AQA GCSE PHYSICS (HIGHER) · 8463

# PHYSICS



## MARK SCHEME

### 4.2.4 ENERGY TRANSFERS (PACK 1)

| SCORE | PERCENTAGE |
| --- | --- |
| /275 | % |

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## Q1.

(a) 0.08 (s)

**1**

(b) the current goes higher than normal value

*allow the current goes (too) high*

**or**

the current goes higher than 1.5 A

**1**

(c) P = 1.5 × 24

**1**

P = 36 (W)

**1**

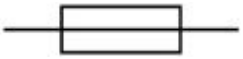
*an answer of 36 (W) scores **2** marks*

(d) LED lamps waste a smaller proportion of the input energy than filament lamps

**1**

**[5]**

## Q2.

(a) 

**1**

(b) E = 13 × 230

**1**

E = 2990 (J)

**1**

*an answer 2990 (J) scores **2** marks*

(c) charge flow = current × time

*allow Q = It*

**1**

(d) 1.52 = I × 0.40

**1**

$$I = \frac{1.52}{0.40}$$

**1**

I = 3.8 (A)

**1**

*an answer of 3.8 (A) scores **3** marks*

(e) E = 0.00175 × 205 000

**1**

E = 359 (J)



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*allow an answer that rounds to 360 (J) for **2** marks*

1

*an answer of 359 (J) scores **2** marks*

**[9]**

## Q3.

(a) to vary the current.

1

(b) the temperature of the filament increases

*allow the filament heats up*

1

(c) E = 12 × 8.5

1

E = 102 (J)

*an answer of 102 (J) scores **2** marks*

1

(d) (LED lamp)

longer lifetime (per lamp)

1

wastes less energy

**or**

lower input energy (for same light energy output)

1

**[6]**

## Q4.

(a) risk of electric shock (if someone touched the case)

*allow risk of electrocution (if someone touched the case)*

1

(b) 2530 = I × 230

*this mark may be awarded if P is incorrectly / not converted*

1

$$I = \frac{2530}{230}$$

*this mark may be awarded if P is incorrectly / not converted*

1

I = 11 (A)

*this answer only*

*an answer of 0.011 (A) scores **2** marks*

1

*an answer of 11 (A) scores **3** marks*



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(c) E = 2530 × 14

*this mark may be awarded if P is incorrectly / not converted*

1

E = 35 420 (J)

*this answer only*

1

35 420 = m × 4200 × 70

*allow their calculated E = m × 4200 × 70*

1

$$m = \frac{35\,420}{4200 \times 70}$$

*allow* $m = \frac{\textit{their calculated } E}{4200 \times 70}$

1

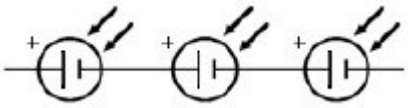
m = 0.12 (kg)

*allow an answer that is consistent with their calculated value of E*

1

**[9]**

## Q5.

(a) 

1

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

1

current = 0.28 (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



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useful power output = 0.48 (W)

*an answer of 0.48 (W) scores **3** marks*

**1**

**[9]**

## Q6.

(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 × 60 = 1500 (s)

**1**

E = 65 × 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]**

## Q7.

(a) changes

*allow reverses*

**1**

(b) dependent

**1**

(c) kettle **C**
**or**
2.8 kW

**1**

highest power (output)

*allow higher power (output)*

**1**



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(d) values for gradient calculation shown on graph or on answer lines

1

power input = 2200 (W)

*accept an answer that rounds to 2200 (W) for **2** marks*

1

(e) charge flow = current × time

*allow Q = It*

1

(f) 2400 = I × 250

1

$$I = \frac{2400}{250}$$

1

I = 9.6 (A)

*an answer of 9.6 (A) scores 3 marks*

1

**[10]**

## Q8.

(a) current at 0.5 V = 0.91 (A)

1

P = 0.91 × 0.5

1

P = 0.455 (W)

*an answer of 0.455 (W) scores **3** marks*

1

(b) straight line with positive gradient

*allow for **1** mark a straight line that passes through (0.1, 0)*

1

positive y-axis intercept

*ignore any values on y-axis*

1

(c) $0.15 = \frac{0.52}{\text{total P}}$

1

total P = 3.47 (W)

