AQA GCSE PHYSICS (HIGHER) · 8463

PHYSICS



MARK SCHEME

4.1.3 NATIONAL AND GLOBAL ENERGY RESOURCES (PACK 3)

SCORE	PERCENTAGE
/131	%

STEMUP

These questions belong to AQA, not to us.

The examination questions, mark schemes and examiner comments in this pack were written and published by AQA. They are past assessment materials, reproduced here so that students can revise from them.

What we do not own

STEMUP is not affiliated with AQA and does not own, and makes no claim to own, any of the question, mark scheme or examiner report material in this pack. AQA has not endorsed, approved or been involved in the production of it. AQA and the qualification titles used here belong to their respective owners and appear for identification only.

Where to find the originals

AQA publishes its past papers, mark schemes and examiner reports. Always check the current specification at aqa.org.uk before you revise, because content and wording can change between series.

If you hold the rights to any material in this pack and would like it amended or removed, contact admin@stemup.co.uk and we will act on it.

Mark schemes

Q1.

To gain marks the candidate must

1. Select one option — Advantages) Max 4

2. State 8 valid advantages/disadvantages/relevant comparisons with either of the alternatives — Disadvantages) Min 1 Comparisons)
   If no A or D or C then Max 4
   No option then Max 4

Look for As, Ds for chosen scheme.
Then for Cs compared with A/D for chosen scheme.

Below are listed some of the relevant mark scoring points.

	Advantages	Disadvantages
Wind	Land available to North No pollution Close/low transmission costs No fuel costs Renewable energy resource	Initial cost Many windmills/much land Calm day problem Few long term jobs
Coal	Waste land to North Prevailing wind to East Good road/rail transport Close/low transmission costs Save coal industry Overall labour intensive	Pollution Initial costs Fuel costs Non-renewable energy Resource
Hydroelectric	No pollution Mountains/lake/river nearby No fuel costs Renewable energy source	Possible drought Distant/transmission costs Few jobs created Possible expensive underground transmission cable Construction of dam affects environment

[8]

Q2.

(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

STEMUP.CO.UK

(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]

Q3.

coal has chemical energy
when burnt heat/energy produced longest
used to boil water/make steam sequence
used to turn turbine(s)
which now have ke
turbine(s) turn generator(s)
(where (ke) transferred electrical energy)
(or electrical energy produced)

any 5 for 1 mark each

[5]

Q4.

the higher the voltage the smaller the current
small current gives small energy loss
in the form of heat
(or efficiency greater, or energy/heat losses low – gets 1)

for 1 mark each

[3]

Q5.

(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)

STEMUP.CO.UK

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]

Q6.

(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

<u>anti-nuclear</u> 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

<u>anti-coal</u> examples
unsightly
pollution
supplies of fuel limited
acid rain
non-renewable

STEMUP.CO.UK

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]

Q7.

Read all the answer first. See below.

Mark the first two advantages and disadvantages (√ or *X*) ignoring

neutral answers. Only allow a third advantage if there is only one disadvantage given. Only allow a third disadvantage if only one advantage is given.

max. 3 advantages (e.g. cheap fuel, good availability, saving fossil fuels, low running costs, reliable, more energy / kg, less fuel needed, no greenhouse gases emitted, no SO_2 causing acid rain)

max. 3 disadvantages (e.g. danger to health of local community, non renewable, high cost of decommissioning, long half life of waste materials, need for safe storage of waste, high cost of commissioning, danger involved in transporting fuel / waste)

max. 4 marks

[4]

Q8.

(a) **Using wind (advantage)**

any **one** from

can be used in remote locations

renewable

clean

accept does not cause pollution to the air / land

1

STEMUP.CO.UK

Using wind (disadvantage)

any **one** from

does not generate much (electrical) energy
many hundreds wind turbines would be needed

*accept many hundreds wind turbines would be needed **or** too much land would be needed for wind farms **or** wind energy is 'dilute'*

the wind is unreliable

*accept the wind does not blow all of the time **or** the wind is not always strong enough*

noise / visual pollution

*do **not** accept just the word pollution*

1

Using coal (advantage)

any **one** from

can generate electricity all of the time

accept reliable electrical / energy supply

generates a lot of (electrical) energy

1

Using coal (disadvantage)

any **one** from

pollution by carbon dioxide / greenhouse gas

*accept slow start-up time **or** production of ash **or** difficult to transport (coal) **or** there's not much coal left*

non renewable

pollution by sulphur dioxide acid rain

1

(b) all link lines correct

accept one link line correct for one mark

2

[6]

Q9.

