Question	Answer	Marks	Guidance
1 C O M M O N	Correct comparison: cost higher than expected / less than 18% saving **/ saving is less** [1] correct relevant calculation [1] some years are warmer / colder than others [1] the average may not be representative / average calculated over atypical years AW [1] differences in behaviour [1] cost of energy higher in later years [1]	3	**allow** 2012 and 2013 are higher / 2014 is lower [1] **allow** average is £920 **allow** any other correct use of data e.g. 2014 is £98 lower / £32 per year saving / £96 saved over 3 years [1] eg. only 15% lower / [2] **not** merely 'different weather' [0] **allow** examples e.g. 2009-11 may have been warmer than usual [1] allow examples e.g. Simon may have had windows opened more (often) / more people at home / more time at home / more heating used / more TV watched / settings on heating changed / alterations to house / different or extra appliances used / other or different insulation or energy collecting methods fitted [1]
	Total	**3**	

Question	Answer	Marks	Guidance
2 a C O M M O N	(full calculation): (720 – 240p =) 480p or £4.80 **and** Habib is correct scores [3] **if numerical answer above is incorrect or incomplete then:** cooker: 2 x 6 x 20p = 240p [1] immersion heater : 3 x 12 x 20p = 720p [1] **or** use of **2** x 6 **and** 3 x 12 [1] use of x 20p [1]	3	**answers acceptable in pence or pounds** **allow** 720 – 240p = 480p with no comment [2] **allow** 720 – 240p = 480p and Habib is correct [3] **allow** £4.80 with no comment [2] **allow** 720 – 240p = 480p [2] **allow** £4.80 and Alice is correct [2] Other acceptable full calculations: **But** £2.40 + £5.00 = £7.40 and this is near to £7.20 so Habib is correct [3] **OR** 2 x £2.40 = £4.80 which is less than £7.20 so Habib is correct [3] **Only** award 3 marks if Habib is identified along with a full calculation

b	**(at a voltage of 4.00 x 10^5)** 5(.00) x 10^3 **or** 5000 (A) [1] **(at a voltage of 2.75 x 10^5)** 7.273 x 10^3 **or** 7.273 x 10^3 **or** 7273 **or** 7272 (A) [1] (higher voltages best because) lower current / keeps wires cooler / reduces heat loss or energy waste [1]	3	for higher voltage **allow** 7270 **allow** 7.3 x 10^3 or 7300 **allow** 7200 or 7.2 x 10^3 [1] **allow** (higher voltages) - greater efficiency / less power loss [1] **ignore** cost
	Total	**6**	

Question	Answer	Marks	Guidance
3 a	**Risk max 1** radiation **leak / leak** of nuclear material / **leak** of nuclear waste (1) power station / reactor may get damaged / attacked by terrorist / earthquake (1) radiation sickness / poisoning (1) **how the risk is reduced/managed max 1** monitor people (for contamination) (1) monitor radiation around the nuclear power station (1) safe storage or disposal of nuclear materials (1) idea of better control of reactor (1) better shielding against radiation loss (1) have good shut down / emergency procedures (1) extra protection if in earthquake risk area (1) better security at nuclear power station (1)	**2**	**ignore** power stations emit radiation **allow** correct examples such as radioactive materials stored (deep) underground / encased in (thick) concrete / lead (1) **allow** correct examples such as surround the reactor with (thick) concrete walls (1)

Question	Answer	Marks	Guidance
b	idea of voltage change (1) but voltage increase / steps up voltage (2) **reduces** energy loss / **reduce** the cost (1)	3	**allow** higher level answers e.g. idea of current change (1) but to reduce current (2) **allow** voltage reduces (1) **allow** reduces power loss (1) **allow** increases efficiency (1) **ignore** stops energy loss
	Total	**5**	

Question	Answer	Marks	Guidance
4	**Level 3: (5 – 6 marks)** **fuel power station AND pumped storage system linked together with demand** **Quality of written communication does not impede communication of the science at this level.** **Level 2: (3 – 4 marks)** **fuel power station OR pumped storage system linked together with demand** **Quality of written communication partly impedes communication of the science at this level.** **Level 1: (1 – 2 marks)** **sensible comment about the system** **Quality of written communication impedes communication of the science at this level.** **Level 0: (0 marks)** **Insufficient or irrelevant science. Answer not worthy of credit.**	6	**This question is targeted up grade A*** **Indicative scientific points may include:** **fuel power station (on own)** difficulty in stopping and starting fuel power stations generates electricity all (or most of) the time at a steady rate cannot store electricity **pumped storage system (together with fuel power station)** with pump storage system it can store surplus energy energy stored off peak or when demand is low / in the middle of the night. with pump storage system it can generate electricity when needed water released when extra energy needed at high or peak demand **changes in demand** can cope with surges in demand (idea that there is) a (relatively fast) response time to demand less likely to result in power cuts (when demand is greater than steady supply) (idea that) energy not 'wasted' so cheaper for both consumers and producers saves the need to redistribute energy using the national Grid **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
	Total	**6**	

