HIGHER TIER

Question			Answer / Explanatory Notes	Marks Available
1.		(i)	speed $= \frac{2(1)\times 98}{0.56}$ (1) = 350 (m/s) (1) [NB lack of × 2 → 2 max] [175 m/s → (2)]	3
		(ii)	v = 260 × 1.3 = 338 m/s [subst in $v = f\lambda$ (1); answer (1)]	2
		(iii)	Any 1 sensible answer from: air movement • inaccuracy of only doing 1 measurement • inaccuracy of timings (starting/stopping stopwatch) / reaction times • distraction from other noises	1 **6**
2.	*(a)*		Any 2 × (1) from • Supply to grid can vary to match demand ✓ • all power stations connected to grid ✓ • can cope if one breaks down. ✓	2
	(b)	(i)	substitution(1), matching units (award 1 mark even if eq incorrect), e.g. 950 000 000/25 000, ans 38 000 (A) (1 mark – allow ecf from non matching units, e.g. 38 →(2)]	3
		(ii)	**Indicative content:** Transformers are used to step-up voltage, resulting in decreased current so less energy loss along cables. Then step-down transformer reduces voltage to consumer, because high voltages are dangerous in the home. The use of step-up and step-down transformers makes for more-efficient energy transfer. **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 **11**

Question			Answer / Explanatory Notes	Marks Available
3.	*(a)*		4.4	1
	(b)		10 (count/s) (1) Any 1× (1) from: All radiation from source stopped by paper, [so only background remains] / Graph flattens at 10 units / accept cand. showing on graph	2
	(c)		β / beta (1) α is stopped by [thin] paper [but β is not] / γ would not show any attenuation [however expressed] [accept any correct and relevant reference to different penetration.] (1) [2nd mark only awarded if first mark is given]	2 **5**
4.		(i)	A = 700 kWh Conversion to kW (1) Answer (1) [700 → 2 marks; 700000 → (1)] B = [£]84 (1) [e.c.f. from A, if 8400 must be 8400 p]	3
		(ii)	Cost of buying 5 CFL = [£]12.50 (1) [no e.c.f.] Total cost for 5 CFLs = [£]96.50 (1) [e.c.f. from B, allow 9650]	2
		(iii)	Both emit same light output (1), power used by led is less than cfl (1), 14/6 or or 2.33 times less (1) [3rd point implies 2nd] [accept converse argument]	3 **8**
5.	*(a)*	(i)	[atoms of a] gas <u>absorb</u> light at specific wavelengths….(1) light passes through gas / lines are characteristic of the elements in the gas. (1) NB 2nd mark must link to the 1st.	2
		(ii)	[Chemical] composition / make-up of [the atmosphere of] the star or equiv. **Or –** speed of recession of the star / galaxy	1
	(b)		For distant galaxy: lines would be further red shifted [Or the wavelengths of the lines would be larger in the distant galaxy] (1), galaxy moving away faster. [or because the universe has expanded more since the radiation from the first galaxy was sent out](1) NB 2nd mark must link to the 1st.	2
	(c)	(i)	Sensible scales [linear, points occupying at least half the grid] (1) Accurate plots [within ½ a minor scale division] (1) Good line of best fit – drawn using a ruler (1) [independent mark]	3
		(ii)	The recession speed is [directly] proportional to the distance [or, e.g. if the distance doubles the speed doubles](2) [The greater the distance the greater the recession speed , or positive correlation→ (1)]	2
		(iii)	matter 'expelled' from a Big Bang (1) Galaxies must have come from one point / back in time must have been closer together (1) 2nd mark must link to 1st.	2 **12**

Question			Answer / Explanatory Notes	Marks Available
6.	*(a)*		Any 2 × (1) from: • High cost …..✓ • [Relatively] low power output / produces less electricity ✓ • ….. so a long payback period ✓ • Intermittent ✓	2
	(b)	(i)	Any 1 × (1) from: • Reduced energy / electricity bills [for the householder] ✓ • [Generous] feed-in tariffs✓ Any 1 × (1) from • Reduced burning of fossil fuels …✓ • …so reduction in greenhouse gas / CO_2 [accept acid rain] emission ✓ [1 mark only for an air-pollution effect] + 1× (1) for any other bullet point.	3
		(ii)	trees/plants absorb take in as much CO_2 (1) as they give out [when burnt] (1)	2
	(c)		Naming any one method, e.g. loft insulation / cavity wall insulation / double glazing / draft excluders (1) Description of how reduction achieved for that method in terms of conduction, convection or radiation (1) More detail in energy transfer explanation (1) NB 2nd and 3rd mark must link to 1st mark.	3
				10

Question			Answer / Explanatory Notes	Marks Available
7.		(i)	Any 2 × (1) from • Travel though a vacuum ✓ • Transverse waves ✓ • Travel at same speed [through space] ✓ • Transfer energy **or** information ✓ • Other wave property, e.g. reflection, refraction, interference ✓] •	2
		(ii)	**Indicative content**: The Earth absorbs sunlight, eventually radiates energy [or heat] back out. Some of this radiation makes it into space. The rest of it ends up getting absorbed in the atmosphere, by carbon dioxide, methane gas and water vapor. After these components in our atmosphere absorb all this heat, they re-emit energy (also in the form of radiation / heat). The heat that doesn't make it out through Earth's atmosphere keeps the planet warmer than it would be without the atmosphere. **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 many inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.	6 **8**
			Total for higher tier paper	**60**