**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) 46 200

accept 46 000

allow 1 mark for correct substitution

ie 0.5 × 4200 × 22 provided no subsequent step

2

(b) Energy is used to heat the kettle.

1

[3]

Q4.

(a) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also apply a ‘best-fit’ approach to the marking.

0 marks

No relevant information

Level 1 (1-2 marks)

There is a relevant statement about an energy saving method

Level 2 (3-4 marks)

There is at least one clear comparison of energy saving methods and their cost effectiveness with an appropriate calculation

Level 3 (5-6 marks)

There is a comparison of energy saving methods and their cost effectiveness with appropriate calculations. Comparison to include further detail.

examples of physics points made in the response

examples of relevant statements

• energy efficient boiler saves the most (energy / money) per year

• loft insulation costs the least to install

• double-glazing costs the most to install

examples of statements that include cost effectiveness

• loft insulation is the most cost effective in the long term

• double-glazing is the least cost effective

• loft insulation has the shortest payback time

• double-glazing has the longest payback time

• payback time calculated for any method

payback times:

energy efficient boiler: 6.25 years

loft insulation: 2 years

double glazing: 100 years

cavity wall insulation: 2.86 years

examples of further detail

• for cost effectiveness install in the following order: loft, cavity wall, boiler, double-glazing

• for reducing energy use install in the following order: boiler, loft, cavity wall, double glazing

• don’t install double-glazing for insulation purposes

• double-glazing won’t pay for itself in your lifetime

• justified choice of best / worst method

6

(b) (i) how effective a material is as an insulator

accept ‘heat’ for energy

accept how effective a material is at keeping energy in

accept the lower the U-value the better the insulator

accept the lower the U-value the lower the rate of energy transfer

1

(ii) (the U-value) decreases

1

[8]

Q5.

(a) (i) 0.5 °C

1

(ii) data is continuous

or

both variables are continuous

or

independent variable is continuous

or

time is continuous

accept results / measurements for data

accept data is not categoric

one variable is continuous is insufficient

air temperature is continuous is insufficient

1

(b) (i) 20.5 (°C)

1

(ii) 60 (minutes)

accept 1 hour

1

(c) (i) so a comparison can be made

or

outside temperature is a control variable

accept:

(outside) temperature would affect energy required (to maintain temperature of the house)

or

(outside) temperature would affect internal temperature (of the house)

or

heat loss will be faster on a cold day

outside temperature will affect the results is insufficient

fair test is insufficient

1

(ii) the cost is equal to the number of kWh × the cost per kWh

accept (heating) bill depends on (number of) kWh used

accept energy for kWh

1

calculation 0.8 / 8.0 = 0.1 or 10%

allow 7.2 / 8.0 = 0.9 or 90%

1

(iii) heating is on for more / less time (than anticipated)

1

because some days it is cooler / warmer (than anticipated)

accept other sensible suggestions

an answer giving two sensible situations gains 2 marks

possible examples:

• some houses have different amounts of

insulation

• there are different styles of house

temperature (inside / outside) is always changing is insufficient

1

[9]

Q6.

(a) (i) 5(.0)

1

(ii) 35 or their (a)(i) × 7 correctly calculated

allow 1 mark for correct substitution, ie 5 or their (a)(i) × 7 provided no subsequent step shown

2

(iii) 525(p)

or

(£) 5.25

or

their (a)(ii) × 15 correctly calculated

if unit p or £ given they must be consistent with the numerical answer

1

(iv) decreases

1

temperature difference (between inside and outside) decreases

accept gradient (of line) decreases

do not accept temperature (inside) decreases

do not accept graph goes down

1

(b) air (bubbles are) trapped (in the foam)

do not accept air traps heat

foam has air pockets is insufficient

1

(and so the) air cannot circulate / move / form convection current

air is a good insulator is insufficient

no convection current is insufficient

answers in terms of warm air from the room being trapped are incorrect and score no marks

1

[8]

Q7.

(a) fan

1

drill

1

washing machine

four circled including correct three scores 1 mark

five circled scores zero

1

(b) Appliances only transfer part of the energy usefully

1

The energy transferred by appliances makes the surroundings warmer

1

[5]

Q8.

(a) kinetic

1

(b) (i) generates a lot more energy / electricity / power

need fewer conventional large-scale hydroelectric power

stations is neutral

or

can supply (energy / electricity / power) to more homes

1

(ii) Large areas of land are flooded.

1

(c) (i) National Grid

this answer only

1

(ii) less energy / heat loss (from the cables)

accept wasted for loss

accept answers in terms of fewer transformers needed

do not accept less electricity lost / wasted

do not accept no energy lost

1

(d) any one from:

• fewer rivers (suitable for generators)

• less mountainous (so rivers fall smaller distances)

accept answers in terms of difficulty linking villages and towns to grid (in Nepal)

accept answers in terms of more isolated communities

accept answers in terms of UK having more resources for large-scale power stations

1

[6]

Q9.

(a) (i) kinetic

accept KE

do not accept movement

1

(ii) 0.75

allow 1 mark for correct substitution ie

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]

Q10.

(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]

Q11.

(a) (i) radiation

1

(ii) traps (small pockets of) air

do not accept it’s an insulator

do not accept reduces conduction and / or convection

do not allow it doesn’t allow heat to escape

1

(b) (i) bigger temperature difference (between the water and surroundings)

at the start (than at the end)

do not accept water is hotter

1

(ii) starting temperature (of the water)

accept thickness of fleece

do not accept same amount of fleece

do not accept thermometer / can

do not accept time is the same

1

(iii) 18 (°C)

correct answer only

1

(iv) M

1

smallest temperature drop (after 20 mins)

cannot score if M is not chosen

accept it’s the best insulator

accept smallest loss in heat

accept keeps heat / warmth in for longer

1

[7]

Q12.

(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]

Q13.

(a) (i) as a source of thermal radiation

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]

Q14.

(a) 60% sector correct

other two sectors closer to 13:7 than 12:8 or 14:6

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

each for 1 mark

3

(b) (i) ideas that wasted energy

is transferred to surrounding air

pan

stove

is converted to another/correctly named energy form

any 2 for 1 mark each

2

(ii) 40

for 1 mark

1

[6]

Q15.

each for 1 mark

allow ‘error carried forward' to the last box’

[3]