Mark schemes

1

(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]

2

(a) (i) 0.75

*allow **1** mark for correct transformation and substitution*

ie 0.15 = 5

2

(ii) 2

accept 1.5 ÷ their (a)(i) correctly calculated

1

(b) any **one** from:

- seasonal <u>changes</u>

  accept specific <u>changes</u> in conditions

  eg shorter hours of daylight in winter

- cloud cover

  accept idea of <u>change</u>

  must be stated or unambiguously implied

  eg demand for water will not (always) match supply of solar energy

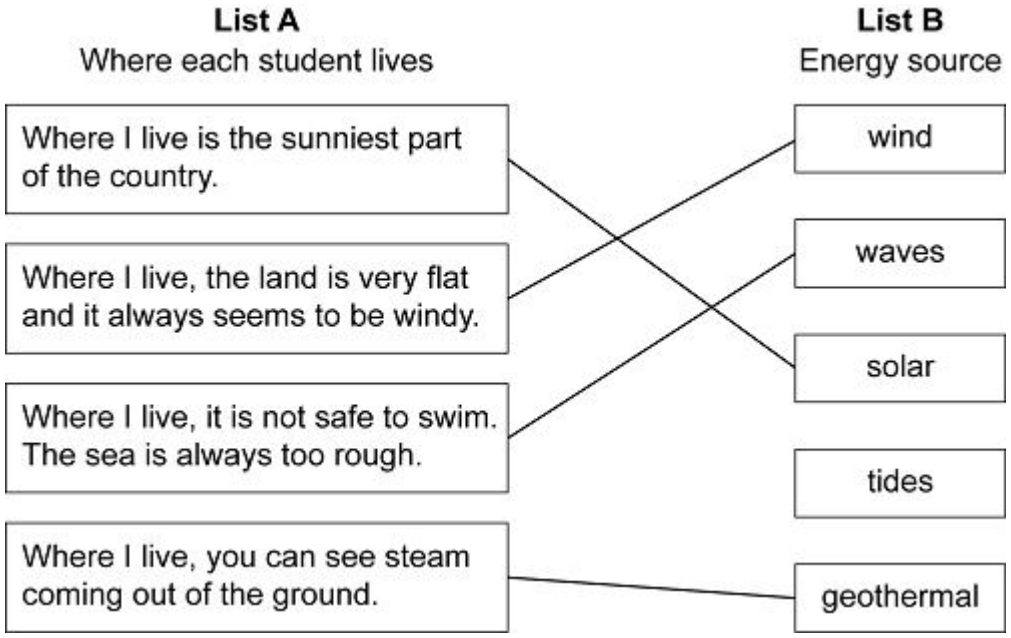
  *do **not** accept figures are average on its own*

  *do **not** accept solar panels are in the shade*

1

[4]

3 (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]

4

(a) (i) 2.1

correct answer only

1

(ii) 3.15

or

their (a)(i) × 1.5 correctly calculated

*allow **1** mark for correct substitution*

ie 2.1 × 1.5

or

their (a)(i) × 1.5

2

kilowatt-hour

accept kWh

or

*a substitution 2100 × 5400 scores **1** mark*

*2100 × 5400 incorrectly calculated with answer in joules scores **2** marks*

*an answer of 11 340 000 scores **2** marks*

*an answer of 11 340 000 J scores **3** marks*

1

(iii) most (input) energy is usefully transformed

accept does not waste a lot of energy

accept most of the output / energy is useful

*do **not** accept it does not waste energy*

1

(b) the room is losing energy / heat

1

at the same rate as the heater supplies it

this mark only scores if the first is scored

*do **not** accept heater reaches same temperature as room / surroundings*

rate of heat gain = rate of heat loss scores both marks

1

[7]

5

(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 CO_2 / carbon emissions reduced

- energy source is free

- energy source / tides are predictable

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

  accept no CO_2 / 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]

6 (a)

accept 'the humpback bridge' symbol

accept circle with cross but no lines

if more than one symbol drawn, no mark unless lamp is labelled

1

(b) (i) 24

*allow **1** mark for correct substitution ie* $\frac{2800}{120}$

*allow **1** mark for an answer 1440*

ignore any unit

2

(ii) watt

1

(c) larger than

accept correct indication inside the box

accept an answer meaning larger than ie greater than

1

[5]

