**Mark schemes**

Q1.

(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]

Q2.

(a) power output increases (to meet demand) due to people returning home from work / school

accept many electrical appliances are switched on (which increases demand)

1

accept other sensible suggestions

(b) 00.00

accept midnight

1

allow answers between 00.00 and 04.00

(c) any two from:

• conserves fuel reserves

• spare capacity to compensate for unreliable renewable resources

• provides spare capacity in case of power station emergency shut-down

• so as to not make unnecessary environmental impact

2

[4]

Q3.

(a) geothermal

1

nuclear

1

biofuel

1

(b) gravitational (potential)

1

kinetic

1

sound

1

(c) (i) 90% or 0.9(0)

an answer of 0.9(0) with a unit gains 1 mark

2

(ii) 60 (MW)

allow 10%

1

(iii) increased

1

[10]

Q4.

(a) any one from:

• high cost of installing overhead power lines or underground cables or pylons

• high cost as (very) long cables needed

• amount of electricity required is too low

allow not enough (surplus) electricity would be generated

1

(b) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should apply a 'best-fit' approach to the marking.

Level 3 (5 – 6 marks):

clear comparison of advantages and disadvantages of each method

Level 2 (3 – 4 marks):

at least one advantage and one disadvantage is stated for one method and a different advantage or disadvantage is stated for the other method

Level 1 (1 – 2 marks):

at least one advantage or one disadvantage of either method

Level 0 (0 marks):

No relevant information

examples of physics points made in the response

Advantages of both methods:

• both renewable sources of energy

• both have no fuel (cost)

• both have very small (allow 'no') running costs

• no carbon dioxide produced

accept carbon neutral

accept no greenhouse gases

accept doesn't contribute to global warming

Advantages of wind:

• higher average power output

produces more energy is insufficient

Advantages of hydroelectric:

• constant / reliable power (output)

• lower (installation) cost

Disadvantages of wind:

• higher (installation) cost

• variable / unreliable power output

• (may) kill birds / bats

Disadvantages of hydroelectric:

• lower power output

• (may) kill fish or (may) damage habitats

• more difficult to set up (within river)

Disadvantages of both methods:

• (may be) noisy

• visual pollution

ignore payback time unless no other relevant points made

ignore time to build for both

6

[7]

Q5.

(a) any two from:

• cost per kWh is lower (than all other energy resources)

allow it is cheaper

ignore fuel cost

ignore energy released per kg of nuclear fuel

• infrastructure for nuclear power already exists

accept cost of setting up renewable energy resources is high

accept many renewable power stations would be needed to replace one nuclear power station

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

accept France benefits economically from selling electricity

• more reliable (than renewable energy resources)

accept (nuclear) fuel is readily available

ignore destruction of habitats for renewables

2

(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]

Q6.

(a) (i) high levels of infrared radiation (from the Sun)

allow lots of (solar) energy (available)

do not accept ‘heat’ for infrared

‘it is hot’ is insufficient

‘lots of sunlight’ is insufficient

1

(ii) reflected

1

(iii) boiler

correct order only

1

turbine

1

transformer

1

(b) 2 100 000 (kWh)

allow 1 mark for correct substitution i.e. 140 000 × 15 provided no subsequent step

2

(c) (i) only 1 wind turbine was considered

accept only one location is considered

1

or

other wind turbines may have generated more electricity

accept insufficient sample size

only 1 week’s weather was reported on

or

wind speed varies from one week to another

‘wind speed varies’ is insufficient

1

(ii) any one from:

• wind speed is too high / low

allow no wind

allow too windy

• wind is unreliable.

allow wind is variable

1

(iii) any one from:

• wind is a renewable energy source

• do not use fuel

• energy source is free

• do not release carbon dioxide

• do not release greenhouse gases

• do not release sulfur dioxide

• do not cause acid rain

• do not cause climate change

• do not cause global warming

• do not cause global dimming.

answer must be an advantage of wind, converse answers in terms of fossil fuels are insufficient

accept do not release pollutant gases

‘no pollution’ is insufficient

1

[11]

Q7.

