**Equations: These are the equations that you need to be able to recall and apply for your exam:**

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| **Equation number** | **Word equation** | **Symbol equation** |
| 1 | Weight = mass x gravitational field strength (g) | W = mg |
| 2 | Work done = force x distance (along the line of action of the force) | W = F s |
| 3 | Force applied to a spring = spring constant x extension | F = ke |
| 4 | Moment of a force – force x distance (normal to direction of force) | M = F d |
| 5 | Pressure = force normal to a surface / area of that surface | $$p=\frac{F}{A} $$ |
| 6 | Distance travelled = speed x time | s = v t |
| 7 | Acceleration = change in velocity / time taken | $$a=\frac{∆v}{t}$$ |
| 8 | Resultant force = mass x acceleration | F = m a  |
| 9 | Momentum = mass x velocity | P = m v |
| 10 | Kinetic energy = 0.5 x mass x (speed)2 | Ek= ½ m v2 |
| 11 | Gravitational potential energy = mass x gravitational field strength (g) x height | Ep = m g h |
| 12 | Power = energy transferred / time | $$P= \frac{E}{t}$$ |
| 13 | Power = work done / time | $$P= \frac{W}{t}$$ |
| 14 | Efficiency = useful output energy transfer/total input energy transfer |  |
| 15 | Efficiency = useful power output/total power input |  |
| 16 | Wave speed = frequency x wavelength | V = f λ |
| 17 | Charge flow = current x time | Q = I t |
| 18 | Potential difference = current x resistance | V = I R |
| 19 | Power = potential difference x current | P = V I |
| 20 | Power = (current)2 x Resistance | P = I2R |
| 21 | Energy transferred = power x time | E = P t |
| 22 | Energy transferred = charge flow x potential difference | E = Q V |
| 23 | Density = mass / volume | $$ρ=\frac{m}{V}$$ |

**These are the equations that you will be given and will need to select from.**

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| **Equation number** | **Word equation** | **Symbol equation** |
| 1 | Pressure due to a column of liquid = height of column x density of liquid x gravitational field strength (g) | P = h ρ g |
| 2 | (final velocity)2 – (initial velocity)2 = 2 x acceleration x distance | v2-u2 = 2 a s |
| 3 | Force = change in momentum / time taken | $$F= \frac{m∆v}{∆t}$$ |
| 4 | Elastic potential energy = 0.5 x spring constant x (extension)2 | Ee= ½ k e2 |
| 5 | Change in thermal energy = mass x specific heat capacity x temperature change | $$∆E=mc∆θ$$ |
| 6 | Period = 1/frequency |  |
| 7 | Magnification = image height /object height |  |
| 8 | Force on a conductor (at right angles to a magnetic field) carrying a current = magnetic flux density x current x length | F=B I l |
| 9 | Thermal energy for a change of state = mass x specific latent heat | E = m L |
| 10 | $$\frac{potential difference across primary coil}{potential difference across secondary coil}=\frac{number or turns in primary coil}{number of turns in secondary coil}$$ | $$\frac{V\_{p}}{V\_{s}}=\frac{n\_{p}}{n\_{s}}$$ |
| 11 | Potential difference across primary coil x current in primary coil = potential difference across secondary coil x current in secondary coil | VsIs = VpIp |
| 12 | For gases: pressure x volume = constant | p V = constant |

Good Luck ☺