

HSC Physics Sample

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Space

- explain the concept of escape velocity in terms of the:

- gravitational constant
- mass and radius of the planet

- Escape velocity is the minimum initial velocity a projectile needs to be fired at, to rise vertically from a planet and not fall back.
- To do this, an object must have a greater energy than the gravitational energy binding it to the planet (gravitational potential energy):

$$\frac{1}{2}mv^2 + \left(-\frac{GmM}{r}\right) \geq 0$$

$$\frac{1}{2}mv^2 \geq \frac{GmM}{r}$$

$$\therefore v_{\text{escape}} = \sqrt{\frac{2GM}{r}}$$

- As seen above, the escape velocity is only dependent on the mass and radius of the planet it is being launched from, and the gravitational constant.

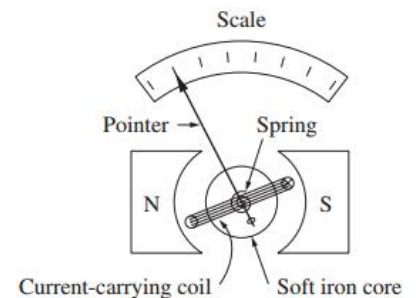
- identify why the term 'g forces' is used to explain the forces acting on an astronaut during launch (The HSC does not require you to know for formula for, or calculate g-forces)

- The term *g*-force is used to express apparent weight as a proportion of true weight.
- The term is used, because it is numerically simpler to interpret and use than the absolute force system, whilst communicating the same relative forces acting on astronauts of different masses (*m* is cancelled).

Motors and Generators

-identify data sources, gather and process information to qualitatively describe the application of the motor effect in: –the galvanometer –the loudspeaker

- **A galvanometer** is a device that measures very small DC currents (pictured)
- On either side of the coil, curved magnets produce a radial B field.
- As current is fed into the coil, it interacts with the B field to produce a force by the motor effect given by $F = BIl$.
- These forces act on either sides of the coil produce a torque given by $\tau = nBIA$.
- This causes the needle attached to the coil to rotate.
- When the restoring force of the radial spring equals the force by the motor effect, the needle stops spinning and gives a current reading.
- Because the curved magnets produce a radial B field, the plane of the coil is always parallel to the plane of the coil.
- Since the coil is always perpendicular to the B field, the only variable affecting the force by the motor effect is the current, and thus a linear scale for the galvanometer can be used.



-define magnetic field strength B as magnetic flux density

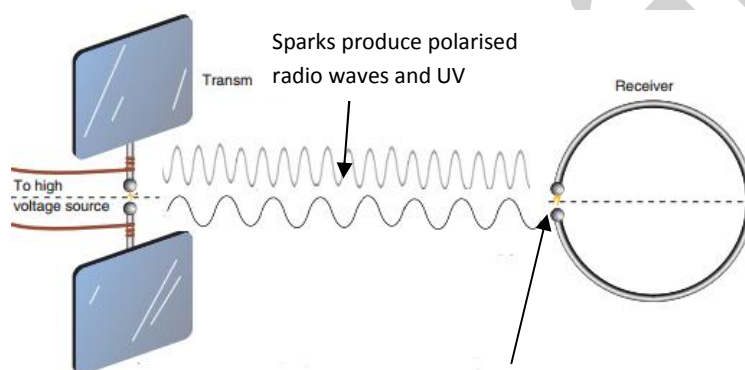
- Magnetic field strength is the magnetic flux density; the number of flux lines (ϕ) per unit area (A).

B is measured in Tesla (T) or Weber per m^2 (Wb/m^2) $B = \frac{\phi}{A}$

Ideas to Implementation

-describe Hertz's observation of the effect of a radio wave on a receiver and the photoelectric effect he produced but failed to investigate

- Hertz observed that producing a spark between the terminals of a wire loop using an induction coil, caused a spark to jump across a gap in a receiving loop.
- He concluded this receiving loop was a detector for unknown EM waves he presumed were made by the jumping spark.
- Hertz discovered the photoelectric effect when he exposed the receiving gap with UV, generating stronger sparks.
- When blocked by glass there was a reduced spark intensity in the receiving loop (as it blocked UV).
- Hertz confined his research to the production and study of EM waves and failed to investigate the photoelectric effect.



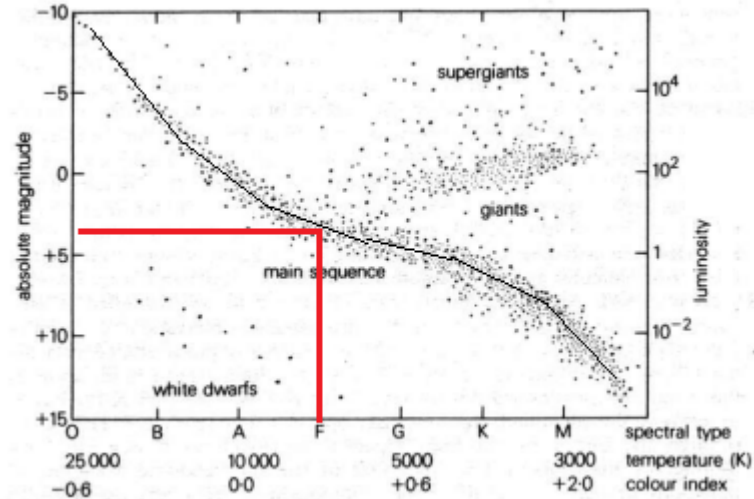
-process information to identify some of the metals, metal alloys and compounds that have been identified as exhibiting the property of superconductivity and their critical temperatures

Material	T_c
Magnesium Dibromide ($MgBr_2$)	39K
Yttrium Barium Copper Oxide (YBCO)	93K

Astrophysics

-outline spectroscopic parallax

- Spectroscopic parallax is another method used to find the approximate distance to stars, using the HR diagram and the distance modulus formula.



Method

1. Using photometry, measure the star's apparent magnitude (m).
2. Using spectroscopy, determine the star's spectral and luminosity class (e.g. O, B)(or colour index)
3. Starting at the spectral class on the HR's diagram's x-axis, draw a vertical line to the middle of the correct star group. Draw a horizontal line from this position across to the y-axis, and read of the absolute magnitude (M).
4. Calculate the approximate distance to the star using the distance modulus formula.

END OF SAMPLE

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