

MARK SCHEME

GCSE

PHYSICS

AQA - TRIPLE SCIENCE

P1 - TEST 5

ENERGY

Intermediate

Mark schemes

- 1.** (a) gravitational potential 1
- kinetic 1
- chemical 1
- (b) flying drones may damage aircraft
or
falling drones may injure people
or
damage buildings / vehicles
allow any sensible suggestion of a hazard caused by a flying / falling drone 1
- (c) energy transferred = power × time
allow $E = Pt$ 1
- (d) $t = 25 \times 60 = 1500$ (s) 1
- $E = 65 \times 1500$ 1
- $E = 97\,500$ (J)
an answer of 97 500 (J) scores 3 marks
allow 2 marks for an answer of 1625 (J) 1
- [8]**
- 2.** (a) apparatus diagram to show:
- aluminium block (surrounded by insulation) 1
 - thermometer and immersion heater inside (or in contact with) aluminium 1
 - joulemeter connected to immersion heater
or
ammeter and voltmeter connected correctly around immersion heater
full credit can be given for a correct alternative method
ignore position or absence of stopclock
ignore position or absence of electric balance 1

(b)

Level 3: The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5-6
Level 2: The design/plan would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced.	3-4
Level 1: The design/plan would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1-2
No relevant content	0
Indicative content measurements: <ul style="list-style-type: none">energy (transferred) using joulemeter or ammeter, voltmeter and stopclockmass using electric balancetemperature change using thermometer SHC calculation: $E = mc\theta$ or $c = \frac{E}{m\theta}$ valid results: <ul style="list-style-type: none">repeat practical and calculate a meanplot a graph of temperature against time and use linear section of graph for temperature changesmall (eg 10 °C) temperature change (so cylinder isn't significantly hotter than surroundings) safety: immersion heater gets very hot so avoid touching (heating element) with bare hand	

6

(c) some thermal energy
transferred to the surroundings
(not to the metal block)

allow not all of the energy (as measured by the joulemeter) is transferred to the block

1

(so) temperature increase not as high as it should be for the total energy transferred

allow justification using the equation: $C = \frac{E}{m\theta}$

1

[11]

3.	(a) (i)	150	1
	(ii)	transferred to the surroundings by heating <i>reference to sound negates mark</i>	1
	(iii)	0.75 <i>450 / 600 gains 1 mark</i> <i>accept 75% for 2 marks</i> <i>maximum of 1 mark awarded if a unit is given</i>	2
	(iv)	20 (s) <i>correct answer with or without working gains 2 marks</i> <i>correct substitution of 600 / 30 gains 1 mark</i>	2
(b)	(i)	to avoid bias	1
	(ii)	use less power and last longer 1 LED costs £16, 40 filament bulbs cost £80 or filament costs (5 times) more in energy consumption	1
	(iii)	any one from: <ul style="list-style-type: none"> • availability of bulbs • colour output • temperature of bulb surface 	1
			[10]

4.

(a) 78 (°C)

allow 2 marks for correct temperature change ie 22 °C

allow 1 mark for correct substitution

ie $46\ 200 = 0.5 \times 4200 \times \theta$

or

$$\frac{46200}{0.5 \times 4200} = \theta$$

3

(b) 6.4 (W)

allow 2 marks for an answer that rounds to 6.4

allow 1 mark for correct substitution

ie $46\ 200 = P \times 7200$

an answer of 23 000 or 23 100 or 385 gains 1 mark

2

[5]

5.

(a) advantage

any **one** from:

- produce no / little greenhouse gases / carbon dioxide
allow produces no / little polluting gases
allow doesn't contribute to global warming / climate change
allow produce no acid rain / sulphur dioxide
reference to atmospheric pollution is insufficient
produce no harmful gases is insufficient
- high(er) energy density in fuel
accept one nuclear power station produces as much power as several gas power stations
nuclear power stations can supply a lot of or more energy is insufficient
- long(er) operating life
allow saves using reserves of fossil fuels or gas

1

disadvantage

any **one** from:

- produce (long term) radioactive waste
accept waste is toxic
accept nuclear for radioactive
- accidents at nuclear power stations may have far reaching or long term consequences
- high(er) decommissioning costs
accept high(er) building costs
- long(er) start up time

1

(b) (i) 12 000 (kWh)

allow 1 mark for correct substitution eg

$$2000 \times 6$$

or

$$2\ 000\ 000 \times 6$$

or

$$\frac{12\ 000\ 000}{1000}$$

an answer of 12 000 000 scores 1 mark

2

(ii) any idea of unreliability, eg

- wind is unreliable
reference to weather alone is insufficient
- shut down if wind too strong / weak
- wind is variable

1

(c) any **one** from:

- cannot be seen
- no hazard to (low flying) aircraft / helicopters
- unlikely to be or not damaged / affected by (severe) weather
unlikely to be damaged is insufficient
- (normally) no / reduced shock hazard
safer is insufficient
less maintenance is insufficient
installed in urban areas is insufficient

1

[6]

6.