(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]

Q8.

(a) (i) water

1

heated

accept boiled or turned to steam

do not accept evaporated

1

generator

1

(ii) geothermal power stations provide a reliable source of electricity

1

(b) falling water

1

[5]

Q9.

(a) advantage

any one from:

• produce no / little greenhouse gases / carbon dioxide

allow produces no / little polluting gases

allow doesn’t contribute to global warming / climate change

allow produce no acid rain / sulphur dioxide

reference to atmospheric pollution is insufficient

produce no harmful gases is insufficient

• high(er) energy density in fuel

accept one nuclear power station produces as much power as several gas power stations

nuclear power stations can supply a lot of or more energy is insufficient

• long(er) operating life

allow saves using reserves of fossil fuels or gas

1

disadvantage

any one from:

• produce (long term) radioactive waste

accept waste is toxic

accept nuclear for radioactive

• accidents at nuclear power stations may have far reaching or long term consequences

• high(er) decommissioning costs

accept high(er) building costs

• long(er) start up time

1

(b) (i) 12 000 (kWh)

allow 1 mark for correct substitution eg

2000 × 6

or

2 000 000 × 6

or

an answer of 12 000 000 scores 1 mark

2

(ii) any idea of unreliability, eg

• wind is unreliable

reference to weather alone is insufficient

• shut down if wind too strong / weak

• wind is variable

1

(c) any one from:

• cannot be seen

• no hazard to (low flying) aircraft / helicopters

• unlikely to be or not damaged / affected by (severe) weather

unlikely to be damaged is insufficient

• (normally) no / reduced shock hazard

safer is insufficient

less maintenance is insufficient

installed in urban areas is insufficient

1

[6]

Q10.

(a) water moves (from a higher level to a lower level)

1

transferring GPE to KE

1

rotating a turbine to turn a generator

accept driving or turning or spinning for rotating

moving is insufficient

1

transferring KE to electrical energy

transferring GPE to electrical energy gains 1 mark of the 2 marks available for energy transfers

1

(b) (TVs in stand-by) use electricity

accept power / energy

1

generating electricity (from fossil fuels) produces CO2

accept greenhouse gas

accept sulfur dioxide

1

(CO2) contributes to global warming

accept climate change for global warming

accept greenhouse effect if CO2 given

accept acid rain if linked to sulfur dioxide

1

(c) a factor other than scientific is given, eg economic, political or legal

personal choice is insufficient

1

[8]

Q11.

(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 × 103 =

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]

Q12.

(a) (i) 77

1

(ii) Oil

1

(b) water

accept H2O

1

(c) Carbon dioxide causes global warming

1

[4]

Q13.

(a) (i) changing the distance may / will affect / change the voltmeter reading

accept so only one independent variable

accept distance affects speed of wind (turbine)

accept it is a control variable

accept to give valid results

fair test is insufficient

to make the results accurate is insufficient

1

(ii) any sensible practical suggestions, eg

• so fan reaches a steady / full speed

accept power for speed

• so wind (turbine) reaches a steady / full speed

• so voltmeter reaches / gives a steady reading

accept accurate or valid reading a correct reading is insufficient

do not accept precise reading

1

(iii) as the number of blades increases so does the (voltmeter) reading / output / voltage

number of blades affects the reading / output is insufficient

1

further relevant detail, eg

• voltmeter increase is greatest up to 3 blades

• voltmeter reading hardly changes with 4, 5 or 6 blades

accept does not change between 4 and 6 blades

• increase is directly proportional up to 3 blades

• it reaches a limit

accept does not change after 4 / 5 blades

• a numerical example giving two pairs of numbers, eg 2 blades = 0.6V, 4 blades = 1V

1

(b) C

reason scores only if C is chosen

1

wind speed / strength varies

accept wind is not constant / reliable

1

[6]

Q14.

