AQA GCSE PHYSICS (HIGHER) · 8463

PHYSICS



MARK SCHEME

4.1.2.1 ENERGY TRANSFERS IN A SYSTEM

SCORE	PERCENTAGE
/144	%

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Q1.

(a) higher

1

(b) low(er)

1

hot(ter)

allow warm(er)

1

(c) advantage:

- water heated continuously (by the Sun)

1

one disadvantage from:

- temperature of water is lower (for most of the time than water heated by immersion heater)
- water may not be hot enough

allow less control over water temperature

- it takes longer to heat the water

1

(d) $\frac{4\,030\,000}{4\,070\,000}$

1

0.99

*an answer of 99% scores **2** marks*
*an answer of 99 or 0.99% scores **1** mark*

1

*an answer of 0.99 scores **2** marks*
*allow an answer that rounds to 0.99 for **2** marks*

(e) power = energy transferred / time

allow P = E / t

1

(f) $5000 = \frac{4\,070\,000}{t}$

1

$t = \frac{4\,070\,000}{5000}$

1

t = 814

1

seconds

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other units of time must be consistent with numerical value

1

*an answer of 814 seconds scores **4** marks*
*an answer of 13.57 minutes scores **4** marks*

[12]

Q2.

(a) $P = \frac{120\,000}{8.0}$

1

P = 15 000 (W)

1

*an answer of 15 000 (W) scores **2** marks*

(b) energy is transferred in heating the surroundings

1

friction causes energy to be transferred in non-useful ways

1

(c) the switches are in parallel

1

(so) closing either switch completes the circuit

1

(d) gravitational potential energy = mass × gravitational field strength × height
allow $E_p = m\ g\ h$

1

(e) $E_p = 280 \times 9.8 \times 14$

1

$E_p = 38\,416$ (J)

1

$E_p = 38\,000$ (J)
*an answer that rounds to 38 000 scores **2** marks*

1

*an answer of 38 000 scores **3** marks*

[10]

Q3.

(a) uniform acceleration
allow constant / steady acceleration
allow velocity / speed increasing at a constant rate
ignore reference to direction
*acceleration scores **1** mark*
or
*velocity / speed is increasing scores **1** mark*
*do **not** accept acceleration increases*

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2

(b) up(wards)

1

(c) a group of objects that interact

1

(d) velocity just after bounce is less than just before bounce

allow velocity is less / decreases

velocity decreases to zero − on its own scores zero

or

the height at the top of the bounce is less than the height from which it was dropped

1

so the ball has lost energy

1

correct reference to (loss of) ke or (reduced) gpe

1

total energy of ball and Earth / ground is constant

allow 'a system' for ball and Earth

allow energy is conserved

1

[8]

Q4.

(a) 20 (°C)

1

(b) largest temperature decrease

allow larger temperature decrease

1

(c) insulation is thicker

1

so temperature decrease will be lower (for all insulation types)

1

(d) Higher

1

Lower

1

(d) polyurethane foam

1

lowest thermal conductivity

1

[8]

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Q5.

(a) 80 (°C)

1

(b) **C**

1

temperature after 10 minutes was lowest
or
final temperature was lowest

*reason only scores if material **C** is chosen*
allow temperature after 10 minutes was lower

1

(c) lower total temperature rise (for all materials)

allow lower final temperature (for all materials)

1

(because) the rate of temperature increase would be lower

allow lower gradient lines

1

(d) higher resolution

1

reduced risk of misreading instrument

1

(e) polyurethane foam

no marks if polyurethane foam not chosen

1

(because it has the) lowest rate of energy transfer

1

[9]

Q6.

(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

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appears to reach a limit

accept efficiency cannot be greater than 100%

1

(d) heating the surroundings

1

(e) 0 (%)

1

[7]

Q7.

(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]

Q8.

(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]

Q9.

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(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

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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]

Q10.

(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

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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]

Q11.

(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

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(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]

Q12.

(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]

Q13.

(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

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(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]

Q14.

(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 <u>and</u> 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*

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1

as the cables are shorter

1

[7]

Q15.

(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* $\frac{2000}{5000}$
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]

Q16.

(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

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(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]

Q17.

(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

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- 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]

Q18.

(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) <u>foam</u> and aluminium foil

1

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(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]

Q19.

(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

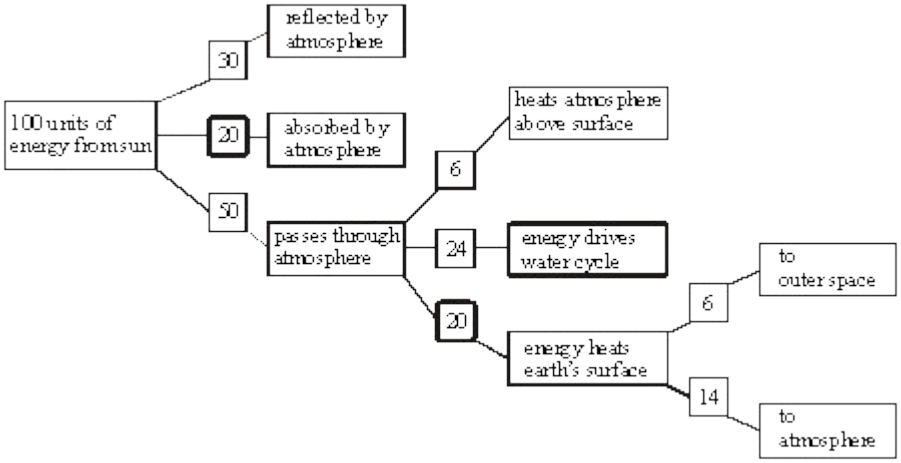
for 1 mark

1

[6]

Q20.

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each for 1 mark
allow 'error carried forward' to the last box'

[3]

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