Question	Answer	Marks	Guidance
5 a	**Idea that:** water heated /steam is produced / fuels release heat / AW (1)	1	**allow** Heat energy is used (to produce electricity) (1) **ignore** burning Heat unqualified = 0 fuel is heated =0
b	renewable energy (1) less polluting gases (1) fossil fuels finite (1)	1	 **allow** reduces CO_2 output / greenhouse gases (1) **allow** fossil fuels are running out (1) **allow** no fuel costs (1) **not** just environmentally friendly
c	19800 (MJ) (3) **But if answer is incorrect** 330 (MW) (2) 66% of 500 or .66 x 500 (1)	3	**if no other marks scored allow** evidence of power x time (1) **allow** 500 – 170 OR 330 (2) **allow** 34% of 500 or 0.34 x 500 = 170 (1)
	Total	5	

Question			Answer	Marks	Guidance
6	(a)		**any two from:** idea of renewable energy (1) idea of no polluting waste produced (1) crops can be grown under them / placed at sea (1) useful in remote locations (1) (idea that) new technology are making wind turbines more efficient (than conventional power stations) (1)	2	**allow** does not need **fossil** fuels or named fossil fuel (1) **allow** no carbon dioxide produced / no greenhouse gases (1) allow idea of less global warming (1) **allow** idea of less maintenance / labour or staff required (1) **allow** generation close to consumer / AW (1) **ignore** pollution unless qualified
O/L	(b)	(i)	as wind speed increases the noise increases / ora (1)	1	
		(ii)	idea of: for **low** speeds / up to 5 m/s / up to mean speed - the noise level is below background / 33dB (1) idea of: for **high** speeds / above 5 m/s / above mean speed - the noise level is generally below / not much above background (1)	2	**allow** 'most dots below background (1) **eg.** 'turbine noise less than tree noise' (1) **eg** 'at high wind speeds the noise is rarely above background' (1) **allow** (if no other marks obtained) normal background is usually higher than turbine noise (1)
			Total	**5**	

Question			Answer	Marks	Guidance
7	(a		0.66 or 0.67 (2) **but** if incorrect: 6/9 or 3/4.5 scores (1)	2	**allow** 0.7 (1) do not allow final answers over 3 or more Decimal place: Eg 0.666 scores (1) **Eg.** 0.6 or 0.6 reoccurring (1)
	(b)		no (no mark to be awarded) 12 (m) (1) doubling speed doubles thinking distance / thinking distance is proportional to speed / AW (1) **OR** from calculation 18 x 0.66 (1)	2	**ignore** no / yes answer **allow** reverse arguments Eg. 9 / 18 = 0.5s which is not the same as the answer to part a because thinking time is constant (2)
	(c)		no (no mark to be awarded)	3	If answer is yes award a maximum of (1) for the idea of KE

Question			Answer	Marks	Guidance
			54 (m) (1) **any two from:** • doubling speed quadruples braking distance / AW (1) • KE or braking distance is proportional to v^2 / AW (1) • KE is absorbed in braking (1)		being absorbed **allow** correct answers derived through calculation
	(d)		**maximum of three marks** Idea of 'the **distance** the car moves' (1) tired / drunk AW / distracted / not concentrating / drugged (1) (The road) is icy / wet / muddy / slippy / downhill **AND** (…. the tyres) have little tread / grip / friction AW (1)	3	 **ignore** old / ill **allow** worn tyres / bald tyres (1)
			Total	**10**	

Question			Answer	Marks	Guidance
8	(a)		**maximum of three marks from:** **more** collision **time** (1) **more** collision **distance** (1) **less acceleration** (1) same quantity of energy absorbed / same change of momentum for each car (1)	3	**allow** ora for an old car longer collision (1) **allow** areas under graph correctly compared (1) **allow** higher level answers in terms of force = change in momentum / time: Eg. force = change in momentum / time (1) **but** stating and using the equation can score (3): Eg. force = change in momentum / time (1) so a longer collision time (1) means a smaller **rate** of change of momentum (1)
	(b)	(i)	**maximum of two marks from:** experiment with collisions **on a dummy** (under controlled conditions) / model a real **vehicle-pedestrian** collision / AW (1) collect data / measurements / results from this collision (1) draw conclusions from this data (1) change or recommend changes in design / experiment (1)	2	Eg. try dummies of different heights (1) Eg. try crashes at different speeds (1) Eg. make bumpers lower (1)

Question			Answer	Marks	Guidance
		(ii)	(Important so that other scientists can) develop more/improve tests or research (1) (critically) look at their conclusions/findings (1) to see if their research agrees (1) add more data (in time as cars and traffic develop) (1) inform future design (1) inform customer choice (1)	1	 **allow** 'check accuracy' (1) Eg. people can choose the safest car (1)
			Total	**6**	