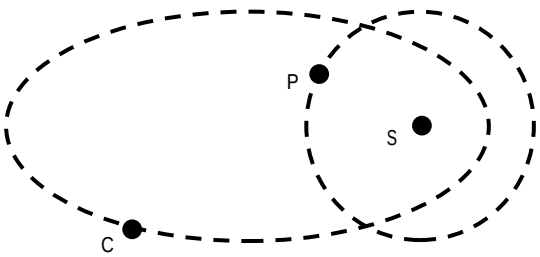
Question number	Answer	Notes	Marks
1 (a)	C (132 000 V);		1
(b)	B (efficiency of transmission);		1
(c)	C (transformer);		1

Total 3 marks

Question number	Answer	Notes	Marks
2 (a)	Gravitational (force)	Allow (force of) gravity Gravitational pull Centripetal (force)	1
(b) (i)	All three labels correct;  	C Comet P Planet S Sun	1
(ii)	Any two of - MP1 Idea that orbits cross/meet/ intersect; MP2 Idea that comet and planet can be (at the same place) at the same time; MP3 Idea that orbit time periods are different;	Allow at the same place orbits overlap idea of orbiting at different speeds	2

Total 4 marks

Question number	Answer	Notes	Marks
3 (a)	MP1 Due to friction; MP2 Idea of <u>electron</u> transfer;	Allow idea of materials rubbing Ignore "charge" "static" Reject (for MP2 mark) idea of protons moving	2
(b) (i)	Idea of spark / ignition / fire / explosion	Ignore reference to shock and petrol fumes	1
(ii)	Idea of current (in the wire); OR Idea of charge moving (in the wire); Idea that this discharges tanker; OR No voltage/ p.d. remains;	ignore references to positive charges Allow: No charge is left No overall charge Charge is removed Tanker becomes neutral Ignore: "Electricity" further discussion of danger	2

Total 5 marks

Question number	Answer	Notes	Marks
5 (a)	- 268.8 (°C);	Minus sign is essential Allow - 269(°C) - 268.95 (°C)	1
(b) (i)	Any two of - MP1 idea that molecules move faster; MP2 idea that molecules become further apart; MP3 idea that molecules move more freely;	Must be comparative statements relating to boiling Allow increased KE increased vibration Allow (for "freely") idea that forces between molecules have been overcome Ignore ideas of bonding	2
(ii)	Straight line with positive slope; Aimed at origin;	Allow line passing through origin, stopping short or dropping to θ axis at "4.2 K"	2
(c)	Any four of - MP1 Appropriate instrument to measure temperature; MP2 Appropriate instrument to measure volume or length or tube diameter; MP3 Means of varying temperature; MP4 consideration of diameter and volume; MP5 Idea of obtaining a range of values; MP6 Idea of repetition or averaging of readings; MP7 Draw a graph to display results; MP8 Mention of kelvin temperature;	Points may be shown as labelled additions to the diagram e.g. ruler e.g. water bath / heater Allow treatment of anomalies	4

Total 9 marks

Question number	Answer	Notes	Marks
7 (a) (i)	90		1
(ii)	time; either for amount of (radioactive) isotope to halve; or for (radio)activity to halve;	Allow for amount - (number of un-decayed) nuclei/atoms/molecules (un-decayed) mass of isotope	2
(iii)	Any two of – MP1 Idea that (beta) radiation causes a stated hazard; MP2 Idea that strontium-90 has a long half-life; MP3 Idea that <u>all</u> beta emission will be absorbed by the body;	 e.g. causes cancer, kills cells, mutates DNA, ionises tissue Accept lasts a long time Accept answers in terms of range	2
(b) (i)	90 and 0; -1; $^{90}_{38}Sr \rightarrow {}^{90}_{39}Y + {}^{0}_{-1}\beta^{-}$	Must have both Minus is essential	2
(ii)	Any two ideas from – MP1 They are isotopes of different elements; MP2 Strontium-90 (nucleus/atom) has the same number of protons as other strontium (nuclei/atoms); MP3 Yttrium-90 (nucleus/atom) has the same number of protons as other yttrium (nuclei/atoms);	 Allow use of proton number data (38) Allow use of proton number data (39)	2

Total 9 marks

Question number	Answer	Notes	Marks
8 (a) (i)	Any one of- MP1 Speed / velocity (in a vacuum); MP2 Transverse (wave); MP3 Electromagnetic (wave); MP4 A general wave property;	 e.g. reflection, refraction, diffraction, transfer energy	1
(ii)	Any two of- Frequency; Wavelength; Energy;	Any wavelength or frequency relationship if stated must be correct	2
(b) (i)	There are more than two values; Reference to shape/slope/ramp(s);	Accept peaks not all same height not just 1 and 0 Accept RA Ignore "analogue"	2
(ii)	MP1 More than one gap measured / averaging seen; MP2 Value of 1.15 or 1.35 (s);	 Allow 2 marks for bald answers of: 1.15 or 1.35 (s) Allow 1 mark (MP1) for bald answers of: 1.2, 1.25, 1.4, 1.55 (s)	2
(iii)	Calculation of frequency (from f= 1/T); Unit to match value; e.g. f = 1/1.15 = 0.87 Hz	Allow e.c.f from time value given in (b)(ii) 1/1.35 = 0.74	2

Total 9 marks