

MARK SCHEME

GCSE

PHYSICS

AQA - TRIPLE SCIENCE

P1 - TEST 7

ENERGY

Advanced

Mark schemes

- 1.** (a) resultant force = zero
or
upward force = downward force
accept forces are balanced
accept weight for downward force 1
- (b) (i) 84
allow 1 mark for correct substitution ie $840 = m \times 10$ 2
- (ii) 12
accept 12.02 for both marks
or
1010 \div their (b)(i) correctly calculated
a resultant force of 1010 (N) gains 1 mark
an answer 22(.02) gains 1 mark 2
- m/s²
accept m/s/s 1
- [6]
- 2.** (a) energy required to raise the temperature of a substance by 1 °C
accept heat for energy 1
- unit mass / 1 kg 1
- (b) (i) 7 140 000 (J)
allow 2 marks for a correct substitution, ie
 $E = 20 \times 420 \times 850$
provided no subsequent step
850 gains 1 mark if no other mark awarded 3
- (ii) particles in the air have more (kinetic) energy than the particles in the steel
allow particles in the air have a greater speed. 1
- steel**
particles vibrate (about fixed positions) 1
- air**
particles move freely 1

(ii) the most energetic particles

accept molecules for particles throughout

accept the fastest particles

1

have enough energy to escape from (the surface of) the water

1

therefore the mean energy of the remaining particles decreases

accept speed for energy

1

as energy decreased, temperature has decreased

1

[12]

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) current at 0.5 V = 0.91 (A)

1

$$P = 0.91 \times 0.5$$

1

$$P = 0.455 \text{ (W)}$$

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

$$\text{total P} = 3.47 \text{ (W)}$$

1

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

1

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

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

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]

5.

(a) (i) decreases (to zero)

1

resultant force acts in opposite direction to motion

accept air resistance and weight for resultant force

accept resultant force acts downwards

do not accept air resistance increases

1

(ii) velocity includes direction

or

velocity is a vector (quantity)

1

(b) (i) 3.6

allow 1 mark for correct substitution i.e.

$\frac{1}{2} \times 0.05 \times 12^2$ provided no subsequent step

2

(ii) 3.6 **or** their (i)

1

(iii) 7.2

or

their (ii) $\div 0.5$ correctly calculated

allow 1 mark for correct substitution i.e.

3.6 or their (ii) = $0.05 \times 10 \times h$

2

(iv) **B**

1

(c) range increases up to 45°

1

range decreases from 45°

the range is a maximum at 45° gains both marks

for any two angles that add up

to 90° the range is the same gains both marks

the range increases then decreases gains 1 mark

1

[11]

6.

(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

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 $\left(\frac{£30.00}{48000}\right) = 0.0625\text{p}/£0.000625$

buying cost per hour for halogen = $\left(\frac{£1.50}{2000}\right) = 0.075\text{p}/£0.00075$
a calculation of both buying costs scores 1 mark

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

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

7. (a) (i) produces carbon dioxide / nitrogen oxides
accept greenhouse gases
ignore pollutant gases

1

that (may) contribute to global warming
accept causes global warming
damages ozone layer negates this mark
accept alternative answers in terms of: sulfur dioxide / nitrogen oxides causing acid rain

1

(ii) carbon capture / storage
answer must relate to part (a)(i)
collecting carbon dioxide is insufficient

or

plant more trees

or

remove sulfur (before burning fuel)

1

- (b) (i) (power station can be used) to meet surges in demand
accept starts generating in a short time
can be switched on quickly is insufficient 1
- (ii) can store energy for later use
accept renewable (energy resource)
accept does not produce CO₂ / SO₂ / pollutant gases 1
- (c) (i) turbines do not generate at a constant rate
accept wind (speed) fluctuates
accept wind is (an) unreliable (energy source) 1
- (ii) any **one** from:
- energy efficient lighting (developed / used)
use less lighting is insufficient
 - increased energy cost (so people more likely to turn off)
accept electricity for energy
 - more people becoming environmentally aware 1

[7]

8.

- (a) water heated by radiation (from the Sun)
accept IR / energy for radiation 1
- 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 $150 \times 0.4(0)$ 150×40
allow ecf from (c)(i)

2

- (iii) 25 (years)
an answer of $6000 / 240$
or
 $6000 / \text{their (c)(ii)} \times 4$
gains 2 marks
an answer of $6000 / 60$
or
 $6000 / \text{their (c)(ii)}$ 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]

9. (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]

10.

do **not** give any credit for renewable **or** non-renewable **or** installation **or** decommissioning costs

fossil fuel advantage

1

a reliable source of energy

fossil fuel disadvantage

pollution by carbon dioxide /

accept causes acid rain

accept highest costs / more expensive than nuclear / more expensive than renewable

1

nuclear advantage

do not produce gases that increase the greenhouse effect **or** cause acid rain

accept nuclear is cheaper than fossil

1

nuclear disadvantage

accidents / waste can release very dangerous radioactive material radiation

*accept it produces waste that stays dangerously radioactive for thousands of years **or** radioactive waste has to be stored safely for thousands of years*

1

renewable advantage

there are no fuel costs

almost pollution free (apart from noise and visual)

accept cheaper than fossil

1

renewable disadvantage

not a reliable source of energy except for hydroelectric

accept (most) require large areas of land

accept visual / noise pollution

1

[6]