**Mark schemes**

Q1.

(a) weight (lifted)

or

height (lifted)

1

(b) any two from:

• calculate a mean

• spot anomalies

• reduce the effect of random errors

2

(c) as speed increases, the efficiency increases

1

(but) graph tends towards a constant value

or

appears to reach a limit

accept efficiency cannot be greater than 100%

1

(d) heating the surroundings

1

(e) 0 (%)

1

[7]

Q2.

(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]

Q3.

(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]

Q4.

(a) field

correct order only

1

current

1

force

accept motion

accept thrust

1

(b) (i) arrow pointing vertically downwards

1

(ii) increase current / p.d.

accept voltage for p.d.

1

increase strength of magnetic field

accept move poles closer together

1

(iii) reverse (poles of) magnets

1

reverse battery / current

1

(c) (i) 1.5 or 150%

efficiency = 120 / 80 (× 100)

gains 1 mark

an answer of 1.5 % or 150

gains 1 mark

2

(ii) efficiency greater than 100%

or

output is greater than input

or

output should be 40 (W)

1

(iii) recorded time much shorter than actual time

accept timer started too late

accept timer stopped too soon

1

[12]

Q5.

(a) chemical

correct order only

1

kinetic

1

sound

1

(b) 48% or 0.48

an answer of 0.48 with a unit gains 1 mark

an answer of 0.48% gains 1 mark

an answer of 48 with or without a unit gains 1 mark

2

[5]

Q6.

(a) (i) 150

1

(ii) transferred to the surroundings by heating

reference to sound negates mark

1

(iii) 0.75

450 / 600 gains 1 mark

accept 75% for 2 marks

maximum of 1 mark awarded if a unit is given

2

(iv) 20 (s)

correct answer with or without working gains 2 marks

correct substitution of 600 / 30 gains 1 mark

2

(b) (i) to avoid bias

1

(ii) use less power and last longer

1

1 LED costs £16, 40 filament bulbs cost £80

or

filament costs (5 times) more in energy consumption

1

(iii) any one from:

• availability of bulbs

• colour output

• temperature of bulb surface

1

[10]

Q7.

(a) (i) temperature (increase) and time switched on are directly proportional

accept the idea of equal increases in time giving equal increases in temperature

answers such as:

• as time increases, temperature increases

• positive correlation

• linear relationship

• temperature and time are proportional

score 1 mark

2

(ii) any one from:

“it” refers to the metal block

• energy transfer (from the block) to the surroundings

accept lost for transfer

accept air for surroundings

• (some) energy used to warm the heater / thermometer (itself)

accept takes time for heater to warm up

• (metal) block is not insulated

1

(iii) 15 000

allow 1 mark for correct substitution, ie 50 × 300 provided no subsequent step shown

2

(b) lead

reason only scores if lead is chosen

1

needs least energy to raise temperature by 1°C

accept needs less energy to heat it (by the same amount)

lowest specific heat capacity is insufficient

1

[7]

Q8.

(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]

Q9.

(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]

Q10.

(a) (i)

1.6 (W)

allow 1 mark for correct substitution ie

2

(ii)

32 (%) / 0.32

or

their (a)(i) ÷ 5 correctly calculated

ignore any units

1

(b) (i) any two from:

• comparison over same period of time of relative numbers of bulbs

required eg over 50 000 hours 5 CFL’s required to 1 LED

accept an LED lasts 5 times longer

• link number of bulbs to cost eg 5 CFL’s cheaper than 1 LED

an answer in terms of over a period of 50 000 hours CFLs cost £15.50 (to buy), LED costs £29.85 (to buy) so CFLs are cheaper scores both marks

an answer in terms of the cost per hour (of lifetime) being cheaper for CFL scores 1 mark if then correctly calculated scores both marks

• over the same period of time LEDs cost less to operate (than CFLs)

2

(ii) any one from:

• price of LED bulbs will drop

do not accept they become cheaper

• less electricity needs to be generated

accept we will use less electricity

• less CO2 produced

• fewer chips needed (for each LED bulb)

• fewer bulbs required (for same brightness / light)

• less energy wasted

do not accept electricity for energy

1

[6]

Q11.

(a) any two from:

• black is a good emitter of (infrared radiation)

accept heat for radiation

ignore reference to absorbing radiation

• large surface (area)

• matt surfaces are better emitters (than shiny surfaces)

accept matt surfaces are good emitters

ignore reference to good conductor

2

(b) 90% or 0.9(0)

allow 1 mark for correct substitution, ie

provided no subsequent step shown

an answer of 90 scores 1 mark

an answer of 90 / 0.90 with a unit scores 1 mark

2

(c) (producing) light

allow (producing) sound

1

(d) any two from:

• wood is renewable

accept wood grows again / quickly

accept wood can be replanted

• (using wood) conserves fossil fuels

accept doesn’t use fossil fuels

• wood is carbon neutral

accept a description

cheaper / saves money is insufficient

2

(e) E = m × c × θ

2 550 000

allow 1 mark for correct substitution

ie 100 × 510 × 50

provided no subsequent step shown

answers of 1 020 000, 3 570 000 gain 1 mark

2

joules /J

accept kJ / MJ

do not accept j

for full credit the unit and numerical answer must be consistent

1

[10]

Q12.

(a) heat / thermal

or / and

sound

do not accept noise

other forms of energy eg light negates answer

1

(b) 0.4

or

40 %

allow 1 mark for

or

equivalent fraction

an answer 0.4 % gains 1 mark

answers 0.4 or 40 given with any unit gains 1 mark

40 without % gains 1 mark

2

[3]

Q13.

(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]

Q14.

(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 changes

accept specific changes in conditions

eg shorter hours of daylight in winter

• cloud cover

accept idea of change

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]

Q15.

(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]

Q16.

(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]