

HIGHER TIER

Question			Marking details	Mark
1.	(a)	(i)	best ability to conduct electricity	1
		(ii)	Lead	1
		(iii)	Steel provides the strength (up to 2 000 units) (1), aluminium is used for its low density (1) meaning the wires aren't too heavy (1)	3
	(b)		mass = 2 700 x 0.12 (1 substitution) = 324 [kg] (1)	2
Question total				[7]
2.	(a)	(i)	900 or 1 800 <u>MHz</u> (1) (value + unit for the mark)	1
		(ii)	The bigger the frequency, the <u>smaller</u> the output power (1) whereas to be proportional, as one increases, the other would increase.(1) OR EQUIVALENT	2
		(iii)	more research (1) by <u>other</u> scientists (1)	2
	(b)		microwaves	1
Question total				[6]
3.	(a)		A network (1) of power stations/substations/power lines (1)	2
	(b)	(i)	To reduce voltage (1) to safe levels (1)	2
		(ii)	Convert 0.46 MW to 460 000 W (1), subs, (1),	3
			rearrange $\frac{460000}{230} = 2\,000\text{ [A]}$ (1)	
Question total				[7]
4.	(a)		Indicative content: Cost of generating electricity using nuclear energy is cheaper than wind. To generate the same power output requires 1 800 turbines for every nuclear power station which would cost £5 400 million compared with £4 000 million. Also during the lifetime of a nuclear power station, wind turbines would need to be replaced 3 times. There is no waste produced by wind but with nuclear power there is radioactive waste to dispose of which adds cost and has an impact on the environment due to radiation hazards. Onshore wind power would produce less of a greenhouse effect than nuclear but offshore wind would produce more.	6

Question			Marking details	Mark
			5 – 6 marks The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. 3 – 4 marks The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. 1 – 2 marks The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. 0 marks The candidate does not make any attempt or give a relevant answer worthy of credit.	
	(b)	(i)	plots (1) x2 smooth curve or best fit straight line (1)	3
		(ii)	As rotor diameter increases so does the maximum power output (1) but the increase is non-uniform / at an increasing rate / non-linear / not proportional (1)	2
	(c)		use of 3 MW (1), subs into equation (1), rearrange to give $\frac{3}{0.6}$ ans = 5 [MW] (1)	3
Question total				[14]
5.	(a)		Helium Y, Iron N, Hydrogen Y, Sodium Y, (all correct 2 marks / 2 or 3 correct 1 mark / 0 or 1 correct 0 marks)	2
	(b)	(i)	Conversion of 410 nm to 410×10^{-9} (1) subs (1), rearrange $\frac{3 \times 10^8}{410 \times 10^{-9}} = 7.3 \times 10^{14}$ [Hz] (1)	3
		(ii)	Convert light year to m – $3 \times 10^8 \times 3.2 \times 10^7$ (1) = 9.6×10^{15} [m] (1), $\times 8.6 = 8.26 \times 10^{16}$ [m] (1) (accept 8.3×10^{16} but not 8.2×10^{16})	3
Question total				[8]

Question			Marking details	Mark
6.		(i)	Low penetrating power (1) so would not get to tumour (1)	2
		(ii)	Penetration depends on energy (1) and do not have to penetrate the body to get to the tumour (1).	2
		(iii)	They are ionising radiation (1) so destroy/kill the cancer cells (1).	2
			Question total	[6]
7.	(a)	(i)	3 100 [J] (1)	1
		(ii)	3.1 [kW] (1)	1
		(iii)	$3.1 \times 10 = 31 \text{ kWh}$ (1) $\times 13 = \underline{403 \text{ p}}$ (1)	2
	(b)		There would be a greater temperature difference (1) so energy loss per second increases resulting in greater cost of heating (1).	2
			Question total	[6]
8.			Indicative content: In cosmological red shift, the wavelength at which the radiation is <i>originally</i> emitted is lengthened as it travels through expanding space. Cosmological red shift results from the expansion of space itself and <i>not</i> from the motion of an individual body. Compare a galaxy formed a long time ago, with a galaxy formed more recently. Although each galaxy emits the same wavelength of the light, the light from the older galaxy has spent longer travelling through the expanding Universe, and has therefore experienced a greater 'stretching' (red shift). The universe must have originated from a singularity, formed by a Big Bang and has been expanding ever since. 5 – 6 marks The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. 3 – 4 marks The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. 1 – 2 marks The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. 0 marks The candidate does not make any attempt or give a relevant answer worthy of credit.	6
			Question total	[6]
			Higher paper total	[60]