(a) (i) produces carbon dioxide / nitrogen oxides

accept greenhouse gases

ignore pollutant gases

1

that (may) contribute to global warming

accept causes global warming

damages ozone layer negates this mark

accept alternative answers in terms of: sulfur dioxide / nitrogen oxides causing acid rain

1

(ii) carbon capture / storage

answer must relate to part (a)(i)

collecting carbon dioxide is insufficient

or

plant more trees

or

remove sulfur (before burning fuel)

1

(b) (i) (power station can be used) to meet surges in demand

accept starts generating in a short time

can be switched on quickly is insufficient

1

(ii) can store energy for later use

accept renewable (energy resource)

accept does not produce CO2 / SO2 / pollutant gases

1

(c) (i) turbines do not generate at a constant rate

accept wind (speed) fluctuates

accept wind is (an) unreliable (energy source)

1

(ii) any one from:

• energy efficient lighting (developed / used)

use less lighting is insufficient

• increased energy cost (so people more likely to turn off)

accept electricity for energy

• more people becoming environmentally aware

1

[7]

Q15.

allow 1 mark for each correct line

if more than one line goes from an energy source then all lines from that energy source are wrong

[3]

Q16.

(a) electrical

1

chemical

1

light

1

(b) 25% or 0.25

allow 1 mark for correct substitution, ie 50 ÷ 200 provided no subsequent step shown

or

answers of 25 with a unit or 0.25 with a unit gain 1 mark

answers of 25 without a unit or 0.25% gain 1 mark

2

(c) the information board can be used anywhere it is needed

1

[6]

Q17.

(a) any three from:

• gas can be switched on (and off) quickly but nuclear cannot

gas has a short start-up time alone is insufficient

• gas can be used to meet surges in demand

accept specific times from graph, anything from 1700 to 2200

• gas can contribute to / meet the base load

• nuclear provides base load

or

nuclear is used to generate all of the time

3

(b) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information in the Marking guidance, and apply a ‘best-fit’ approach to the marking.

0 marks

No relevant content.

Level 1 (1-2 marks)

There is a brief description of one advantage or disadvantage of using either biogas or wind

or

makes a conclusion with a reason.

Level 2 (3-4 marks)

There is a description of some advantages and / or disadvantages for biogas

and / or wind

or

there is a direct comparison between the two systems and at least one advantage / disadvantage

or

a detailed evaluation of one system only with a conclusion.

Level 3 (5-6 marks)

There is a clear and detailed comparison of the two systems.

There must be a clear conclusion of which system would be best with at least one comparative reason given for the choice made.

Examples of the points made in the response

extra information

Biogas

• renewable

• energy resource is free

• reliable energy source

accept works all of the time

• does not depend on the weather

• uses up (animal) waste products

• concentrated energy source

• cheaper (to buy and install)

accept once only

• shorter payback-time (than wind)

• adds carbon dioxide to the atmosphere

when waste burns it produces carbon dioxide is insufficient

• contributes to the greenhouse effect

or

contributes to global warming

• no transport cost for fuels

Wind turbine

• renewable

• energy resource is free

• not reliable

• depends on the weather / wind

• will be times when not enough electricity generated for the farm’s needs

• dilute energy source

• longer payback-time (than biogas)

• more expensive (to buy and install)

accept once only

• does not produce any carbon dioxide

accept does not pollute air

accept pollutant gases for carbon dioxide

produces visual or noise pollution is insufficient

harmful gases is insufficient

6

[9]

Q18.

(a) any one from:

• energy / source is constant

• energy / source does not rely on uncontrollable factors

accept a specific example, eg the weather

• can generate all of the time

will not run out is insufficient

1

(b) (dismantle and) remove radioactive waste / materials / fuel

accept nuclear for radioactive

knock down / shut down is insufficient

1

(c) any two from:

• reduce use of fossil fuelled power stations

accept specific fossil fuel

accept use less fossil fuel

• use more nuclear power

accept build new nuclear power stations

• use (more) renewable energy sources

accept a named renewable energy source

do not accept natural for renewable

• make power stations more efficient

• (use) carbon capture (technology)

do not accept use less non-renewable (energy) sources

2

(d) (by increasing the voltage) the current is reduced

1

this reduces the energy / power loss (from the cable)

accept reduces amount of waste energy

accept heat for energy

do not accept stops energy loss

1

and this increases the efficiency (of transmission)

1

[7]

Q19.

