- 1
  - a
    - $udd \Rightarrow \text{Neutron}$
  - b
    - Strong Interaction
  - c
    - boson
  - d
    - The equasion is as follows: $udd \rightarrow uud + e^{-} + \overline{\nu_e}$. On the left hand side the charge is $+\frac{2}{3} - \frac{1}{3} - \frac{1}{3}$, which totals to 0. On the RHS, the total is also equal to 0: $(+\frac{2}{3} + \frac{2}{3} - \frac{1}{3}) - 1 + 0$. The baryon number is conserved too, with 1 on both sides. each quark has baryon number $+\frac{1}{3}$, while the leptons have none, so it adds to +1 on both sides.
  - e
    - proton
  - f
    - electron, electron antineutrino, muon neutrino
- 2
  - a
    - When current flows through the filament lamp, the electrons bump into the positive metal ions in the wire. This causes heat in the wire. When the heat rises, it causes the positive ions to vibrate more, which will cause it to be more likely to be hit by flowing electrons. This causes more heat. This causes a curve on an IV graph because the electrons get impeded more the hotter the wire is, and the wire becomes hotter the more current is put through.
  - b-e
    - In Paper
- 3
  - a-d
    - In Paper
  - e
    - Effect of mass: By increasing the mass, you will reduce the range of the wheelchair, because there is more energy used when accelerating to the top speed.
    - Effect of speed: By increasing the speed, you will reduce the range, as air resistance increases with speed.
- 4

- a
    - As the waves coming from the slits will have different path differences between the points, it will produce a phase difference between the waves. This will then cause destructive interference to occur.
- b
    - In Paper
- c
    - The intensity of a wave decreases with distance. Because one wave travels more than the other, it causes the amplitudes to not be equal at minimums
- d
    - The signal will become weaker and weaker until it reaches 0. This is because the waves are polarised, so there can be no detection when waves are 90° to transmitter.

- 5
    - a
        - In Paper
    - b
        - In Paper
    - c
        - Wind induces a wave in the cable, which is reflected against the masts. the incident and reflected waves will interfere and superpose, can only be certain frequencies because there must be an integer of wavelengths across the whole cable.
    - d
        - In Paper
    - e
        - In Paper
    - f
        - In Paper
    - g
        - The copper may have been stretched past its elastic limit, which will cause permanent deformation, i.e. sagging.
- 6
    - In Paper
- 7
    - a
        - In Paper
    - b
        - They are just free of the atom

- c
    - At a ground state
- d
    - To become free, energy must be supplied
- e
    - pd accelerates electrons in the tube, electrons have to have high enough energy to excite the electrons in hydrogen. Visible spectrum produced from excited electrons moving to the lower state at -3.4eV. Each transition results in a photon of light. Energy of photon is difference between two levels. The lowest frequency is due to the transition between -1.5 and -3.4.

- 5-34
    - In Paper