(a) **(oil / natural gas / coal)**

no marks are given for choosing the correct non-renewable energy source

burning releases carbon dioxide (1) greenhouse effect (1)

OR

allow 2 effects for 2 marks

STEMUP.CO.UK

burning (releases sulphur dioxide (1) acid rain (1)

OR

(nuclear power)

no marks given for choosing the correct non-renewable energy source

accidents can release very dangerous radioactive material (1)

produces waste that stays dangerously radioactive for thousands of years **or** radioactive waste has to be stored safely for thousands of years (1)

accept the cost of installation and decommissioning is high

2

(b) any four from:

(wind power)

no marks are given for choosing the correct non-renewable energy source

- considered unsightly / visual pollution (1) very large areas of land (1)
- noisy for people living nearby / noise pollution (1)

(tidal power)

no marks are given for choosing the correct non-renewable energy source

- barrages / visual pollution (1)
- destroys the habitat of many living organisms (1)

(hydroelectricity)

no marks are given for choosing the correct non-renewable energy source

- damming / visual pollution (1)
- very large areas of land (1) flooding (1)

4

[6]

Q10.

*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 /

STEMUP.CO.UK

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]

Q11.

(a) 20

accept twenty

1

(b) correct division 35/15

1

larger area labelled coal

accept smaller area labelled oil

1

(c) can be started up very quickly

1

(d) (i) carbon dioxide

1

(ii) sulphur dioxide

accept nitrogen oxidestotal

1

[6]

STEMUP.CO.UK

Q12.

(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]

Q13.

(a) mark independently

(from) gravitational

accept potential
do not credit stored

1

(to) kinetic

accept movement

1

(b) **advantage**

STEMUP.CO.UK

* the current can be low (for the same power)
* less energy **or** heat loss **or** power loss

accept the cables do not have to be (so) thick

accept less cost to support higher (rather than heavier) cables

accept aluminium can be used and aluminium is cheaper than copper

*do not credit efficient **or** cheaper*

do not credit no loss of energy

do not credit electricity loss

2

disadvantage

* it is difficult to insulate high voltage
* pylons have to be taller and so more expensive

...to give a good separation between them and the ground /people/high vehicles

***or** ... to prevent/reduce the danger of electric shock **or** lethal*

do not credit dangerous

do not credit get a shock

*do not credit reference to step down transformers **or** electromagnetic field*

2

[6]

Q14.

(i) gravitational **or** potential

do not accept stored

1

light

credit solar

1

kinetic **or** movement

credit moving

1

chemical

1

(ii) any **one** from

gas

coal

1

(iii) any **one** from

oil

*do not accept petrol **or** paraffin*

STEMUP.CO.UK

peat **or** turf
nuclear

*credit coal **or** gas if not given as answer to part (ii)*
*do not accept wood **or** fossil fuel **or** chemical*

1

[6]

Q15.

(a) sectors nearer to correct value than to 1% either side
coal 35%
nuclear 5%
gas 24%
moving water 1%

each for 1 mark -
to a maximum of 3 marks
deduct 1 mark if sector left blank

three sectors labelled correctly w.r.t. rank order of size

for 1 mark

4

(b) (fossil) fuels (*allow* combustible/flammable/non renewable)

1

(c) moving water/hydro
wind/waves/tides/solar (*allow* geothermal/
wood/biomass)

each for 1 mark

2

(d) any indication that we get more (energy from nuclear sources)

gains 1 mark

but
5 times as much/more

gains 2 marks

2

[9]

Q16.

(a) *sectors closer to correct value than ± 1%* nuclear (5%)
gas 24% moving water 1%

each for 1 mark
maximum of 2 marks

3

sectors labelled correctly w.r.t. rank order of size

for 1 mark

But deduct 1 mark if not all sectors used

(b) 5 × as much (do **not** credit simply more/4% more)
4 × as much

1

STEMUP.CO.UK

(c) wind/waves/solar/tides
(allow geothermal/wood/biomass)

any one for 1 mark

1

(d) *idea that*
electricity is a secondary/man made source/needs another source to produce it

for 1 mark

1

[6]

Q17.

$\frac{3}{20} \quad \frac{0.3}{}$

each for 1 mark

[3]

Q18.

(a) cooking and heating water 30
heating rooms 50

each for 1 mark

2

(b) <u>coal</u>
idea that amount used fell/declined/line goes down

gains 1 mark

but *idea that* fall/decline is steady/gradually/approx halved

gains 2 marks

<u>gas</u>
ideas that
amount used rose/increased
in/from 1980/more used before 1980/ref to 1980
as an important date/*rapid* increase in use
(*credit idea that* gas>coal from c.1990
<u>in either part with 1 mark</u> (to maximum 4)

each for 1 mark

max 4

(c)
- *less* carbon dioxide produced
- less change to weather/food production/gained warming/water levels (no mark for "greenhouse gas" alone)
- no/less sulphur dioxide produced/coal produces sulphur dioxide
- less acid rain/damage to fish/buildings/trees/crops/animals/tumours etc (do not credit reference to cost unless : cheaper <u>so can spend more on environment</u>)

("It" used in an answer will refer to "gas") any 3 for 1 mark each

3

STEMUP.CO.UK

[9]

Q19.

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 <u>in winter</u>
- 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 <u>allowed</u>, though not <u>required</u>)

any ten for 1 mark each

[10]

STEMUP.CO.UK