(a) (i) an unreliable energy source

1

(ii) a renewable energy source

1

(b) plant / grow (at least) one new tree

1

(c) greater than 4%

1

[4]

Q20.

(a) light

correct order only

1

electrical

1

(b) 0.2 or 1/5

accept 20% for both marks

allow 1 mark for correct substitution ie

answers of 0.2% or 20 gain 1 mark only

2

(c) any one from:

• produces no (pollutant) gases

or

no greenhouse gases

accept named gas

accept no air pollution

do not accept no pollution

accept less global warming

accept harmful for pollutant

accept produces no carbon

do not accept environmentally friendly

• produces no / less noise

• less demand for fuels

accept any other sensible environmental advantage

1

[5]

Q21.

(a) (i) replaced faster than it is used

accept replaced as quick as it is used

accept it will never run out

do not accept can be used again

1

(ii) any two from:

two sources required for the mark

• wind

• waves

• tides

• fall of water

do not accept water / oceans

accept hydroelectric

• biofuel

accept a named biofuel eg wood

• geothermal

1

(b) (i) any two from:

• increases from 20° to 30°

• reaches maximum value at 30°

• then decreases from 30°

• same pattern for each month

accept peaks at 30° for both marks

accept goes up then down for 1 mark

ignore it’s always the lowest at 50°

2

(ii) 648

an answer of 129.6 gains 2 marks

allow 1 mark for using 720 value only from table

allow 2 marks for answers 639, 612, 576, 618(.75)

allow 1 mark for answers 127.8, 122.4, 115.2, 123.75

3

(c) (i) (sometimes) electricity demand may be greater than supply (of electricity from the system)

accept cloudy weather, night time affects supply

or

can sell (excess) electricity (to the National Grid)

1

(ii) decreases the current

accept increases the voltage

1

reducing energy loss (along cables)

accept less heat / thermal energy lost / produced

1

[10]

Q22.

(a) grid

accept any unambiguous indication

1

(b) (i) A (only)

1

(ii) D (only)

1

(c) less than

1

[4]

Q23.

(a) (i) correct data point identified (4, 0.96)

1

(ii) a decrease in

1

(b) (i) no / less atmospheric pollution

accept specific examples eg no CO2 / greenhouse gases produced

accept no harmful gases / fumes

accept reduced pollution from transportation (of coal)

accept does not contribute to global warming

it / they refers to solar cells

do not accept no / less pollution

does not harm the environment is insufficient

it is a renewable energy source is insufficient

1

(ii) 8

allow 1 mark for showing correct method ie provided that no subsequent step is shown

2

(iii) increase

1

(iv) these marks can score even if (b)(iii) is wrong

less / no electricity generated

accept energy for electricity

accept reduced power / voltage output

1

(because) lower light intensity (hitting solar panel / cell)

or

so decreases money paid / gained (from selling electricity)

allow less light / sun (hitting solar panel / cell)

1

[8]

Q24.

(a) increases the voltage (across the cables)

or

decreases the current (through the cables)

1

reducing energy losses (in cables)

accept heat for energy

do not accept electricity for energy

do not accept no energy loss

accept wires do not get as hot

or

increases efficiency of (electricity / energy) transmission

ignore reference to travel faster

1

(b) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response.

Examiners should also refer to the Marking Guidance, and apply a ‘best-fit’

approach to the marking.

0 marks

No relevant content

Level 1 (1-2 marks)

There is a brief description of one advantage or disadvantage of using

either overhead or underground cables.

Level 2 (3-4 marks)

There is a description of some of the advantages and / or disadvantages

for both overhead and underground cables, with a minimum of three

points made. There must be at least one point for each type of cable.

Level 3 (5-6 marks)

There is a clear and detailed description of the advantages and disadvantages

of overhead and underground cables, with a minimum of five points made.