1

$$\text{area} = \frac{3.47}{450}$$

1

area = $7.7 \times 10^{-3}$ ($m^2$)

*an answer of $7.7 \times 10^{-3}$ ($m^2$) scores **4** marks*



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*allow use of student's calculated incorrect total power for last 2 marking points*

1

(d) connect the solar cells in parallel

1

(so that) the current has multiple paths it can take

**or**

the total resistance is less than the resistance of one solar cell

1

**[11]**

## Q9.

(a) 97 500 = 65.0 × t

1

$t = \frac{97500}{65.0}$

1

t = 1500 (s)

*an answer of 1500 (s) scores **3** marks*

*an answer of 1.5 scores **2** marks*

1

(b) $19.6 = I^2 \times 1.60$

1

$I^2 = \frac{19.6}{1.60}$

1

I = 3.5 (A)

*allow 1 mark for a correct value for I correctly multiplied by 4*

1

current through battery = 14 (A)

*an answer of 14 (A) scores **4** marks*

1

**[7]**

## Q10.

(a) current that is always in the same direction

1

(b) total resistance = 30 (Ω)

1

V = 0.4 × 30

1

12 (V)

1



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*allow 12 (V) with no working shown for **3** marks*
*an answer of 8 (V) or 4 (V) gains **2** marks only*

(c) P = 0.4 × 12 = 4.8

**1**

5 (W)

**1**

*allow 5 (W) with no working shown for **2** marks*
*allow 4.8 (W) with no working shown for **1** mark*

**[6]**

## Q11.

(a) he may receive an electric shock

**or**

he may be electrocuted

**1**

if he touches the live wire

**1**

(b) 10 690 = I × 230

**1**

I = 10 690 / 230

**1**

46.478(260) (A)

**1**

46

**1**

*allow 46 (A) with no working shown for **4** marks*

(c) cost is higher

**1**

more energy is used (per second)

**1**

**[8]**

## Q12.

(a) (because the) potential of the live wire is 230 V

**1**

(and the) potential of the electrician is 0 V

**1**

(so there is a) large potential difference between live wire and electrician

**1**

charge / current passes through his body

*allow voltage for potential difference*

**1**



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(b) diameter between 3.50 and 3.55 (mm)

*allow correct use of value of cross-sectional area of 9.5 to 9.9 ($mm^2$) with no final answer given for **1** mark*

**2**

(c) $18000 = I \times 300$

**1**

$I = 18000 / 300 = 60$

**1**

$13\ 800 = (60^2) \times R$

**1**

$R = 13\ 800 / 60^2$

**1**

3.83 (Ω)

**1**

*allow 3.83(Ω) with no working shown for **5** marks*

*answer may also be correctly calculated using P = IV and V = IR if 230 V is used.*

**[11]**

## Q13.

(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



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*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]**

## Q14.

(a) field

*correct order only*

**1**

current

**1**

force

*accept motion*

*accept thrust*

**1**

(b) (i) arrow pointing vertically downwards

**1**

(ii) increase current / p.d.

*accept voltage for p.d.*

**1**

increase strength of magnetic field

*accept move poles closer together*

**1**

(iii) reverse (poles of) magnets



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1

reverse battery / current

1

(c) (i) 1.5 or 150%

*efficiency = 120 / 80 (× 100)*

*gains **1** mark*

*an answer of 1.5 % or 150*

*gains **1** mark*

2

(ii) efficiency greater than 100%
**or**
output is greater than input
**or**
output should be 40 (W)

1

(iii) recorded time much shorter than actual time

*accept timer started too late*

*accept timer stopped too soon*

1

**[12]**

## Q15.

(a) 4

1

(b) (i) 2

*allow **1** mark for correct substitution ie*

$I = \frac{100}{20}$

*provided no subsequent step*

2

(ii) 5

*allow **1** mark for correct substitution ie*

$V = \frac{100}{20}$

*provided no subsequent step*

2

**[5]**

## Q16.

(a) increases

*accept reaches highest value*

*do **not** accept increases and decreases*

1

(b) (i) increases

1



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(ii) increases

1

(c) 18

*allow **1** mark for correct substitution i.e. 12 × 1.5 provided no subsequent step*

