



GCSE Physics

Energy Resources

Mark Scheme

Time available: 65 minutes

Marks available: 60 marks

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Mark schemes

- 1.** (a) minimum distance between wind turbines is at least 500 m in all directions
turbines can rotate to face into wind and still maintain the minimum distance
- 1**
- (b) density = mass/volume
allow $\rho = m / V$
- 1**
- (c) $1.2 = \frac{51000}{V}$
- 1**
- $V = \frac{51000}{1.2}$
- 1**
- $V = 42\,500$
- 1**
- $V = 43\,000$
- 1**
- m^3
an answer of 43 000 scores 4 marks
an answer of 42 500 scores 3 marks
- 1**
- (d) $2.4 \times 10^9 / 1.6 \times 10^6$
- 1**
- 1500
an answer of 1500 scores 2 marks
- 1**
- (e) wind power is unreliable
- 1**
- (very) large numbers of wind turbines would need to be constructed
allow calculation of this (15 625)
- 1**
- [11]**

2.

(a)

Level 2: Relevant reasons are identified, given in detail and logically linked to form a clear account.	3-4
Level 1: Relevant reasons are identified, and there are attempts at logically linking. The resulting account is not fully clear.	1-2
No relevant content	0
<p>Indicative content</p> <p>nuclear</p> <ul style="list-style-type: none"> no carbon dioxide released (when generating electricity) or doesn't release greenhouse gases reliable high energy density power stations already built other power stations being built <p>wind</p> <ul style="list-style-type: none"> no carbon dioxide released (when generating electricity) or doesn't release greenhouse gases renewable energy resource no fuel cost 	

4

(b) wind power is unreliable

1

(so) will be unable to meet demand when wind speed is low

or

when there is no wind

or

unable to maintain base load at all times

1

(c) electricity generation will need to increase (to meet higher demand)

1

(using)

nuclear power

or

wind power

or

other renewables

1

so that carbon dioxide emissions don't increase

or

reference to Paris Climate agreement

1

[9]

3.

(a) any **two** from:

- nuclear
- oil
- (natural) gas

2

(b) 4 (hours)

1

(c) a system of cables and transformers

1

(d) The power output of wind turbines is unpredictable

1

(e) 1500 / 0.6

1

2500 (wind turbines)

1

allow 2500 with no working shown for 2 marks

(f) Most energy resources have negative environmental effects.

1

[8]

4.	<p>(a) geothermal</p> <p>nuclear</p> <p>biofuel</p> <p>(b) gravitational (potential)</p> <p>kinetic</p> <p>sound</p> <p>(c) (i) 90% or 0.9(0) <i>an answer of 0.9(0) with a unit gains 1 mark</i></p> <p>(ii) 60 (MW) <i>allow 10%</i></p> <p>(iii) increased</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>2</p> <p>1</p> <p>1</p> <p>[10]</p>
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5.	<p>(a) any two from:</p> <ul style="list-style-type: none"> • cost per kWh is lower (than all other energy resources) <i>allow it is cheaper</i> <i>ignore fuel cost</i> <i>ignore energy released per kg of nuclear fuel</i> • infrastructure for nuclear power already exists <i>accept cost of setting up renewable energy resources is high</i> <i>accept many renewable power stations would be needed to replace one nuclear power station</i> <i>accept (France in 2011 already had a) surplus of nuclear energy, so less need to develop more renewable capacity for increased demand in the future</i> <i>accept France benefits economically from selling electricity</i> • more reliable (than renewable energy resources) <i>accept (nuclear) fuel is readily available</i> <i>ignore destruction of habitats for renewables</i> 	<p>2</p>
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(b) any **two** from:

- non-renewable
allow nuclear fuel is running out
- high decommissioning costs
accept high commissioning costs
- produces radioactive / nuclear waste
allow waste has a long half-life
- long start-up time
- nuclear accidents have widespread implications
*allow for nuclear accident a named nuclear accident
eg Fukushima, Chernobyl
ignore visual pollution*

2

(c) 0.48 (kW)

*allow 1 mark for correct substitution
ie $0.15 = P / 3.2$
an answer of 480 W gains 2 marks
an answer of 48 or 480 scores 1 mark*

2

(d) the higher the efficiency, the higher the cost (per m² to manufacture)
accept a specific numerical example

1

more electricity could be generated for the same (manufacturing) cost using lower efficiency solar panels

or

(reducing the cost) allows more solar panels to be bought
accept a specific numerical example

1

[8]

6.

(a) (i) infrared (radiation)
accept IR (radiation)

1

(ii) (heated) water turns to steam
ignore reference to fossil fuels
*do **not** accept water evaporates to steam*

1

steam turns a turbine

1

turbine turns a generator
accept turbine connected to a generator

1

(b) (i) (so the molten salts) can store large amounts of energy
accept there is a small temperature change for a large energy transfer
accept heat for energy

1

(ii) 16 (hours)
an answer that rounds to 16 gains 2 marks eg 15.71
allow 1 mark for a correct substitution ie $2\,200\,000 = 140\,000 \times t$

3

(iii) the number of daylight hours varies
less sunlight is insufficient

1

the (mean) power (received from the Sun per square metre) varies
accept an answer in terms of maximum possible electrical output
only possible during Summer for 1 mark

1

- (c) (i) non-renewable power stations have higher Capacity Factors than renewable power stations

1

fuel (for non-renewable power stations) is always available

reference to non-renewable power stations operating all the time is insufficient

non-renewable energy sources are reliable is insufficient

1

(most) renewable energy sources are unpredictable / unreliable

accept (most) renewable energy sources depend on the weather

1

- (ii) the (proportion of) time that solar storage power stations can generate electricity is greater (than for other renewable energy sources)

1

[14]