At least one advantage and one disadvantage for each type of cable.

examples of the points made in the response

marks may be gained by linking an advantage for one type of cable with a disadvantage for the other type of cable

eg

overhead cables are easy to repair = 1 mark

overhead cables are easier to repair = 1 mark

overhead cables are easier to repair than underground cables = 2 marks

Overhead

Advantages

• (relatively) quick / easy to repair / maintain / access

easy to install is insufficient

do not accept easy to spot / see a fault

• less expensive to install / repair / maintain

less expensive is insufficient

• cables cooled by the air

accept thermal energy / heat removed by the air

• air acts as electrical insulator

accept there is no need for electrical insulation (around the cables)

• can use thinner cables

difficult to reach is insufficient

land beneath cables can still be used is insufficient

Disadvantages

• spoil the landscape

• greater risk of (fatal) electric shock

• damaged / affected by (severe) weather

accept specific examples eg high winds, ice

more maintenance is insufficient

• hazard to low flying aircraft / helicopters

kites / fishing lines can touch them is insufficient

hazard to aircraft is insufficient

Underground

Advantages

• cannot be seen

• no hazard to aircraft / helicopters

• unlikely to be / not damaged / affected by (severe) weather

less maintenance is insufficient

(normally) no / reduced shock hazard

installed in urban areas is insufficient

Disadvantages

• repairs take longer / are more expensive

accept harder to repair / maintain

have to dig up for repairs is insufficient

• (more) difficult to access (cables)

hard to locate (cables) is insufficient

faults hard to find is insufficient

• (very) expensive to install

• thicker cables required

• need cooling systems

• need layers of electrical insulation

• land disruption (to lay cables)

accept damage to environment / habitat(s)

or

cannot use land either side of cable path

accept restricted land use

6

(c) examples of acceptable responses:

allow 1 mark for each correct point

• closest to cables field from underground is stronger

• field from overhead cables stronger after 5 metres

• field from underground cables drops rapidly

• field from overhead cables does not drop much until after 20 metres

accept values between 20 and 30 inclusive

• overhead field drops to zero at / after 50 metres

• underground field drops to zero at / after 30 metres

• (strength of) field decreases with distance for both types of cable

if suitably amplified this may score both marks

2

(d) ethical

1

[11]

Q25.

(a) answers must be in terms of nuclear fuels

concentrated source of energy

idea of a small mass of fuel able to generate a lot of electricity

1

that is able to generate continuously

accept it is reliable

or can control / increase / decrease electricity generation

idea of available all of the time / not dependent on the weather

ignore reference to pollutant gases

1

the energy from (nuclear) fission

1

is used to heat water to steam to turn turbine linked to a generator

1

(b) carbon dioxide is not released (into the atmosphere)

1

but is (caught and) stored (in huge natural containers)

1

[6]

Q26.

(a) (i) any one from:

• produces no (air / atmospheric) pollution

accept named pollutant eg CO2

accept no harmful gases

accept produces no emissions

accept does not add to global warming

environmentally friendly is insufficient

• energy (source) is free

accept no fuel costs

accept the wind / it is free

1

(ii) any one from:

• waves

• tides

• falling water

accept hydroelectric

do not accept water (flow)

• solar

accept Sun / sunlight

accept solar panels / cells

• geothermal

• biofuel / biomass

accept a named biofuel

1

(b) (i) 3000 (kilowatts)

accept 3 megawatts / MW

accept 3 000 000 watts / W

1

(ii) (average) wind speed below 6 m/s

answers giving a wind speed greater than 3 but less than 6 m/s gain both marks

allow 1 mark for calculating the output as 500 kW (maximum)

and

allow 1 mark for wind speed too low or wind not strong enough

do not accept wind above 25 m/s

do not accept the turbines are frozen

2

(iii) A small amount of nuclear fuel generates a large amount of electricity.

both required

Nuclear power stations do not depend on the weather to generate electricity.

1

[6]

Q27.

