

GCSE PHYSICS

Topic Paper: 1.3 & 2.4.3 National grid and global energy resources
Part 1 & 2 Mark Scheme

MARK SCHEME



81 Marks



- M1.** (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]



M2. (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]

M3. (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]



M4. (a) *must 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]

M5. (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]

M6. (a) decrease in (proportion of) oil as reserves are decreasing

1

increase in (proportion of) coal / nuclear / gas / as new reserves / more nuclear power stations built

1

no marks are awarded for simply describing the differences

(b) (i) a prediction

1

forecast based on scientific evidence

1

(ii) less methane goes into the atmosphere

accept air for atmosphere

1

therefore making global warming less rapid

1

(c) idea that many devices transform electricity into other useful forms of energy

1

example related to public health eg refrigeration / production of vaccines / X-ray machines

1

example related to modern communications eg internet / telephones

1

[9]



M7. (a) decrease in oil

PLUS

any **one** from:

increase in (proportion of) coal

increase in (proportion of) nuclear

increase in (proportion of) gas

must have decrease in (proportion of) oil and increase in (proportion of) coal / nuclear / gas

1

(b) (i) (nuclear) fission

accept fission

*do **not** accept any answer that looks like fusion*

1

(ii) water heated to produce (high pressure) steam

1

steam turns turbine which drives generator

1

(iii) any **two** from:

produces no pollutant gases

accept named gas or greenhouse gases

accept no atmospheric pollution

accept harmful for pollutant

accept does not contribute to global warming

*do **not** accept no pollution on its own*

*do **not** accept better for the environment unless qualified*

it is reliable **or** can generate all of the time

concentrated energy source **or** produces a lot of energy from a small mass

produces only small volume of (solid) waste

fossil fuels will last longer

accept a named fossil fuel

accept fossil fuels are running out

*do **not** accept fossil fuels are non-renewable unless qualified*

will need to buy less fuel from other countries

accept no new fossil fuel power stations needed

*do **not** accept it is cheap*

*do **not** accept import less electricity*

2



(iv) it is / can be radioactive
do not accept answers in terms of kills cells / cancer

or emits radiation (from the nuclei)
accept emits gamma (rays)

1

(c) coal (burning) power stations / burning coal produces carbon dioxide
they refers to coal-burning power stations
accept sulfur dioxide / nitrogen oxides for CO₂

1

(increased) CO₂ increases / contributes to / causes global warming /
greenhouse effect

mention of ozone layer negates this mark
do not accept CO₂ warms atmosphere

1

[9]

M8. transformer **X** reduces the current through the transmission cables
accept increases p.d. across the cables

1

this reduces the energy loss from the cables

1

which increases the efficiency of the distribution system

1

transformer **Y** is essential as it reduces the p.d. to a safe
working value for consumers

1

[4]

M9. (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

$$\text{power} = \frac{5600}{4}$$

*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]

- M10.** (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]

- M11.** (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]