2

watt

*accept W*
*answer may be indicated in the list*

1

**[6]**

## Q17.

(a) (i) 1.7

1

(ii) 51
**or**
30 × their (i) correctly calculated

*allow **1** mark for correct substitution i.e. 1.7* $= \frac{Q}{30}$

*or their (i)* $= \frac{Q}{30}$

2

coulomb / C

*do **not** accept c*

1

(iii) 612
**or**
their (ii) × 12 correctly calculated
**or**
their (i) × 360 correctly calculated

*allow **1** mark for correct substitution i.e. E = 12 × 51*
*or 12 × their (ii)*
*or their (i) × 360*

2

(b) ions vibrate faster
**or**
ions vibrate with a bigger amplitude

*accept atoms for ions throughout*
*accept ions gain energy*
*accept ions vibrate more*
*ions start to vibrate is insufficient*

1

electrons collide more (frequently) with the ions
**or**
(drift) velocity of electrons decreases



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*electrons start to collide is insufficient*

*there are more collisions is insufficient, unless both electrons and ions are implied*

**1**

**[8]**

## Q18.

(a) decreased

*correct order only*

**1**

decreased

**1**

increased

**1**

(b) (i) A

*reason only scores if A chosen*

**1**

uses least / less energy (in 1 year)

*a comparison is required*

*accept uses least power*

*accept uses least kWh*

**1**

(ii) greater the volume the greater the energy it uses (in 1 year)

**1**

(iii) a very small number sampled

*accept only tested 3*

*accept insufficient evidence / data*

*allow not all fridges have the same efficiency **or** a correct description implying different efficiencies*

*only tested each fridge once is insufficient*

*there are lots of different makes is insufficient*

**1**

**[7]**

## Q19.

(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



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*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 × 6*

***or***

*2 000 000 × 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]**



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## Q20.

(a) air near freezer compartment is cooled or loses energy

*accept air at the top is cold*

**1**

cool air is (more) dense or particles close(r) together (than warmer air)

*do **not** allow the particles get smaller / condense*

**1**

so (cooler) air falls

**1**

air (at bottom) is displaced / moves upwards / rises

*do **not** allow heat rises*

*accept warm air (at the bottom) rises*

**1**

(b) if volume is doubled, energy use is not doubled
**or**
volume ÷ energy not a constant ratio

**1**

correct reference to data, eg 500 is 2×250 but 630 not 2×300

**1**

(c) accept suitable examples, eg

advantage:

- reduces emissions into atmosphere
- lower input power or uses less energy or wastes less energy
- costs less to run

*cost of buying or installing new fridge is insufficient*

*ignore reference to size of fridge*

**1**

disadvantage:

- land fill
- energy waste in production
- cost or difficulty of disposal
- transport costs

**1**

**[8]**

## Q21.

(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**



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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 $CO_2$

*accept greenhouse gas*

*accept sulfur dioxide*

**1**

($CO_2$) contributes to global warming

*accept climate change for global warming*

*accept greenhouse effect if $CO_2$ 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]**

## Q22.

(a) (i) 5.88 (watts)

*an answer of 5.9 scores **2** marks*

*allow **1** mark for correct substitution ie*

$0.42 = \frac{\text{power out}}{14}$

*allow **1** mark for an answer of 0.0588 or 0.059*

**2**

(ii) 8.12

*allow 14 – their (a)(i) correctly calculated*

**1**

(b) (i) input power / energy would be (much) less (reducing cost of running)

*accept the converse*

*electricity is insufficient*

**1**

(also) produce less waste energy / power

*accept 'heat' for waste energy*

**1**

(as the waste energy / power) increases temperature of the cabinet

**1**

so cooler on for less time

**1**

(ii) line graph



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*need to get both parts correct*

*accept scattergram or scatter graph*

both variables are continuous

*allow the data is continuous*

**1**

(c) number of bulbs used-halogen=24 (LED=1)

**1**

total cost of LED = £30 + £67.20 = £97.20

*accept a comparison of buying costs of halogen £36 and LED £30*

**1**

total cost of halogen= 24 x £1.50 + 24 x £16.00 = £420
**or**
buying cost of halogen is £36 **and** operating cost is £384