(a) 9

allow 2 marks for power = 1400 (kW)

if a subsequent calculation is shown award 1 mark only

or

allow 1 mark for correct substitution and transformation

power =

allow 1 mark for using a clearly incorrect value for power to read a corresponding correct value from the graph

3

(b) (i) system of cables and transformers

both required for the mark

ignore reference to pylons

inclusion of power stations / consumers negates the mark

wire(s) is insufficient

1

(ii) (uses step-up transformer to) increase pd / voltage

accept (transfers energy / electricity at) high voltage

or

(uses step-up transformer to) reduce current

accept (transfers energy / electricity at) low current

ignore correct references to step-down transformers

1

(c) build a power station that uses a non-renewable fuel or biofuel

accept a named fuel

eg coal or wood

or

buy (lots of) petrol / diesel generators

1

stockpile supplies of the fuel

accept fuel does not rely on the weather

or

fuel provides a reliable source of energy

accept as an alternative answer idea of linking with the National Grid (1)

and taking power from that when demand exceeds supply (1)

or

when other methods fail

or

when it is needed

answers in terms of using other forms of renewables is insufficient

1

[7]

Q28.

(a) gas (burning)

1

(b) (i) (transmission) cables and (step-up and step-down) transformers

if transformers are named ie step-up transformer then both step-up and step-down must be given

mention of power station or consumer negates mark

1

(ii) voltage

1

more efficient

1

(c) increase

1

[5]

Q29.

(a) (i) energy from hot rocks in the Earth

accept heat that occurs naturally in the Earth

accept steam / hot water rising to the Earth’s surface

accept an answer in terms of the energy released by radioactive decay in the Earth

heat energy is insufficient

1

(ii) water is pumped / moved

1

up (to a higher reservoir)

this mark point only scores if first mark point is awarded

1

(b) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response.

Examiners should also refer to the Marking Guidance and apply a ‘best-fit’

approach to the marking.

0 marks

No relevant content

Level 1 (1-2 marks)

There is a brief description of at least one advantage or disadvantage for

either the planned wind turbines or the suggested electricity power link.

Level 2 (3-4 marks)

There is a description of advantages and disadvantages for

either the planned wind turbines or the suggested electricity power link.

or

A description of the advantages or disadvantages for both the planned

wind turbines and the suggested electricity power link.

Level 3 (5-6 marks)

There is a clear and detailed description of at least one advantage and

one disadvantage for both the planned wind turbines and suggested

electricity power link.

examples of the points made in the response

Offshore wind turbines

advantages

• renewable (energy resource)

• low running costs

• energy is free

• no gas emissions (when in use)

accept a named gas eg CO2

accept no fuel is burned

accept less dependent on fossil fuels

• land is not used (up)

disadvantages

• unreliable – accept wind does not always blow

ignore references to destroying or harming habitats

• hazard to birds / bats

• visual pollution – do not accept noise pollution

do not allow if clearly referring to onshore wind turbines

do not accept spoils landscape

• difficulty of linking turbines to the National Grid

• large initial cost

• difficult to erect / maintain

accept a lot of maintenance needed

• CO2 emissions in manufacture (of large number of turbines)

Suggested Link

advantages

• income for Iceland

• using Iceland’s (available) energy (resources)

accept using (Iceland’s) renewable energy (resources)

do not accept reduce the amount of Iceland’s wasted energy

• provide electricity when wind does not blow / reliable

• provide electricity at times of peak demand

• even out fluctuations in supply

• excess electricity from Britain (windy days) to Iceland and used to pump water up to store energy

• Britain less dependent on fossil fuels

accept Britain needs fewer (new) power stations

accept conserves fossil fuels

disadvantages

• large initial cost

accept expensive (to lay cables)

• power loss along a long cable

• (engineering) difficulties in laying / maintaining the cable

accept difficult to repair (if damaged)

6

[10]

Q30.