7 (a) (i) 0.2 **or** 1/5

accept 20% for both marks

*allow **1** mark for correct substitution answer of 0.2%*
***or** 20 gains **1** mark*
ignore units

2

(ii) wasted

accept transformed to heat / other forms
accept transferred to the air / surroundings sound = neutral

1

(b) (i) any **one** from:

- can fly at night

  accept can fly when it is cloudy
  accept as a back-up

- can stay in the air for longer
- can fly in the winter
- can fly faster

  increases power is neutral

1

(ii) 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

(iii) accept any sensible suggestion eg, map the Earth's surface / weather forecasting / spying / monitoring changes to the Earth's atmosphere, etc

*do **not** accept ideas in terms of transporting*
accept use as a satellite

1

[6]

8 (a) (i) any **one** from:

- waves
  *do **not** accept water*
- tides
- falling water
  accept hydroelectric
- biofuel / biomass
- solar
  accept sun / sunlight
  *do **not** accept light*
  accept solar cells / panels
- geothermal
  *do **not** accept heat*

1

(ii) decrease

1

(b) (i) increases from 4am (to 8am) remains constant from 8am (to 10am)

accept increases from 30 000
accept stays constant from 40 000
*allow **1** mark for goes up then stays the same*
for full credit must be some indication of time or power

2

(ii) natural gas

1

[5]

9 (a) (i) silvered surfaces

more than the correct number of ticks in a row negates the mark

radiation

2

plastic cap

conduction, convection (both required)

	conduction	convection	radiation	
vacuum	✓	✓		
silvered surfaces			✓	(1)
plastic cap	✓	✓		(1)

(ii)

any mention of air or any other substance in a vacuum scores zero

because there are no particles in a vacuum

accept atoms / molecules for particles
accept vacuum is empty space
accept there is nothing in a vacuum
accept there is no air / gas in the vacuum

conduction **and** convection need particles / medium

*need reference to both conduction **and** convection*
accept correct descriptions

2

(b) (i) less heat lost (to air above the heater)

*do **not** accept **no** heat lost*

light shiny surfaces are poor emitters (of radiation)

accept radiators for emitters
references to reflection are neutral

or dull, matt surfaces are good emitters (of radiation)

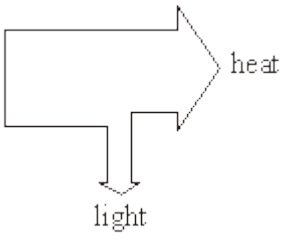
*do **not** credit answers which infer reflection from the underside of the hood*
ignore correct reference to absorption

2

(ii) correct diagram drawn with one output arrow narrower than the other

ignore input

arrows correctly labelled with energy form
eg



flow charts score zero

2

(iii) energy cannot be destroyed

accept (principle of) conservation of energy

*do **not** accept because energy cannot be lost without clarification*

1

[9]

10 (a) 32,400,00 J

*allow **1** mark for correct substitution*

$3.24 \times 10^{\wedge 7}$ J

2

(b) (3kW) fan heater

accept 3kW

accept the middle one

1

(c)

features common to more than one heater, treat as neutral

<u>oil-filled</u>

low level heat

cannot be knocked over / space saving / no trailing wires

*do **not** accept just wall-mounted*

or more control over heat output

*do **not** accept just 3 heat settings*

1

<u>fan</u>

warms (office) rapidly **or** can be used to cool air (in summer)

accept can be used as a fan

accept cool air fan (setting)

accept 'it has a cool air setting in case it gets too hot'

*do **not** accept a specific reference to cooling the heater*

1

<u>ceramic</u>

can be switched on for set periods of time

*do **not** accept just has a timer*

or can be switched on before office is used / switched off automatically at night

1

[6]

