M1. (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]

M2. (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]

M3. (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]

M4. (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) <u>fission</u>

1

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

1

(b) <u>carbon dioxide</u> is not released (into the atmosphere)

1

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

1

[6]

M5. (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** marksallow **1** mark for using 720*
value <u>only</u> 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]

M6. (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 CO_2 / SO_2 / 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]

M7. (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]