National and global energy resources

Mark Scheme

Name: _____

Class: _____

Date: _____

Time: **97 minutes**

Marks: **97 marks**

Comments:

Mark schemes

1 (a) (i) kinetic

accept KE

*do **not** accept movement*

1

(ii) 0.75

*allow **1** mark for correct substitution ie* $\frac{60\,000}{80\,000}$

or

75 %

*an answer 0.75 % **or** 0.75 with a unit gains **1** mark only*

*an answer 75 with or without a unit gains **1** mark only*

2

(b) any **one** from:

- large areas of land are flooded

  uses large areas of land / takes up large areas of land is insufficient

- people's homes may be destroyed

- habitat (of animals and plants) lost / damaged

  construct is neutral

  very noisy is neutral

1

(c) (i) system of cables and transformers

both required for the mark

accept power lines / wires for cables

ignore reference to pylons

inclusions of power stations / consumers negates answer

1

(ii) less energy loss / wasted (in the cables)

accept heat for energy

*do **not** accept no energy loss*

*do **not** accept electricity for energy*

1

as the cables are shorter

1

[7]

2 *do **not** give any credit for renewable **or** non-renewable **or** installation **or** decommissioning costs*

fossil fuel advantage

1

a reliable source of energy

fossil fuel disadvantage

pollution by carbon dioxide /

accept causes acid rain
accept highest costs / more expensive than nuclear / more expensive than renewable

1

nuclear advantage

do not produce gases that increase the greenhouse effect **or** cause acid rain

accept nuclear is cheaper than fossil

1

nuclear disadvantage

accidents / waste can release very dangerous radioactive material radiation

*accept it produces waste that stays dangerously radioactive for thousands of years **or** radioactive waste has to be stored safely for thousands of years*

1

renewable advantage

there are no fuel costs

almost pollution free (apart from noise and visual)
accept cheaper than fossil

1

renewable disadvantage

not a reliable source of energy except for hydroelectric

accept (most) require large areas of land
accept visual / noise pollution

1

[6]

3 (a) any **two** from

reliable

accept it is not always windy

can be used as storage for surplus electricity

generates more electricity

accept would need hundreds of wind turbines to generate this electricity

takes less space is neutral

no noise pollution

*do **not** accept can be started up quickly*

2

(b) advantage :

does not produce greenhouse gases / carbon dioxide / water
or acid rain / sulphur dioxide

1

disadvantage :
danger from radioactive materials if accidents **or** waste radioactive materials

accept slower start-up time

1

(c) any **one** situation with a suitable explanation

satellite
weigh less **or** work for many years **or** remote

remote places on Earth pump water **or** operate phones **or** road signs / lights **or** weather stations **or** too expensive / impractical

calculators / watches small amount of electricity needed

2

[6]

4

(a) (i) national grid

1

(ii) increases voltage / potential difference

accept decrease current

accept step-up / boosts the voltage

*do **not** accept increases energy / power / current*

ignore reference to voltage going through

1

(iii) any **two** from:

- reduce current

  ignore increased voltage / pd

- reduces energy loss / power loss (from cables)

  accept reduces heat loss

  *do **not** accept stops energy loss*

- increases efficiency (of distribution)

2

(b) any **one** from:

- produces pollutant gases

  accept produces carbon dioxide / sulfur dioxide / nitrogen oxides

  accept global warming / greenhouse effect / carbon emissions / air pollution / acid rain

  ignore ozone layer

  *do **not** accept carbon monoxide*

- produces solid waste / ash / smoke

  accept global dimming

  ignore produces pollution

1

(c) (i) any **two** from:

any two valid points gains the marks

- using renewable energy
  accept don't use up non-renewable / fossil fuels
  accept named fuels
- non-renewable fuels can be used for other processes
- no pollutant gases produced
  accept the opposite of (b)
  ignore no pollution
- land can still be used for farming
  ignore economic issues

2

(ii) any **two** from:

- cause noise pollution
- cause visual pollution
  accept spoils the landscape
  accept sunlight flicker
- may interfere with TV / radio / mobile phone signals
- need to put in new infrastructure
  accept new roads needed
- not reliable owtte
- dangerous to birds
- lots of concrete needed for the bases
  or
  producing cement is environmentally damaging
  accept reduces house prices
  ignore any references to cost / jobs / number required
  ignore takes up a lot of land
  accept reference to obstruction of shipping etc. if clear reference tooffshore wind farm

2

[9]

5 (a) 90% of 2.1011
2.16.1011

2

(b) (i) Can be located anywhere
Continuous output
Sustain coal industry

any 2 for 1 mark each

(ii) Low running cost
No atmospheric pollution
Gives calm coastal waters

any 2 for 1 mark each

(iii) High installation costs – built in sea
Coast environmental damage – wildlife disturbance
Time dependence – need dropping tide

any 2 for 1 mark each

(1 for a valid disadvantage, 1 for reason)