11 (a) 1/25 **or** 1:25 **or** 0.04

accept 4 % or $\frac{15}{375}$ *or* $\frac{3}{75}$ *or 1 in 25 for both marks*

*allow **1** mark for total of 375*

*allow **1** mark for a clearly correct method using a clearly incorrect total*

*do **not** accept 1:26*

2

(b) (i) **B**

*do **not** credit reason if **B** is not chosen*

1

(only) burning fossil fuels produces carbon dioxide / carbon (emissions)
or nuclear fuels don't produce carbon dioxide

insufficient – smallest amount of fossil fuels

accept less carbon dioxide

1

(ii) accept anything reasonable eg

increased level of insulation

use energy efficient light bulbs

do not leave appliances on standby

switch thermostats down (1°C)

generate own electricity

install solar panels

accept insulate

accept specific examples eg loft

1

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

- no power output until wind speed exceeds 4m/s
- output rises rapidly after 4m/s
- output begins to level out / rises less rapidly at / after 13m/s
- output peaks at 21 / 22m/s
- output constant between 21 / 22 and 25 / 26 m/s
- output falls (rapidly) after 25 / 26m/s

*accept for **1** mark goes up then comes down*

3

(ii) any **one** from:

- unreliable energy source
- dilute energy source
- take up too much land

accept wind does not always blow
accept need thousands / lots of turbines
ignore reference to visual / noise pollution
ignore reference to kill birds

1

[9]

12 (a) grid

accept any unambiguous indication

1

(b) (i) A (only)

1

(ii) D (only)

1

(c) more than

accept any unambiguous indication

1

[4]

13 (a) electrical

1

sound

correct order only

1

(b) the energy transformed by the TV will be destroyed

1

(c) a higher efficiency than

1

[4]

14 (a) (i) an unreliable energy source

1

(ii) a predictable energy source

1

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

1

(c) greater than 4 %

1

[4]

15 (a) (i) France

1

(ii) any **one** from:

- different homes have different appliances(*)
- different homes have different numbers of appliances(*)
  (*) accept all homes are different
- standby power not the same for all appliances
- some people will switch appliances off
  accept named appliances
  accept people waste different amounts of energy
- homes have different numbers of residents
- can't measure every (individual) home
  accept any sensible suggestions
  *do **not** accept answers in terms of accurate / precise etc*

1

(b) (i) increases amount of energy wasted
accept (encourages) people to leave appliances on (standby)
accept increases it

1

(ii) any **two** from:

- less electricity needed / generated
- fewer power stations needed
- less coal is burned

  *do **not** accept coal is non-renewable / running out*

  answers in terms of fuel stocks neutral
- less pollutant gases produced

  accept named gases
  accept harmful for pollutant
  accept greenhouse gases
  accept reduce / slow / stop global warming
  accept reduces acid rain

2

(c) joule

1

(d) (i) 6800

*accept £68 for **3** marks an answer of 68 gains **2** marks*

*allow **2** marks for correct substitution ie 400 × 17*
*allow **1** mark for obtaining 400*

*answers of 7480, 4760, 12920, 4080 gain **2** marks*

3

(ii) a small . . . . . electricity

1

[10]

16 (a) (i) 0.6

accept 60 %
*allow **1** mark for useful energy = 480*
*answer 0.6 with any unit or 60 gains **1** mark only*

2

(ii) transferred to surroundings

accept goes into the air
accept heats the surroundings up
accept gets spread out
accept transferred into heat (only)

*do **not** accept wasted / lost unless qualified*
destroyed negates mark
transferred into light / sound negates mark

1

(b) (i) 1.75

*allow **1** mark for converting to kW*

*answers of 0.7, 0.525, 0.35, 0.875, 1.05, 5.25 gains **1** mark*
*answers of 1750 or 17.5 gains **1** mark*

2

(ii) 21p or £0.21 or their (b)(i) × 12

1

(c) any **two** from:

- (more) electricity needs to be generated
  (more) electricity is being used
- (more) power stations needed
- (more) fossil fuels burnt
  accept named fossil fuel
- (more) pollutant gases emitted
  accept named gas
  accept harmful for pollutant
  accept greenhouse gases
  accept atmospheric pollution
  accept answer in terms of any form of electricity generation and an associated environmental problem

2

[8]

17 (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 <u>and</u> increase in (proportion of) coal / nuclear / gas

