

# MARK SCHEME

# GCSE

## PHYSICS

## AQA - COMBINED SCIENCE

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P1 - TEST 6

ENERGY

Advanced

## Mark schemes

1.

(a) 1 080 000

*allow 1 mark for correct substitution  
ie  $\frac{1}{2} \times 15\,000 \times 12 \times 12$*

2

(b) any **one** from:

- KE (of wind) more than doubles
- mass of air (hitting blades) more than doubles
- area swept out by blades more than doubles  
*do **not** accept blades are larger / have a bigger area*
- area swept out by blades increases x 4

1

[3]

2.

(a) (i) as temperature difference increases, power output increases  
at an increasing rate / as temperature difference doubles,  
power output more than doubles

1

(ii) reduce the temperature difference (between air and water)  
*ignore turn power / heating down  
ignore insulation*

1

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

1000 J/kg °C

*allow 2 marks for 1000*

*allow 1 mark for correct substitution and correct rearrangement of  
correct equation,*

$$\text{eg } c = \frac{580000}{58 \times 10}$$

*give 1 mark for unit (allow J/kgK)*

3

[5]

3.

(a) 13 500 (J)

*allow 1 mark for correct substitution, ie  $90 \times 10 \times 15$  provided no  
subsequent step shown*

2

(b) 17

or

$$\sqrt{\frac{\text{their (a)}}{45}}$$

correctly calculated and answer given to 2 or 3 significant figures

*accept 17.3*

*allow 2 marks for an answer with 4 or more significant figures, ie 17.32*

or

*allow 2 marks for correct substitution, ie  $13\,500 / \text{their (a)} = \frac{1}{2} \times 90 \times v^2$*

or

*allow 1 mark for a statement or figures showing  $KE = GPE$*

3

(c) work is done

1

(against) friction (between the miner and slide)

*accept 'air resistance' or 'drag' for friction*

1

(due to the) slide not (being perfectly) smooth

*accept miners clothing is rough*

or

causing (kinetic) energy to be transferred as heat/internal energy of surroundings

*accept lost/transformed for transferred*

*accept air for internal energy of surroundings*

1

[8]

4.

(a) 4200

*allow 2 marks for correct substitution*

*ie  $6930 = 0.330 \times c \times 5.0$*

*answers of 1050 or 840*

or

*correctly calculated answer from correct substitution of incorrect temperature change*

or

*identification of temperature change ie  $5\text{ }^\circ\text{C}$*

*gain 1 mark*

3

J / kg°C

*accept J / kg K*

1

- (b) (in a metal) free electrons  
*to gain full credit the answer must be in terms of free electrons* 1
- gain kinetic energy  
*accept move faster* 1
- (free electrons) transfer energy to other electrons / ions / atoms  
*do **not** accept particles* 1
- by collision  
*allow a maximum of 2 marks for answers in terms of atoms / ions / particles*  
  - *gaining kinetic energy or vibrating faster / more*
  - *transferring energy by collisions* 1
- (c) (air) particles spread out 1
- (which causes the) air to become less dense / expand  
*do **not** accept particles become less dense* 1
- (so the) warm air rises  
*do **not** accept heat rises*  
*particles rise is insufficient* 1
- (d) large surface area  
*ignore references to type of metal or external conditions* 1
- black / dark (colour) 1
- [13]**
5. (a) gravity (of moon and sun) 1

(b) any **two** from:

*1 mark for statement, 1 mark for correctly linked reason*

- tidal energy is renewable (1)
- so won't run out like fossil fuels (1)

**or**

- doesn't emit carbon dioxide
- so won't contribute to global warming / climate change

**or**

- doesn't emit oxides of sulfur or nitrogen
- so doesn't cause acid rain

**or**

- doesn't use fossil fuels
- so less impact on environment of extraction / transport

**or**

- doesn't produce particulates
- so less effect on health / environment

**Max. 4**

(c) coal consumption per year =  $29.25 \times 1000 \times 6$  million = 175 500 000 000 MJ

**1**

1 hectare of willow will produce  $9 \times 13 \times 1000 = 117\,000$  MJ per year

**1**

so need  $175\,500\,000\,000 \div 117\,000 = 1\,500\,000$  (hectares)

**1**

*allow 1 500 000 with no working shown for 3 marks*

(d) although has higher direct emissions than other fuels

**1**

it has much lower lifetime emissions

**1**

**[10]**

**6.**

- (a) (i) much ash produced  
acid rain  
global warming/greenhouse effect  
*any 2 for 1 mark each*

**2**

- (ii) landscaping/road building\*  
removal of exhaust gases\*  
use alternative source not producing  
CO<sub>2</sub>\* (\*sequential (i))  
*for 1 mark each* 2
- (b) (i)  $E = 5 \times 10^8 \times 3600 \times 24 \text{ J/day}$   
 $\times 4$  (for 4 generators) (sequential on  $P \times t$ ) =  $1.73 \times 10^{14}$  (J/day)  
*for 1 mark each* 3
- (ii)  $2.66 \times 10^{10} \times 18\,829 = 4.86 \times 10^{14}$   
*for 1 mark each* 2
- (iii) Eff = output/input  
Eff =  $1.73/4.86$   
Eff = 0.36 or worked to a percentage  
*for 1 mark each* 3
- (c) (i) boiler – heat to surroundings  
turbine – not all steam energy used/heat/sound lost to surroundings  
generator – heat in wires/coils/heat to surroundings  
transformer – heat in wires/coils/heat to surroundings  
*any 1 for 1 mark* 1
- (ii) energy spread out/diluted  
as surroundings become warmer/energy lost as heat  
difficult to use for further useful energy/transfers  
*any 2 for 1 mark each* 2

[15]

- 7.** (a) water boils at the same temperature each time 1
- control starting temp by allowing enough time for water and kettle to reach room temperature 1
- (b) uncertainty =  $(302 - 298) / 2$  1
- uncertainty =  $\pm 2$  (s)  
*ignore missing  $\pm$*  1

- (c) (Energy transferred = Power  $\times$  time)
- $E = 2.20 \times 300$  1
- $E = 660$  (kJ) 1
- allow 660 (kJ) without working shown for 2 marks*
- allow answer calculated using incorrect value for  $t$  (298 or 302) for 1 mark*
- (d) (mass  $\times$  change in temperature) / mass 1
- allow 1 mark for any correct pair of values from the table*
- eg 20 / 0.25*
- 80 ( $^{\circ}\text{C}$ ) 1
- allow 80 ( $^{\circ}\text{C}$ ) without working shown for 2 marks*
- (e) four points plotted correctly 2
- allow 1 mark for three correctly plotted points*
- ecf their 5.3*
- allow  $\pm 1\text{mm}$*
- accurate line drawn 1
- line should be straight and drawn with a ruler*
- line must not go through the origin*
- (f) values read correctly from graph 1
- correct conversion into J 1
- correct use of  $\Delta y / \Delta x$  1
- value in range 4200 – 4800 1
- allow value in range 4200 – 4800 without working shown for 4 marks*
- (g) some of the energy supplied does not raise the temperature of the water 1
- some of the energy is wasted is insufficient*

(h) (the power of the kettle may not be 2.2kW)

(by measuring the power) the student can accurately calculate the amount of energy supplied to each mass of water

1

[17]