(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 refer to the information in the [Marking guidance](#).

0 marks

No relevant content.

Level 1(1-2 marks)

There is a basic explanation of **one** feature

or

a simple statement relating reduction in energy transfer to **one** feature.

Level 2(3-4 marks)

There is a clear explanation of **one** feature

or

a simple statement relating reduction in energy transfer to **two** features.

Level 3(5-6 marks)

There is a detailed explanation of at least **two** features

or

a simple statement relating reduction in energy transfer to all **four** features.

Examples of the points made in response

extra information

accept throughout:

heat for energy

loss for transfer

plastic cap:

- plastic is a poor conductor
accept insulator for poor conductor
- stops convection currents forming at the top of the flask so stopping energy transfer by convection
- molecules / particles evaporating from the (hot) liquid cannot move into the (surrounding) air so stops energy transfer by evaporation
- plastic cap reduces / stops energy transfer by conduction / convection / evaporation

glass container:

- glass is a poor conductor so reducing energy transfer by conduction
- glass reduces / stops energy transfer by conduction

vacuum:

- both conduction and convection require a medium / particles
- so stops energy transfer between the two walls by conduction and convection
- vacuum stops energy transfer by conduction / convection

silvered surfaces:

- silvered surfaces reflect infrared radiation
accept heat for infrared
- silvered surfaces are poor emitters of infrared radiation
- infrared radiation (partly) reflected back (towards hot liquid)
- silvered surfaces reduce / stop energy transfer by radiation

6

- (b) (the ears have a) small surface area
ears are small is insufficient

1

so reducing energy radiated / transferred (from the fox)

accept heat lost for energy radiated

*do **not** accept stops heat loss*

1

[8]

7.

(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]

8.

(a) any **one** from:

- high cost of installing overhead power lines or underground cables or pylons
- high cost as (very) long cables needed
- amount of electricity required is too low

allow not enough (surplus) electricity would be generated

1

(b) 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 apply a 'best-fit' approach to the marking.

Level 3 (5 – 6 marks):

clear comparison of advantages **and** disadvantages of **each** method

Level 2 (3 – 4 marks):

at least **one** advantage **and one** disadvantage is stated for **one** method **and** a different advantage **or** disadvantage is stated for the other method

Level 1 (1 – 2 marks):

at least **one** advantage **or one** disadvantage of either method

Level 0 (0 marks):

No relevant information

examples of physics points made in the response

Advantages of both methods:

- both renewable sources of energy
- both have no fuel (cost)
- both have very small (allow 'no') running costs
- no carbon dioxide produced

accept carbon neutral

accept no greenhouse gases

accept doesn't contribute to global warming

Advantages of wind:

- higher average power output

produces more energy is insufficient

Advantages of hydroelectric:

- constant / reliable power (output)
- lower (installation) cost

Disadvantages of wind:

- higher (installation) cost
- variable / unreliable power output
- (may) kill birds / bats

Disadvantages of hydroelectric:

- lower power output
- (may) kill fish or (may) damage habitats
- more difficult to set up (within river)

Disadvantages of both methods:

- (may be) noisy
- visual pollution

ignore payback time unless no other relevant points made

ignore time to build for both

6

[7]

9.

- (a) minimum distance between wind turbines is at least 500 m in all directions

turbines can rotate to face into wind and still maintain the minimum distance

1

- (b) density = mass/volume

allow $\rho = m / V$

1

(c) $1.2 = \frac{51000}{V}$

1

$$V = \frac{51000}{1.2}$$

1

$$V = 42\,500$$

1

$$V = 43\,000$$

1

m³

an answer of 43 000 scores 4 marks

an answer of 42 500 scores 3 marks

1

(d) $2.4 \times 10^9 / 1.6 \times 10^6$

1

$$1500$$

an answer of 1500 scores 2 marks

1

(e) wind power is unreliable

1

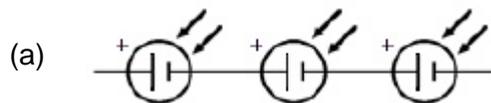
(very) large numbers of wind turbines would need to be constructed

allow calculation of this (15 625)

1

[11]

10.



1

(b) $\text{current} = \frac{0.70}{2.5}$

1

$$\text{current} = 0.28 \text{ (A)}$$

an answer of 0.28 (A) scores 2 marks

1

(c) 0.60 (V)

1

product of potential difference and current gives highest value

1

(d) $\text{efficiency} = \frac{\text{useful power output}}{\text{total power input}}$

1

(e) $0.20 = \frac{\text{useful power output}}{2.4}$

1

useful power output = 0.20×2.4

1

useful power output = 0.48 (W)

an answer of 0.48 (W) scores 3 marks

1

[9]