1

(b) (i) (nuclear) fission

accept fision

*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 CO_2

1

(increased) CO_2 increases / contributes to / causes global warming / greenhouse effect

mention of ozone layer negates this mark

*do **not** accept CO_2 warms atmosphere*

1

[9]

18 (a) any **two** from:

- (burning) fossil fuels produces greenhouse gases / pollutant gases / acid rain / leads to global warming

  accept a named fossil fuel

  accept a named pollutant gas

- nuclear fuels produce dangerous waste

  accept radioactive for dangerous

  accept reference to dangers of nuclear fuels

- fossil fuels are non-renewable

  accept running out of fuels

- renewable energy resources produce no pollutant gases

- large amounts of energy are available

  accept renewable won't run out

- running costs are low

  accept any reasonable benefit of renewables

  accept any reasonable drawback of non-renewables

  *do **not** accept better for the environment on its own*

2

(b) **R U S T**

all in correct order

*allow **2** marks for 2 correct*

*allow **1** mark for one correct*

3

[5]

19 (a) (i) small proportion of energy / power is wasted

accept little / less energy / power / heat is wasted

*do **not** accept it wastes no energy / power*

or transfers most / more / a lot of energy power usefully

1

(ii) it decreases the current / uses low current

or *it* increases the voltage / potential difference

accept pd for potential difference

1

or uses high voltage / potential difference

smaller the current the smaller the energy loss

accept power / heat for energy

1

(b) (i) as a control

accept to make a comparison

*do **not** accept fair test on its own*

1

(ii) so people know how much data the link was based on

accept idea that larger numbers are better

or

people can judge the significance / reliability of the link

*do **not** accept significance / reliability on its own*

ignore reference to accuracy

1

(iii) other possible factors may be responsible

1

or have not been investigated

named factor eg environment / genetic

1

(iv) first box ticked plus reason

acceptable reason such as so people know there may be a risk as soon as possible / so that other scientists can use findings

or second box plus reason

acceptable reason such as no point to worry / confuse / panic people (until the research has been confirmed)

accept idea that it may lead to wrong advice

*do **not** accept in case they are wrong*

1

[8]

20 (a) £15

*allow **1** mark for use of 125 (kWh)*

*allow **1** mark for an answer 1500*

*allow **both** marks for 1500 pence / p*

*allow **1** mark for correct calculation of annual cost for either freezer (£27 and £42)*

2

(b) £45

or their (a) × 3

*allow **1** mark for correct use of 3*

*allow **1** mark for 12 – 9 = 3*

2

(c) any **two** from:

the marks are for the explanation

yes **plus** explanation

- less electricity / energy needed / used

  accept less energy wasted

- less (fossil) fuels burned

  accept a named fossil fuel
  *do **not** accept conserving (fossil) fuels*

- less polluting gases emitted

  accept a named polluting gas / greenhouse gases / carbon emissions / reduce global warming
  accept an answer in terms of nuclear fuel
  eg less nuclear fuel required (1)
  less nuclear waste (1)

2

or no **plus** explanation

- old freezer must be disposed of
- hazardous chemicals inside freezer

  accept CFC gases

- *(*lot of*)* energy used in producing new freezer

[6]

21 (a) (i) makes it warmer / raises the temperature

accept produces convection (current)
accept makes it less dense

1

(ii) reduced **or** slows down

1

(b) (i) electrical energy (to run the pump) must be paid for

accept electricity for electrical energy
accept electricity is needed for the pump
accept it uses electricity
accept because of the pump

1

(ii) more useful (heat) energy is transferred into the house than the energy used to operate the pump

or reduced cost of heating the house is greater than the cost of running the (electrical) pump

or costs little to run compared to the savings made

*accept for **1** mark*

reduces energy bills

***or** reduced fuel costs / heating costs owtte*

*do **not** accept it's cheap*

2

[5]

22 (a) iron

1

hairdryer

1

kettle

answers can be in any order

1

(b) sound

1

(c) is more efficient than

1

[5]

23 (a) gas

1

oil

1

(b) (both) use steam to drive a turbine

accept (both) use turbines to drive generators

*do **not** accept both have a turbine /generator / use steam*
must describe a step in the process

accept heat / thermal energy transformed to kinetic / electrical energy

1

(c) 140 (°C)

correct answer only

*allow **1** mark for method clearly shown on graph*

accept a cross or other indication at correct position on the line

accept correct description

accept even if numerical answer is incorrect

2

(d) any **one** from:

