

GCSE PHYSICS

Topic Paper: 6.2 Electromagnetic waves
Mark Scheme

MARK SCHEME



44 Marks



- M1.** (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 CO₂
accept greenhouse gas
accept sulfur dioxide 1
- (CO₂) contributes to global warming
accept climate change for global warming
accept greenhouse effect if CO₂ 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]**
- M2.** (a) refracted into the block, angle $r < i$ 1
- refracted correctly out of block, two rays in air parallel
judge by eye
if first mark not scored allow 1 mark for correct refraction shown as ray leaves the block 1
- (b) (i) the angle of refraction is (always) less than the angle of incidence 1
- the angle of refraction increases as the angle of incidence increases
*accept angle i and angle r are **not** directly proportional*
accept there is positive correlation 1



(ii) (for the same angle of incidence) the angle of refraction in plastic is less than the angle of refraction in water
accept (for the same angle of incidence) plastic refracts light more than water
accept it is less 1

(c) (i) accept any sensible suggestion to do with being able to see inside (during daylight hours)
 eg able to (see to) work / cook inside
accept to see what they are doing lights up the room is insufficient
ignore no need to pay for electricity 1

(ii) accept any ethical suggestion, eg
 fair access to energy for all
 unequal use of energy resources
 consequences for the future of decisions made now
 damage to global environment affects all
damage to the environment is insufficient 1

[7]

M3. (a) (i) $efficiency = \frac{useful\ energy\ out\ (\times 100\%)}{total\ energy\ in}$
 1.6 (W)

allow 1 mark for correct substitution ie $\frac{0.2}{100} = \frac{output}{8}$ 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) two output arrows
one arrow should be wider – judged by eye 1



narrower arrow labelled light or useful (energy / output / power)
only scores if first mark awarded

and

wider arrow labelled waste (energy / output / power)
accept heat
ignore numerical values

1

(c) (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

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 CO₂ 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

[8]

M4. (a) (i) 7.6

allow 1 mark for correct substitution and / or transformation

$$\text{ie } 0.95 = \frac{x}{8}$$

$$95 \times 8.0$$

2



- (ii) 25 (hours)
 - allow 1 mark for obtaining number of kWh = 200*
 - an answer of 26(.3) gains both marks*

2

- (b) any **two** from
 - transferred to the surroundings / air / atmosphere
 - becomes spread out
 - shared between (many) molecules
 - (wasted as) heat / sound

2

[6]

M5. (a) total saving shown for each method

- ie:
 - cavity wall £325
 - jacket £163
 - central heating £90

allow 1 mark for one correctly calculated value

or

allow 1 mark for showing energy bill savings for each method over 5 years

ie:

- cavity wall £575*
- jacket £175*
- central heating £400*

there are no marks for calculation of payback time

2

- (b) energy cannot be destroyed
 - accept energy is conserved*
 - ignore reference to created*

1

- (c) 4 (hours)
 - allow 1 mark for obtaining number of kWh = 10*
 - or energy transferred = 10*

2

[5]



M6. (a) 1.8 (p)

these 4 marks can be broken down as follows:

1 mark for correct transformation and substitution into efficiency equation

ie 0.8×1200 – useful power

PLUS

1 mark for useful power = $960\text{ W} / 0.96\text{ kW}$

PLUS

1 mark for waste energy transferred = 0.24×0.5

or

waste energy transferred = 0.12 (kWh)

PLUS

1 mark for cost = 0.12×15

where a mathematical error has been made full credit should be given for subsequent correct method

4

(b) the waste energy is transferred as heat and sound

1

to the surroundings where it spreads out / is shared by surrounding particles

accept air for surroundings

1

[6]

M7. (a) changes the sound wave(s)

to a varying **or** changing (electric) potential difference **or** p.d. **or** voltage **or** current **or** to an irregular alternating current or a.c. **or** transfers sound energy to electrical energy (1) mark is vibrations **or** pulses **or** of sound **or** in air become electrical waves

*do not credit just 'to electricity' **or** 'to a.c.'*

2

(b) (i) decrease **or** reduce the amplitude

accept less amplitude nothing else added

1

(ii) increase the frequency **or** decrease wavelength

accept higher frequency nothing else added

1

[4]