HIGHER TIER

Question			Marking details	Marks
1.	(a)	(i)	Gas (1) because it produces <u>smallest amount / less carbon dioxide or carbon monoxide</u> (1) accept converse argument. **Either mark can be awarded on its own but only award 2 marks if they are linked.**	2
		(ii)	Gas (1) because it produces <u>smallest amount / less sulfur dioxide or nitrous oxide</u> (1) (e.g. accept because sulphur dioxide is 1). Accept converse argument. **Either mark can be awarded on its own but only award 2 marks if they are linked.**	2
	(b)	(i)	heats water / produces steam (accept they use cold water)	1
		(ii)	operates 24 hours a day (accept not always sunny / rocks are always hot / produces electricity in the night / [more] reliable)	1
	(c)	(i)	plots (2) ± ½ small square division (ignore any other points that are plotted). -1 mark for each incorrect plot up to a max of 2 straight line (1) (ignore any line before the 1st point). Don't accept double lines / whispy / disjointed / wobbly lines or the line missing points.	3
		(ii)	6.5 ± 0.05 [km] **ecf** value must be taken from their graph	1
	(d)		$\frac{2400000}{2000}$ (1) = 1 200 (1)	2
			Question total	**[12]**
2.	(a)		4 (1), 20 (1)	2
	(b)		Indicative content: The advantages of insulating the loft are of primary importance. The money spent is the least, it is recouped in the shortest time and gives the greatest gain in energy loss reduction (2 700 W), this accounts for £800 of the spending money. The cavity wall insulation is of second priority with an outlay of £1200, a payback time of just 10 years and the next greatest energy saving of 1 700 W. The remaining money of £1200 is better spent on replacing their doors because of the smaller payback time. The doors have a payback time of 60 years but save only 200 W in total. [The total spend is £3 200 with an annual saving of £340 giving a payback time of 9.4 years.] **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.	6

Question			Marking details	Marks
			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.	
	(c)		loft / roof, cavity / wall, windows [2 marks for all correct, 1 mark for 1 or 2 parts correct]	2
	(d)		[Inner] wall / house heats the air (1) which becomes less dense / rises (1) **Either mark can be awarded on its own but only award 2 marks if they are linked.**	2
	(e)		Reduced temperature difference between inside and outside (1) results in less money (spent and) saved / less energy used on heating (1) **Either mark can be awarded on its own but only award 2 marks if they are linked.**	2
	(f)		Units saved = $\frac{12000}{15}$ [or $\frac{120}{0.15}$]= 800 (1 conv+substitution, 1 ans) Time = $\frac{800}{1.7}$ (1) **ecf** for 800= [470.588 hours] Answer of 470.588 / 470.59/470.6/471/470 – award 3 marks 470.58/470.5/ 0.47– award 2 marks 4.7 – award 1 mark 0.0047 – award 0 marks **Question total**	3 **[17]**
3.	(a)		Alpha and beta completely stopped by any thickness (1), gamma intensity reduced (1) by an amount that depends on the thickness of the concrete (1) {NB1 for "alpha, beta, gamma all stopped give 1 mark only} {NB2 for "gamma stopped if the concrete is thick enough" 1 mark}	3
	(b)	(i)	e.g. stored underground / vitrification / in tanks of deep water / lead lined or concrete containers / at sea. Don't accept put into space.	1
		(ii)	suitable advantage such as safe from terrorism/secure/away from living things (1) suitable disadvantage such as may get into water supply / containers leak in time / difficult to monitor / earthquakes (1) Don't accept reference to cost or time. (Accept unrelated answer to part (i))	2
			Question total	**[6]**

Question			Marking details	Marks
4.	(a)	(i)	A network of [power] cables/ wires (1) that connect power stations to consumers / homes / schools / factories.(1)	2
		(ii)	low**er** current (1) to **reduce** energy / heat losses or to improve efficiency (1) **Either mark can be awarded on its own but only award 2 marks if they are linked.**	2
	(b)	(i)	step-down because output voltage is smaller / input voltage higher / reduces voltage **or** less turns on output coil / more turns on input coil / turns reduced. (Accept it supplies homes / schools / industry.)	1
		(ii)	[power = voltage x current] $I = \frac{10000000}{400000}$ (1 sub/manip, 1 conv) {for $\frac{10}{400}$ with answer = 1 mark, but with any compatible conversion gets both marks e.g. $\frac{10000}{400}$ – 2 marks} = 25[A] (1 ans)	3
		(iii)	$99 = \frac{\text{power output}}{10\text{x}10^6} \times 100$ $\text{power output} = \frac{99}{100}\text{x } 10\text{x}10^6 = 9.9\text{x}10^6$ W or 9.9 MW (1sub, 1 manip, 1 ans **with correct unit**)	3
			Question total	**[11]**
5.	(a)		*….stays above the same point on the Earth* (1) *…..and orbits the Earth in 24 hours / same time / same rate as Earth spins [once].* (1) Don't accept orbits the Earth at the same speed	2
	(b)	(i)	2(1) x 0.2 (1) = [0.4 V] On the answer line: If 0.4 only award 2 marks / 0.2 award 1 mark / 2 or 0.8 award 0 marks	2
		(ii)	signal has to travel twice as far [as 36 million km] / up and down	1
		(iii)	[single cycle of] smaller amplitude (1) starting at 0.24 ± 0.02 on horizontal axis (1) Ignore the wavelength or number of cycles.	2
			Question total	**[7]**

Question			Marking details	Marks
6.	(a)		the <u>distance/ how far</u> light travels in **<u>4 years</u>**	1
	(b)		Indicative content: Light coming from the centre of stars is absorbed by the gases in their atmospheres / interstellar gases and re-emitted in all directions. Their frequency / wavelength gives information about the gases present and the fact that they are red shifted gives information about their distance away and the speed at which they are moving away – by the application of Hubble's measurements and law. **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. **Question total**	6 **[7]**
			Higher tier paper total	**[60]**