*do **not** accept answers purely in terms of disadvantages of other methods except for fossil fuels are running out*

- very large energy source / reserves
- no polluting / harmful gases produced

  accept named gas CO_2 SO_2 NO_x

  accept reduces harmful carbon emissions
- reduces carbon emissions

  accept does not contribute to global warming
- no fuel needed
- energy is free
- can generate energy for a long time

  accept energy available for a long time
- renewable (energy source)
- fossil fuels are running out

  accept it saves fossil fuels / non-renewable

  accept reduces the amount of fossil fuels being burnt

  accept a named fossil fuel

  Better for the environment / environmentally friendly insufficient

  it is cheaper is insufficient

1

[6]

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

accept replaced as quick as it is used

accept 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(*)

(*)do __not__ accept water / oceans
accept OTEC

- fall of water

accept hydroelectric

- biomass
- geothermal

accept a named biomass / biofuel eg wood

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) 864

an answer of 108 gains __2__ marks
allow __1__ mark for using 720 value only from table
allow __2__ marks for answers 852, 816, 768, 825
allow __1__ mark for answers 106.5, 102, 96, 103 (.125)

3

(c) the solar cells will not meet demand at all times of the year / day

accept to maintain a constant supply of electricity / energy

or to make up the shortfall in energy required at certain times of the year

or to be able to sell surplus electricity (to the National Grid)

accept to provide energy at night
*do **not** accept because it's cloudy on it's own*

1

[8]

25 (a) (i) £190

nb mention idea of cost per J in £ will come to an approx figure full credit given

*allow **1** mark for showing that the energy loss through the roof is ¼ of the total energy loss ie 150 / 600*

2

(ii) £142.50

allow ecf 50 % of their (a)(i) × 1.5 ie their (a)(i) × 0.75

1

(b) transferred to surroundings / atmosphere

or becomes spread out

1

[4]

26 (a) kinetic

accept movement

1

(b) (i) 3 (kWh)

allow 1 mark for selecting the correct information

1

(ii) transfers more energy

accept transform or use for transfer

accept electricity for energy

*allow higher (average) power **and** switched on for more time*

2

(iii) any **one** from:

- use the internet
- brochures
- reading adverts
- visiting shops
- recommendation from friends / plumbers

1

[5]

27 (a) (i) as a source of thermal <u>radiation</u>

accept heat for thermal radiation

accept to act as the Sun

*do **not** accept sunlight alone*

1

(ii) any **one** from:

- volume of water

  accept amount for volume

- distance between lamp and boiling tube
- initial / starting temperature of water
- same room temperature

  *do **not** accept time or same insulation material*

1

(iii) any **one** from:

- greater sensitivity / precision

  *do **not** accept more reliable (negates mark)*

- could link to a computer for (automatic) data analysis
- could take more frequent readings
- reduces instrument reading error

  accept more accurate

  *do **not** accept easier to use on its own*

1

(b) (i) acts as a control

accept to be able to make a comparison

accept to see the difference

*do **not** accept 'to make it a fair test' OWTTE on its own*

1

(ii) (plastic) foam and aluminium foil

1

(iii) (aluminium) foil is a poor absorber of thermal radiation

accept heat / infra red for thermal radiation

1

or (aluminium) foil is a (good) reflector of thermal radiation

*do **not** accept 'reflects sunlight' on its own*

(plastic) foam traps air which is a (good) insulator

accept (plastic) foam is a poor conductor / (good) insulator

*do **not** accept 'the material' is a good insulator / poor conductor*

1

(c) particles vibrate with a bigger / stronger amplitude / faster / with more (kinetic) energy

accept particles vibrate more

*do **not** accept start to vibrate only*

1

energy transferred by collisions with other particles

*do **not** accept answers in terms of free/mobile electrons*

1

[9]

28 (a) only accept answers in terms of the argument of the nuclear power scientist any **three** from:

- produces a lot of energy for a small mass of fuel **or** is a concentrated energy source
  accept amount for mass
- it is reliable **or** it can generate all of the time
- produces no pollutant gases
  *accept named gas or greenhouse gases do **not** accept no pollution*
- produces only a small volume of (solid) waste
  accept amount for volume
- advances in technology will make fuel reserves last much longer
  accept an argument in terms of supply and demand

3

(b) any **one** from:

- may leak into the ground / environment
- geological changes
  accept earthquakes etc
- may get into the food chain
  *do **not** accept answers in terms of property prices or 'damages the environment'*
- over time if location not correctly recorded it may be excavated

1

(c) any **three** from:

- overall add no carbon dioxide to the environment
  accept do not add to global warming
  accept they are carbon neutral
- power companies can sell electricity at a higher price
  accept power companies make more profit
- opportunity to grow new type crop
  accept specific examples e.g. growing plants in swamps
  accept extends the life of fossil fuel reserve
- more jobs
- more land cultivated **or** different types of land utilised

3

[7]

29 (a) (i) grid
accept any way of indicating correct answer

1

(ii) increases voltage
accept any way of indicating correct answer

1

(iii) 230 V
accept any way of indicating correct answer

1

(iv) reduce
accept any way of indicating correct answer

1

(b) (i) increases the temperature
accept make it hotter / heat goes into the air
accept convection currents
accept sensible comment eg sound energy / it buzzes
ignore pollutes the air

1

(ii) less than 100%

1

[6]

30 (a) coal

1

(b) fossil fuels can be used to generate electricity at any time

if more than 2 boxes ticked, mark incorrect boxes first

1

a few large power stations can generate the electricity for a million homes

1

(c) (i) no fuel is burnt

accept a named fuel

accept nothing is burnt

accept does not use (fossil) fuel

1

(ii) kinetic

1

(iii) any **two** from:

- cause noise pollution
- cause visual pollution

accept causes pollution for 1 mark

- need concrete for bases
- new roads / infrastructure needed
- may interfere with TV / radio / mobile phone signals
- dangerous to birds
- do not generate all of the time

accept generates only when the wind blows

*do **not** accept 'generate when the wind blows'*

- need a lot of generators

*do **not** accept 'take up a lot of space / land'*

- high initial / capital costs
- reduces house prices

2

[7]

31 (a) (i) 7pm

accept 19.00 / 1900

1

(ii) 8pm

accept 20.00 / 2000

1

temperature drops more slowly

accept heat for temperature accept line is less steep

1

(b) insulator

1

conduction *

1

convection *

** answers can be either way around*

1

(c) (i) 4 (years)

1

(ii) it is the cheapest / cheaper / cheap

*do **not** accept answers in terms of heat rising or DIY*

1

has the shortest / shorter payback time

*do **not** accept short payback time*

1

[9]

32 (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]

33 (a) four calculations correctly shown

200 × 10 – 1800 = £200
100 × 10 – 2400 = –£1400
50 × 10 – 600 = –£100
20 × 10 – 75 = 125

*accept four final answers only **or** obvious rejection of solar water heater and underfloor heating, with other two calculations completed any 1 complete calculation correctly shown **or** showing each saving × 10 of all four calculations = 1 mark*
*answers in terms of savings as a percentage of installation cost **may** score savings mark only*

2

hot water boiler

correct answers only

1

(b) less electricity / energy to be generated / needed from power stations

accept less demand

1

reduction in (fossil) fuels being burnt

accept correctly named fuel

accept answer in terms of:
fewer light bulbs required because they last longer (1 mark)
less energy used / fuels burnt in production / transport etc. (1 mark)

ignore reference to CO_2 or global warming

ignore reference to conservation of energy

1

[5]

34 (a) gas

1

(b) fuel burning stations produce electricity at any time / all the time

accept fuel available all the time

1

wind generator can only produce when the wind is strong enough

accept it's not always windy

1

(c) no fuel is burnt **or** no fuel is used **or** uses only energy from wind **or** does not emit harmful gases / soot / smoke

*do **not** accept wind is natural / environmentally friendly / renewable*
*answer must be in terms of wind, **not** negative of fuel burning*
specific examples of gases CO_2, SO_2,
acid rain and greenhouse gases can be accepted
ozone negates credit