6

[8]

6 (a) m*ust give one advantage and one disadvantage of each to get 4 marks and 2 further scoring points*
Advantages and disadvantages relevant to:
(1) health risk
(5) cost
(6) environmental factors
(7) transport/ storage
e.g. common coal / nuclear – high cost of building both

anti-nuclear examples
nuclear fuel transported on roads/rail in region
possible effects on public health in surrounding area
high cost of de-commissioning
long life very active waste materials produced
how waste materials stored safely for a long time

anti-coal examples
unsightly
pollution
supplies of fuel limited
acid rain
non-renewable

pro-nuclear examples
fuel cheap
no foreseeable fuel shortage

pro-coal examples
safe
reliable
large coal reserves
disposal of solid waste is easier

to max 6

6

(b) choice 0 marks

any three valid reasons each with explanation, which may or may not be comparisons with other fuel

But

at least two of which must be relevant to this site

3

[9]

7 (a) water heated by radiation (from the Sun)

accept IR / energy for radiation

1

water used to heat buildings / provide hot water

*allow for **1** mark heat from the Sun heats water if no other marks given*

*references to photovoltaic cells / electricity scores **0** marks*

1

(b) 2 (minutes)

$1.4 \times 10^3 = \frac{168 \times 10^3}{t}$

*gains **1** mark*

*calculation of time of 120 (seconds) scores **2** marks*

3

(c) (i) 150 (kWh)

1

(ii) £60(.00) or 6000 (p)

*an answer of £6000 gains **1** mark*

*allow **1** mark for 150 × 0.4(0) 150 × 40*

*allow ecf from **(c)(i)***

2

(iii) 25 (years)

an answer of 6000 / 240
or
*6000 / their **(c)(ii)** × 4*
*gains **2** marks*

an answer of 6000 / 60
or
*6000 / their **(c)(ii)** gains **1** mark, ignore any other multiplier of **(c)(ii)***

3

(iv) any **one** from:

- will get £240 per year

  accept value consistent with calculated value in ***(c)(iii)***
- amount of light is constant throughout the year
- price per unit stays the same
- condition of cells does not deteriorate

1

(d) any **one** from:

- angle of tilt of cells
- cloud cover
- season / shade by trees
- amount of dirt

1

[13]

8 ideas that

- direct solar radiation will provide enough energy to heat the (specially designed) buildings during the period Oct-Mar / summer
- solar cells will produce plenty of electricity in Oct-Mar / summer (when wind generators produce little)
- a couple of wind generators will produce all electricity needed (for all but heating) Apr-Oct / winter
- number required makes wind generators unsuitable for heating / buildings
- no solar energy in June and July / little in winter
- solar / wind have little effect on environment
- **or** cause no air pollution
- solar and wind complement each other
- **or** together provide energy all year
- fuel / gas / diesel can provide energy all the time / at any time
- fuel / gas / diesel needed for transport
- fuel / gas / diesel needed for heating in winter
- diesel has to be imported

- diesel likely to freeze
- gas wouldn't have to be imported
- drilling for gas difficult / harms environment
- but atmospheric pollution a global rather than local matter so any produced in Antarctic doesn't matter much

(deduct 1 mark (to min^{m}. zero) for incorrect claims about destroying ozone layer)

- gas produces less carbon dioxide (for the same energy released) than diesel*
- gas produces less sulphur dioxide (for the same energy released than diesel*

(* these ideas met by candidates in Q.16 so must be allowed, though not required)

any ten for 1 mark each

[10]

9 (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 × 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]

10 (a) (i) much ash produced
acid rain
global warming/greenhouse effect

any 2 for 1 mark each

2

(ii) landscaping/road building*
removal of exhaust gases*
use alternative source not producing CO_2* (*sequential (i))

for 1 mark each

2

(b) (i) $E = 5 \times 10^8 \times 3600 \times 24$ J/day
$\times 4$ (for 4 generators) (sequential on $P \times t$) $= 1.73 \times 10^{14}$ (J/day)
for 1 mark each

3

(ii) $2.66 \times 10^{10} \times 18\,829 = 4.86 \times 10^{14}$
for 1 mark each

2

(iii) Eff = output/input
Eff = 1.73/4.86
Eff = 0.36 or worked to a percentage
for 1 mark each

3

(c) (i) boiler – heat to surroundings
turbine – not all steam energy used/heat/sound lost to surroundings
generator – heat in wires/coils/heat to surroundings
transformer – heat in wires/coils/heat to surroundings
any 1 for 1 mark

1

(ii) energy spread out/diluted
as surroundings become warmer/energy lost as heat
difficult to use for further useful energy/transfers
any 2 for 1 mark each

2

[15]