(a) can be replaced as fast / faster than it is used

accept will not run out

can be used again negates this mark

1

(b) any one from:

• reduce demand on power stations / National Grid (system)

• to increase the amount of electricity generated (from renewable energy)

• to conserve fossil fuels

accept use less fossil fuels

• plenty of animal waste / fuel (available)

accept so animal waste can be used usefully

accept to save money / sell the electricity

produces less harmful gases / SO2 is insufficient

better for environment is insufficient

1

(c) 60 (months) / 5 (years)

ignore any unit given

1

(d)answers must be in terms of the biogas generator

any two from:

• reliable energy source

or

does not depend on the weather

accept works all of the time

• uses up waste products

accept animal waste readily available

• not visually polluting

• concentrated energy source

• quieter

ignore it is renewable

do not accept generates more electricity (than wind turbine)

2

[5]

Q31.

(a) (i) solar and wind

both required for mark either order

1

(ii) 37(%)

accept their two sources in a(i)

correctly added as an error carried forward (ecf)

1

(b) A

1

(c) gas is non-renewable

do not accept they are not all renewable

statements such as gas produces CO2 is neutral

1

[4]

Q32.

(a) kinetic

1

(b) (i) generates a lot more energy / electricity / power

need fewer conventional large-scale hydroelectric power

stations is neutral

or

can supply (energy / electricity / power) to more homes

1

(ii) Large areas of land are flooded.

1

(c) (i) National Grid

this answer only

1

(ii) less energy / heat loss (from the cables)

accept wasted for loss

accept answers in terms of fewer transformers needed

do not accept less electricity lost / wasted

do not accept no energy lost

1

(d) any one from:

• fewer rivers (suitable for generators)

• less mountainous (so rivers fall smaller distances)

accept answers in terms of difficulty linking villages and towns to grid (in Nepal)

accept answers in terms of more isolated communities

accept answers in terms of UK having more resources for large-scale power stations

1

[6]

Q33.

(a) marks are awarded only for the reason but must match the

ringed answer

for both marks a MAYBE answer should include a YES and NO response answers in terms of the sources being renewable or

non-renewable are insufficient

any two from:

YES answers may include:

• wind produces no pollutant gases

accept wind burns no fuel

accept CO2 / SO2 / oxides of nitrogen / greenhouse gas for pollutant gases

• nuclear produces no pollutant gases

accept nuclear burns no fuel

• (burning) gas does not produce SO2

accept gas does not cause acid rain

do not accept they don’t / none produce pollutant gases

NO answers may include:

• nuclear produces radioactive waste

• (burning) gas produces CO2 / pollutant gases / air pollution

accept contributes to global warming / greenhouse effect

2

(b) nuclear power stations use a non-renewable fuel

accept uranium / plutonium is non-renewable

do not accept some are unrenewable

1

[3]

Q34.

(a) (i) kinetic

accept KE

do not accept movement

1

(ii) 0.75

allow 1 mark for correct substitution ie

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]

Q35.

(a) (i) decommissioning

1

(ii) level of radiation or radiation dose (to workers) decreased

accept the isotope / cobalt(-60) has decayed (a lot)

accept the isotope / cobalt(-60) has decayed in 2 half lives

accept exposed to less radiation

do not accept no radiation left

1

less hazardous / dangerous (to workers' health)

accept safer

do not accept there is no hazard

accept allows reactor to cool (down)

an answer of radiation levels decrease by 75 % or drops to 25 % gains 2 marks

1

(b) (i) more in favour

or

fewer against

quoting figures alone is insufficient

do not accept it increases

ignore any reasons given

1

(ii) any one from:

• sample too small

• do not know how many (people) were asked

• different people asked (in different years)

• sample not representative (of population)

• people did not understand the questions

• do not know who carried out the surveys

do not accept they are biased unless acceptable reason for bias given

• do not know if surveys asked same questions

1

(iii) any one from:

• no / less pollutant gases produced

accept a named gas

accept does not contribute to global warming

• reliable source (of energy / electricity)

• running out of fossil fuels

accept a named fossil fuel

• conserve fossil fuels

accept fossil fuels won’t have to be used

• meet increasing demand

• less reliance on imported fossil fuels / electricity

accept named fossil fuel

• concentrated energy source(s)

• lower transportation costs for fuel

• to replace old nuclear power stations

ignore references to efficiency / job creation / local economy / selling electricity

1

(c) economic issues

1

[7]

Q36.