1

[4]

35 (a) (i) heat

1

(ii) temperature increases **or** (cause) convection (currents)

accept gets warmer
accept gets hotter

1

(iii) 60% **or** 0.6

60 without % scores 1 mark
0.6 with a unit scores 1 mark
60 with incorrect unit scores 1 mark

or correct substitution $\frac{120}{200}$
for 1 mark

2

(b) street

1

more (energy transferred as) light or less (energy transferred as) heat or useful energy output the highest

can only score this mark if first mark scored
all efficiencies calculated correctly score 2nd mark point

1

[6]

36 (a) generator

accept dynamo
accept alternator

1

(b) (i) 1400

ignore units

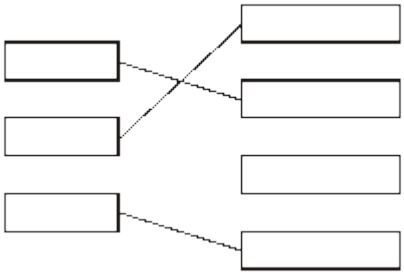
1

(ii) 0.3 or 30%

*any incorrect unit penalise **1** mark*
*allow **1** mark for the correct use of 600*
***or** 0.3% **or** 30*

2

(c) **1** mark for each correct link



if more than 3 lines are drawn, mark only
3 lines starting with those that are incorrect

3

(d) (i) 110

no tolerance

1

(ii) 12

no tolerance

1

(iii) wind speed may be too low to operate the generator

accept wind may not always blow
accept power depends on wind speed
accept does not generate if wind speed is too high
accept does not generate if wind speed is above 12 (m/s)
accept does not generate if wind speed is below 1.6 (m/s)
accept it is unreliable
*do **not** accept answers referring to cost only*

1

[10]

37 (a) hydrogen converted to helium

1

(nuclear) fusion

1

((small) loss in mass) which is converted to large amount of energy

1

(b) (i) any **two** from

it is running out/ takes millions of years/finite

not *non renewable*

allow acid rain ***do not*** *allow waste*

pollution **or** problem with CO_2 production

allow a specific example

more responsible to use fossil fuels for (important) chemical functions

2

(ii) any **three** from

need lots of land for generators **or** many generators needed

generators may not be conveniently located

uncertainty of supply

accept the wind may not always blow

social resistance **or** visual pollution

noise pollution

high initial costs

(possible) interference with (local) radio and TV signals

3

[8]

38 (a) internal **or** thermal **or** heat **or** kinetic **or** movement

electrical

both answers required for ***one*** *mark*

1

(b) (i) Sun **or** solar

do ***not*** *accept sunshine*

1

(ii) any **one** of the follow:

- wind turbines produce no (gaseous) pollutants
- wind turbines use renewable energy
- wind turbines produce no (solid) waste
- reduced running costs

*do **not** allow safety*

1

a supporting statement **or** comparison **or** explanation

1

[4]

39 (a) (i) 3

1

(ii) 1

accept a definition of frequency ignore units

1

(iii) hertz

1

(b) straight line in correct direction

judge by eye (from 'a' of waves to 's' of across) ignore arrow
accept equal angles shown on waves

1

(c) (i) gets smaller

1

(ii) kinetic

accept movement

1

(iii) renewable

1

[7]

40 (a) (i) photosynthesis for growth

accept plants require sunlight for growth

1

plants change into coal

any mention of animals negates second mark

1

(ii) burning

*do **not** accept heating*

accept combustion

1

(b) (i) heat

1

(ii) less heat radiated into space

accept increased insulation round earth

accept reflects heat back to earth

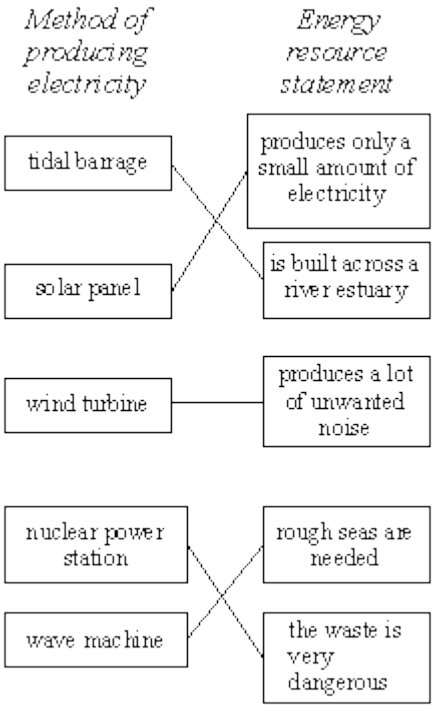
accept greenhouse effect

*accept traps heat **or** energy*

1

[5]

