

# Energy Transfers

## Mark Scheme 1

Level	GCSE (9-1)
Subject	Combined Science: Trilogy - Physics
Exam Board	AQA
Topic	6.2 Electricity
Sub-Topic	Energy Transfers
Difficulty Level	Silver Level
Booklet	Mark Scheme 1

**Time Allowed:** 56 minutes

**Score:** /56

**Percentage:** /100

**Grade Boundaries:**

### M1.(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]

**M2.(a)** water moves (from a higher level to a lower level)

1

transferring GPE to KE

1

rotating a turbine to turn a generator

*accept driving or turning or spinning for rotating*  
*moving is insufficient*

1

transferring KE to electrical energy

*transferring GPE to electrical energy gains 1 mark of the 2*

*marks available for energy transfers*

1

- (b) (TVs in stand-by) use electricity  
*accept power / energy*

1

generating electricity (from fossil fuels) produces CO<sub>2</sub>  
*accept greenhouse gas*  
*accept sulfur dioxide*

1

(CO<sub>2</sub>) contributes to global warming  
*accept climate change for global warming*  
*accept greenhouse effect if CO<sub>2</sub> given*  
*accept acid rain if linked to sulfur dioxide*

1

- (c) a factor other than scientific is given, eg economic, political or legal  
*personal choice is insufficient*

1

[8]

- M3.(a)** (i) to obtain a range of p.d. values  
*accept increase / decrease current / p.d. / voltage / resistance*  
*accept to change / control the current / p.d. / voltage / resistance*  
*to provide resistance is insufficient*  
*a variable resistor is insufficient*  
*do **not** accept electricity for current*

1

- (ii) temperature of the bulb increases  
*accept bulb gets hot(ter)*

*accept answers correctly*  
*expressed in terms of collisions between (free) electrons and ions / atoms*  
*bulb gets brighter is insufficient*

1

(iii) 36

*allow 1 mark for correct substitution, ie  $12 \times 3$  provided no subsequent step shown*

2

watt(s) / W  
*accept joules per second / J/s*  
*do **not** accept w*

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 also refer to the information in the [Marking guidance](#), and apply a 'best-fit' approach to the marking.

**0 marks**No relevant content.

**Level 1 (1-2 marks)**There is a basic comparison of either a cost aspect or an energy efficiency aspect.

**Level 2 (3-4 marks)**There is a clear comparison of either the cost aspect or energy efficiency aspect **OR** a basic comparison of both cost and energy efficiency aspects.

**Level 3 (5-6 marks)**There is a detailed comparison of both the cost aspect and the energy efficiency aspect.

For full marks the comparisons made should support a conclusion as to which type of bulb is preferable.

**Examples of the points made in the response:**

### cost

- halogen are cheaper to buy  
*simply giving cost figures is insufficient*
- 6 halogen lamps cost the same as one LED
- LEDs last longer
- need to buy 18 / more halogen lamps to last the same time as one LED
- 18 halogens cost £35.10
- costs more to run a halogen than LED
- LED has lower maintenance cost (where many used, eg large departmental store lighting)

### energy efficiency

- LED works using a smaller current
- LED wastes less energy
- LEDs are more efficient
- LED is 22% more energy efficient
- LED produces less heat
- LED requires smaller input (power) for same output (power)

6  
[11]

M4.(a) (i) kinetic

*do **not** accept movement*

1

(ii) thermal sound

*accept heat for thermal*

*do **not** accept noise for sound*

***both** answers required in either order*

1

(b) transferred to surroundings / surrounding molecules / atmosphere

*'it escapes' is insufficient*

**or** becomes dissipated / spread out

*accept warms the surroundings*

*accept degraded / diluted*

*accept a correct description for surroundings eg to the washing machine*

*do **not** accept transformed into heat on its own*

1

(c) (i) 3 (.0 p)

*allow 1 mark for correct substitution of correct values ie  $0.2 \times 15$*

*allow 1 mark for calculating cost at  $40^{\circ}\text{C}$  (16.5p)*

**or**

*cost at  $30^{\circ}\text{C}$  (13.5p)*

2

(ii) any **two** from:

- less electricity needed

*ignore answers in terms of the washing machine releasing less energy*

*an answer in terms of the washing machine releasing  $\text{CO}_2$  negates mark*

*do **not** accept less energy is produced*

- fewer power stations needed

- less fuel is burned

*accept a correctly named fuel*

*do **not** accept less fuel is needed*

2

[7]

**M5.** (a) (i) conduction

1

convection

1

*correct order only*

(ii) to keep the ceramic bricks hot for a longer time

1

(b) (i)  $E = P \times t$

18.2

allow **1** mark for correct substitution ie  $2.6 \times 7$  provided that no subsequent step is shown

2

(ii) 91 (p)

**or** their (b)(i)  $\times 5$  correctly calculated

accept £0.91

do **not** accept 0.91 without £ sign

1

(c)  $E = m \times c \times \theta$

2 250 000

allow **1** mark for correct substitution ie  $120 \times 750 \times 25$  provided that no subsequent step is shown

answers 2250 kJ or 2.25 MJ gain both marks

2

[8]

**M6.** (a)  $E = P \times t$

91 (p)

an answer £0.91 gains 3 marks

an answer 0.91 gains 2 marks

allow **2** marks for energy transferred = 18.2 (kWh)

**or**

substitution into 2 equations combined, ie  $2.6 \times 7 \times 5$

allow **1** mark for correct substitution into  $E = P \times t$ , ie  $E = 2.6 \times 7$

**or**

allow **1** mark for multiplying and correctly calculating an incorrect energy transfer value by 5

3

- (b) answers should be in terms of supply exceeding demand  
*accept there is a surplus / excess of electricity (at night)*

1

- (c) reduce (rate of) energy transfer (from ceramic bricks)  
*accept heat for energy*  
*do **not** accept no energy / heat escapes*  
*do **not** accept answers in terms of lost / losing heat if this implies heat is wasted energy*

1

so keeping the (ceramic) bricks hot for longer  
*accept increase time that energy is transferred to the room*  
*accept keep room warm for longer*

**or**

to stop the casing getting too hot  
*accept so you do not get burnt (on the casing)*

1

- (d)  $E = m \times c \times \theta$

120

*allow 1 mark for correct substitution*  
*ie  $9\,000\,000 = m \times 750 \times 100$*

2

[8]

- M7.** (a) (i) food processor  
hairdryer  
*both required and no other*  
*either order*

1

- (ii) TV  
Table lamp  
Food processor  
*all required and no other  
any order*

1

(b) any **two** from:

- transfers / requires / uses more energy / power  
*accept more electricity used  
accept higher power*
- more electricity needs to be generated
- more (fossil) fuels (likely) to be burnt  
*accept a named fossil fuel*

2

- (c) (i) precise  
*this answer only*

1

(ii) any **three** from:

- can look for trends / patterns
- help reduce energy use / consumption
- reduce bills  
*accept save money*
- identify appliances which use a lot of energy
- replace appliances with more efficient ones
- see effect of leaving appliances on (standby)  
*to monitor usage is insufficient  
answers in terms of environment are insufficient*

3

[8]