(a) (i) 4

allow 1 mark for correct transformation and substitution

ie

substitution only scores if no subsequent steps are shown

2

(ii) diagram showing two output arrows with one arrow wider

than the other with the narrower arrow labelled

electrical / electricity / useful

1

(b) any one from:

• to check reliability / validity / accuracy

• to avoid bias

1

(c) any two from:

• produce no / less (air) pollution

accept named pollutant

accept produces no waste (gases)

• energy is free

accept it is a free resource

do not accept it is free

• (energy) is renewable

• conserves fossil fuel stocks

• can be used in remote areas

• do not need to connect to the National Grid

2

[6]

Q37.

(a) (i) gas

1

(ii) one variable is categoric, the other is continuous

1

(iii) fuel is not burned

accept nothing is burned

do not accept they don’t use fossil fuels

1

(b) (i) boiler

1

steam

1

turbine

1

generator

1

(ii) any one from:

• wind

accept wind turbines

• waves

• tidal

accept tide

• geothermal

• solar

accept the Sun / sunlight

accept solar panels / cells

do not accept light

• falling water

accept hydroelectric

do not accept water

do not accept any named biofuel

1

(iii) 18 000

allow 1 mark for showing a correct method

ie 36 000 000 ÷ 2 000

an answer of 0.018 gains 1 mark

2

[10]

Q38.

(a) (i) (dismantle and) remove radioactive waste / materials / fuels

accept nuclear for radioactive

do not accept knock down / shut down

1

(ii) increases it

do not accept it has a negative effect

1

(b) (i) if efficiency is not mentioned it must be implied

answers in terms of energy

generated only gains no credit

K most efficient

or

M least efficient

accept K and / or L are more efficient than M

1

(efficiency) of K and L increases, (efficiency) of M (almost) constant /

slightly reduced

all 3 power stations must be mentioned to get this mark

1

(ii) any two from:

• do not know how many (nuclear) power stations there will be

• power stations may continue to increase in efficiency

• do not know what type of power station new ones will be

accept new methods may be found to generate electricity / energy

accept other ways of generating energy may be expanded

• do not know future energy / electricity demands

accept we may become more energy efficient

• may be new uses for uranium

2

[6]

Q39.

(a) all 4 lines correct

allow 1 mark for each correct line

if more than 1 line goes from a box in List A then all those lines are incorrect

4

(b) all renewable

accept a correct description of renewable

eg replaced faster than used or never run out

do not accept can be used again

accept any other common feature

eg do not produce pollution /

polluting (gases)

no fuel is burnt

(energy input) is free

eco-friendly / environmentally friendly / natural resources / sustainable sources are insufficient

1

(c) large areas of land are flooded

1

[6]

Q40.

(a) (i) tidal / tides

do not accept water / waves

1

(ii) any three from:

• shorter journey time

accept easier to go from town to town

accept less petrol / fuel used

• less pollution from traffic

accept CO2 / carbon emissions reduced

• energy source is free

• energy source / tides are predictable

• produces less / no pollutant gases (than fuel burning power stations)

accept no CO2 / greenhouse gases produced

accept air pollution for pollutant gases

• conserves supplies of fossil fuels

• uses renewable energy (to generate electricity)

• provides employment

• no visual / noise pollution

less harm to the environment is insufficient

the electricity is cheaper is insufficient

do not accept produces no radioactive waste

the pollution mark scores twice only if it is clear one reference is to traffic and the other is to electricity generation

3

(b) (i) (sometimes) electricity demand may be greater

than supply (of electricity from the system)

accept in case turbines / generators fail

or

can sell (excess) electricity (to the National Grid)

1

(ii) decreases the current

accept increases the voltage

1

reducing energy loss (along cables)

accept less heat / thermal energy lost / produced

1

[7]