Question number	Answer	Notes	Marks
1	five suitable comments: O/P = output power **Wind** • wind O/P is (far) too low (to meet demand)/the lowest; • (can't rely on) wind O/P is weather dependent; **Gas** • gas O/P (too) low /need many gas power stations (to meet demand); • gas (turbine) is the fastest to start up; **Tidal** • tidal gives the highest O/P; • tidal only occurs at fixed times (so is not useful); **Nuclear** • nuclear O/P is (relatively) high; • nuclear takes too long to start up; **Coal** • coal O/P is second highest; • coal second fastest to start up; **Evaluation statement(s)** • none of them is enough to meet the power demand; • nuclear/wind/tidal would be unsuitable; OR coal or gas could be suitable; OR a mixture of stations would be suitable; **Costs** **allow 1 mark for relevant statement**	ignore comments about • renewable • non-renewable • green-house effect • climate change • pollution can't be used for sudden need/RA e.g. coal is most expensive fuel gas is second most expensive fuel total marks =5	5

Question number	Answer	Notes	Marks
2 (a) (i)	B - 960 joules per second;		1
(ii)	power = current x voltage;	allow equation as correct symbols and/or rearrangement e.g. I = P ÷ V	1
(iii)	appropriate calculation (including substitution OR rearrangement); answer to at least 2 sf seen anywhere; e. 960 = I × 230 (I =) 4.2 (A)	using 4 (A) to calculate power (920 W) or voltage (240 V) scores 1 mark max. (4.17391) allow 4.1 (A)	2
(b) (i)	any 3 of: MP1. large **current** to earth / in earth wire; MP2. fuse blows / melts / breaks; MP3. idea that circuit is broken; MP4. idea that the risk of shock is reduced / prevented;	ignore references to electricity or charge allow 'current surge' for large current 'ground' for earth ignore references to fire	3
(ii)	D - 13 A;		1
(c)	MP1. a way of measuring current e.g. ammeter; MP2. a **method** to vary current in fuse; MP3. a **method** of identifying that the fuse has broken e.g. lamp goes out, idea that current falls to zero etc.;	accept any points seen in diagram allow data logger allow **variable** power supply, **variable** resistor	3

Total 11 marks

Question number			Answer	Notes	Marks
3	a		B;		1
			E;		1
	b	i	p = m.v	in words or accepted symbols do not accept 'M' for momentum	1
		ii	substitution; evaluation; e.g. 900 x 15 14 000 unit = kg m/s OR N s;	 13 500 Independent Allow kg ms^{-1}	3
		iii	KE = ½ m.v^2;	in words or accepted symbols allow speed for velocity	1
		iv	substitution; evaluation; e.g. 0.5 x 900 x 15^2 100 000(J)	 101 250 Allow 101 000	2
				total = 9 marks	

Question number	Answer	Notes	Marks
4	Any FOUR suitable points where ever seen Location, e.g. MP1. Latitude / Sun angle; MP2. suitability of site – e.g. enough area for solar array; MP3. geological factor – e.g. accessible source of heat / hot water; MP4. proximity of population/cities; Climate, e.g. MP5. Effect of seasons; MP6. hours of sunlight; MP7. intensity of sunlight; MP8. geothermal power station unaffected by climate;	Allow arguments for or against e.g. build solar on the equator e.g. no shadow from hills/trees e.g. volcanic activity e.g. rainy season e.g. short winter days, sunny all year round e.g. strong sun, cloudy	4

(Total for Question 4 = 4 marks)

Question number			Answer	Accept	Reject	Marks
5	(a)		Any one of <u>Reduced</u> (running) costs; No atmospheric pollution / CO_2; Renewable (resource);	 No polluting emissions No greenhouse gases Cleaner (only if qualified)	The wind is free No costs	1

Question number			Answer	A	Reject	Marks
5	(b)		Up to two points about each of unreliability, environmental issues, site choice, maintenance difficulties, data use, or cost. 1 mark per point to a maximum 4 marks Unreliability - the wind does not always blow (at the right speed); the turbine does not always provide output OR a back-up generator is needed; Environmental effects - spoils the view OR is noisy; (construction) destroys habitats OR a hazard to flying birds; Site choice – a large site is needed; a windy site is needed; Maintenance difficulties – need to work in remote location (usually); need to work in a hazardous location e.g at height / sea; Data use – one turbine produces less power than a power station; need many/800 turbines to give same output as coal-fired; Cost – building a wind farm needs much money / time; other costs for research / land / maintenance;	Accept – appropriate reverse arguments in terms of the suitability of coal-fired power stations Ignore comments about efficiency or cost effectiveness		4
					Total	**5**

Question number	Answer	Notes	Marks
6 (a) (i)	turbine		1
(ii)	C generator		1
(b) (i)	power = voltage x current	Allow: equivalent arrangements Allow: P=IV etc Reject use of units for quantities	1
(ii)	Correct equation (any arrangement); e.g.: power in = power out / $V_{IN}I_{IN} = V_{OUT}I_{OUT}$ / $I_{IN}/I_{OUT} = V_{OUT}/V_{IN}$ Correct substitution; e.g.: V_{OUT}/V_{IN} = 115/25 (or 4.6) OR I_{OUT}/I_{IN}= 25/115 (or 0.22) Correct deduction based on working: e.g. output current is smaller	Accept: 5/23 and correct conversion to volts Bald 'output current smaller' = 0 mark Bald 'output current 4.6 times smaller' = 3 marks	3
(iii)	(lower current leads to) less (resistive) energy /heat/ power losses		1

Question number	Answer	Notes	Marks
6 (c)	ANY FOUR FROM Radioactive / emits radiation; High activity; Long half live / need for long term storage; Danger / harm to people /environment; Expensive to contain / dispose of; Need for security /shielding / burial; Social aspect eg. location of storage;		4