*accept a comparison of operating costs of halogen £384 and LED £67.20*

*allow for **3** marks the difference in total cost is £322.80 if the number 24 has not been credited*

**1**

statement based on correct calculations that overall LED is cheaper

*must be **both** buying **and** operating costs*

an alternative way of answering is in terms of cost per hour:

buying cost per hour for LED $\left(\frac{£30.00}{48000}\right)$ = 0.0625p/£0.000625

buying cost per hour for halogen = $\left(\frac{£1.50}{2000}\right)$ = 0.075p/£0.00075

*a calculation of both buying costs scores **1** mark*

operating cost per hour for LED = $\left(\frac{£67.20}{48000}\right)$ = 0.14p/£0.0014

operating cost per hour for halogen= $\left(\frac{£16.00}{2000}\right)$ = 0.8p/£0.008

*a calculation of both operating costs scores **1** mark*

**all** calculations show a correct unit

***all** units correct scores **1** mark*

statement based on correct calculations of **both** buying **and** operating costs, that overall LED is cheaper

*correct statement scores **1** mark*

**1**

**[12]**

## Q23.

(a) water heated by radiation (from the Sun)

*accept IR / energy for radiation*

**1**



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water used to heat buildings / provide hot water

*allow for **1** mark heat from the Sun heats water if no other marks given*

*references to photovoltaic cells / electricity scores **0** marks*

**1**

(b) 2 (minutes)

$1.4 \times 10^3 = \frac{168 \times 10^3}{t}$

*gains **1** mark*

*calculation of time of 120 (seconds) scores **2** marks*

**3**

(c) (i) 150 (kWh)

**1**

(ii) £60(.00) or 6000 (p)

*an answer of £6000 gains **1** mark*

*allow **1** mark for 150 × 0.4(0) 150 × 40*

*allow ecf from **(c)(i)***

**2**

(iii) 25 (years)

*an answer of 6000 / 240*
***or***
*6000 / their **(c)(ii)** × 4*
*gains **2** marks*

*an answer of 6000 / 60*
***or***
*6000 / their **(c)(ii)** gains **1** mark, ignore any other multiplier of **(c)(ii)***

**3**

(iv) any **one** from:

- will get £240 per year
  *accept value consistent with calculated value in **(c)(iii)***
- amount of light is constant throughout the year
- price per unit stays the same
- condition of cells does not deteriorate

**1**

(d) any **one** from:

- angle of tilt of cells
- cloud cover
- season / shade by trees
- amount of dirt

**1**

**[13]**

## Q24.

(a) (i) temperature (increase) and time switched on are directly proportional



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*accept the idea of equal increases in time giving equal increases in temperature*

*answers such as:*

- *as time increases, temperature increases*
- *positive correlation*
- *linear relationship*
- *temperature and time are proportional*

*score **1** mark*

**2**

(ii) any **one** from:

*"it" refers to the metal block*

- energy transfer (from the block) to the surroundings

*accept lost for transfer*

*accept air for surroundings*

- (some) energy used to warm the heater / thermometer (itself)

*accept takes time for heater to warm up*

- (metal) block is not insulated

**1**

(iii) 15 000

*allow **1** mark for correct substitution, ie 50 × 300 provided no subsequent step shown*

**2**

(b) lead

*reason only scores if lead is chosen*

**1**

needs least energy to raise temperature by 1°C

*accept needs less energy to heat it (by the same amount)*
*lowest specific heat capacity is insufficient*

**1**

**[7]**

## Q25.

(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*



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*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 × 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



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- 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]**

## Q26.

(a) iron

**1**

hairdryer

**1**

kettle

**1**

*answers can be in any order*

(b) (i) **Y**

**1**

(ii) bar drawn with any height greater than **Y**

*ignore width of bar*

**1**

(c) (bigger volume) takes more time (to boil)

*accept explanation using data from graph*

**1**

(so) more energy transferred

*do **not** accept electricity for energy*

**1**

(and) this costs more money

*ignore reference to cost of water*

*wasting more money because heating more water than needed is insufficient*

**1**

**[8]**

## Q27.

(a) £16.50

*allow **1** mark for correct substitution ie 110 × 15*



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*an answer of 1650 gains **both** marks*