41 (a) (i) correct links shown



4

*1 link for **1** mark*
*2 links for **2** marks*
*3 links for **3** marks*
4 *links for **3** marks*
5 *links for **4** marks*
*do **not** credit if more than one link goes to **or** from any box*

(ii) nuclear (power station)

*do **not** accept power station*

1

(b) (i) heat from the Sun

1

(ii) kinetic

1

(iii) insufficient wind (to turn turbine)

accept wind does not always blow

*do **not** allow it does not always work or it is switched off*

*do **not** accept wind in wrong direction*

1

[8]

42 any **one** from:

*basic idea of reduced use of fuels to heat homes **or** offices **or** shops for **1st** mark*

less (heat) energy wasted (to the environment)

reduced demand for fuels to heat homes etc

simply re-quoting figures gets no credit

1

any **one** from:

*idea of less pollution for the **2**nd mark*

reduced (air) pollution

*do **not** accept no pollution*

fewer power stations required **or** less electricity needs to be produced

less (fossil) fuels being burnt (in power stations)

reduced greenhouse effect

reduced global warming

1

[2]

43

(a) (i) sources of energy

for 1 mark

(ii) wood coal
oil
gas

all correct gains 2 marks
3 correct gains 1 mark

3

(b) geothermal nuclear
tides
wind
solar

all correct gains 2 marks
4 correct gains 1 mark

2

(c) non-renewable fuels cause pollution (or reverse)
conserve/limit use of coal/gas/oil;
so supplies last longer/renewable sources can be replaced

any 2 from 4 for 1 mark each

2

[7]

44 light;
sound;
heat;
kinetic/movement

for 1 mark each

[4]

45 (i) reduces

for 1 mark

1

(ii) less heat/energy/power wasted (in power lines)

for 1 mark

1

(iii) for safety

for 1 mark

1

[3]

46 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	Initial cost
	No pollution	Many windmills/much land
	Close/low transmission costs	Calm day problem
	No fuel costs	Few long term jobs
	Renewable energy resource	

Coal	Waste land to North	Pollution
	Prevailing wind to East	Initial costs
	Good road/rail transport	Fuel costs
	Close/low transmission costs	Non-renewable energy
	Save coal industry	Resource
	Overall labour intensive	
Hydroelectric	No pollution	Possible drought
	Mountains/lake/river nearby	Distant/transmission costs
	No fuel costs	Few jobs created
	Renewable energy source	Possible expensive underground transmission cable
		Construction of dam affects environment

[8]

47 (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]

48 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]

49 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]

50 (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]

51 (a) product of mass and velocity

1

(b) (i) 4kg or 4000g

1

(ii) M = 8kgm/s or Ns
for 3 marks

else M = 8
for 2 marks

else M – mv or 4 × 2
for 1 mark

3

(iii) 8 kgm/s (watch e.c.f.)

1

(iv) v = 400
for 3 marks

else v = 8/0.02
for 2 marks

else M – mv, v – M/m or 8 = 0.02v
for 1 mark

3

(v) ke = 8

for 3 marks

else ke = 1/2 (4×2^2)

for 2 marks

else ke = 1/2 (mv^2)

for 1 mark

3

(vi) transferred to heat and sound
or does work against wood/pushing wood aside/deforming bullet

1

[13]

52 (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

<u>pro-nuclear</u> examples
fuel cheap
no foreseeable fuel shortage

<u>pro-coal</u> 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]

53 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]

54 (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

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]

55 *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]

56 newton **or** N

metre **or** m

joules **or** J

all three correct 2 marks
two or one correct 1 mark

[2]

57 (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

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]