*an answer of 43.80 gains **both** marks*

*allow **1** mark for 292 × 15*

**2**

(b) 292

*allow **1** mark for correctly using the reading 53490*
*ie 53782 – 53490*

*accept £43.80 for both marks*

**2**

**[4]**

## Q28.

(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 x 15*

*allow **1** mark for calculating cost at 40°C (16.5p)*

***or***

*cost at 30°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 $CO_2$ negates mark*
*do **not** accept less energy is produced*

- fewer power stations needed



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- less fuel is burned

*accept a correctly named fuel*
*do **not** accept less fuel is needed*

**2**

**[7]**

## Q29.

(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 × 7 provided that no subsequent step is shown*

**2**

(ii) 91 (p)
**or** their (b)(i) × 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 × 750 × 25 provided that no subsequent step is shown*
*answers 2250 kJ or 2.25 MJ gain both marks*

**2**

**[8]**

## Q30.

(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 × 7 × 5*
*allow **1** mark for correct substitution into E = P × t, ie E = 2.6 × 7*
***or***
*allow **1** mark for multiplying and correctly calculating an incorrect energy transfer value by 5*

**3**



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(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]**

## Q31.

(a) (i) $$efficiency = \frac{useful\ energy\ out\ (\times 100\%)}{total\ energy\ in}$$

1.6 (W)

*allow **1** mark for correct substitution ie* $0.2 / \frac{20}{100} = \frac{output}{8}$

**2**

(ii) $$efficiency = \frac{useful\ energy\ out\ (\times 100\%)}{total\ energy\ in}$$

32 (%) / 0.32

**or**

their (a)(i) ÷ 5 correctly calculated

*ignore any units*

**1**

(b) (i) any **two** from:

- comparison over same period of time of relative numbers of bulbs required eg over 50 000 hours 5 CFL's required to 1 LED

  *accept an LED lasts 5 times longer*



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- link number of bulbs to cost eg 5 CFL's cheaper than 1 LED

  *an answer in terms of over a period of 50 000 hours CFLs cost £15.50 (to buy), LED costs £29.85 (to buy) so CFLs are cheaper scores both marks*

  *an answer in terms of the cost per hour (of lifetime) being cheaper for CFL scores 1 mark if then correctly calculated scores both marks*

- over the same period of time LEDs cost less to operate (than CFLs)

**2**

(ii) any **one** from:

- price of LED bulbs will drop

  *do **not** accept they become cheaper*

- less electricity needs to be generated

  *accept we will use less electricity*

- less $CO_2$ produced

- fewer chips needed (for each LED bulb)

- fewer bulbs required (for same brightness / light)

- less energy wasted

  *do **not** accept electricity for energy*

**1**

**[6]**

## Q32.

(a) (i) TV

**1**

(ii) hairdryer and sandwich toaster

*both required either order but no others*

**1**

(b) (i) 1.2

*allow **1** mark for correct substitution*

*ie 0.4 × 3 provided that no subsequent step is shown*

**2**

(ii) 18

*accept £0.18 for both marks*

**or**

their (b)(i) × 15 correctly calculated

*an answer 0.18 scores **1** mark*

*allow **1** mark for correct substitution*

*ie 1.2 or their (b)(i) × 15 provided that no subsequent step is shown*

**2**

**[6]**



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## Q33.

(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]**

## Q34.

(a) fan

**1**

drill

**1**



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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]**

## Q35.

(a) (i) A

**1**

(ii) bar drawn with correct height

*ignore width of bar*

**1**

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

2.4

*allow **1** mark for correct substitution*
*ie 1.2 × 2*
*provided no subsequent step shown*

**2**

(ii) 36 or their (b)(i) × 15 correctly calculated

**or**

their (b)(i) × 0.15 correctly calculated with an answer given in £

*allow **1** mark for correct substitution*
*ie 2.4 × 15*
***or***
*their (b)(i) × 15*
*allow **1** mark for correct substitution*
*provided no subsequent step shown*
*an answer £0.36 gains both marks*

**2**

**[6]**



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