Name of the Student:_____
Max. Marks : 27 Marks **Time : 27 Minutes**

Mark Schemes

Q1.

(a) (matt) black is a good <u>emitter</u> of infrared / radiation

accept heat for infrared / radiation
ignore reference to good absorber
attracts heat negates this marking point

1

to give maximum (rate of) energy transfer (to surroundings)

accept temperature (of coolant) falls fast(er)
*accept black emits more radiation for **1** mark*
*black emits most radiation / black is the best emitter of radiation for **2** marks*

1

(b) the fins increase the surface area

accept heat for energy

1

so increasing the (rate of) energy transfer
or
so more fins greater (rate of) energy transfer

1

(c) 114 000

*allow **1** mark for correct temperature change, ie 15 (°C)*
or
*allow **2** marks for correct substitution, ie 2 × 3 800 × 15*
*answers of 851 200 **or** 737 200 gain **2** marks*
or
*substitution 2 × 3800 × 112 **or** 2 × 3800 × 97 gains **1** mark*
*an answer of 114 kJ gains **3** marks*

3

(d) increases the efficiency

1

less (input) energy is wasted

accept some of the energy that would have been wasted is (usefully) used

or

more (input) energy is usefully used

accept heat for energy

1

[9]

Q2.

(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

- less fuel is <u>burned</u>

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

2

[7]

Q3.

(a) increases the voltage (across the cables)
or
decreases the current (through the cables)

1

reducing energy losses (in cables)

accept heat for energy

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

*do **not** accept no energy loss*

accept wires do not get as hot

or

increases efficiency of (electricity / energy) transmission

ignore reference to travel faster

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 Marking Guidance, and apply a 'best-fit' approach to the marking.

0 marks
No relevant content

Level 1 (1-2 marks)
There is a brief description of one advantage or disadvantage of using either overhead or underground cables.

Level 2 (3-4 marks)
There is a description of some of the advantages **and / or** disadvantages for both overhead and underground cables, with a minimum of three points made. There must be at least **one** point for each type of cable.

Level 3 (5-6 marks)
There is a clear and detailed description of the advantages and disadvantages of overhead **and** underground cables, with a minimum of five points made. At least one advantage and one disadvantage for each type of cable.

examples of the points made in the response

marks may be gained by linking an advantage for one type of cable with a disadvantage for the other type of cable

eg

overhead cables are easy to repair = 1 mark

overhead cables are easier to repair = 1 mark

overhead cables are easier to repair than underground cables = 2 marks

Overhead
Advantages

- (relatively) quick / easy to repair / maintain / access

  easy to install is insufficient

  *do **not** accept easy to spot / see a fault*

- less expensive to install / repair / maintain

  less expensive is insufficient

- cables cooled by the air

  accept thermal energy / heat removed by the air

- air acts as <u>electrical</u> insulator

  accept there is no need for electrical insulation (around the cables)

- can use thinner cables
  difficult to reach is insufficient
  land beneath cables can still be used is insufficient

Disadvantages

- spoil the landscape
- greater risk of (fatal) electric shock
- damaged / affected by (severe) weather
  accept specific examples eg high winds, ice
  more maintenance is insufficient
- hazard to low flying aircraft / helicopters
  kites / fishing lines can touch them is insufficient
  hazard to aircraft is insufficient

Underground
Advantages

- cannot be seen
- no hazard to aircraft / helicopters
- unlikely to be / not damaged / affected by (severe) weather
  less maintenance is insufficient

(normally) no / reduced shock hazard
installed in urban areas is insufficient

Disadvantages

- repairs take longer / are more expensive
  accept harder to repair / maintain
  have to dig up for repairs is insufficient
- (more) difficult to access (cables)
  hard to locate (cables) is insufficient
  faults hard to find is insufficient
- (very) expensive to install
- thicker cables required
- need cooling systems
- need layers of electrical insulation
- land disruption (to lay cables)
  accept damage to environment / habitat(s)
  or
  cannot use land either side of cable path
  accept restricted land use

6

(c) examples of acceptable responses:

*allow **1** mark for each correct point*

- closest to cables field from underground is stronger
- field from overhead cables stronger after 5 metres
- field from underground cables drops rapidly
- field from overhead cables does not drop much until after 20 metres
  accept values between 20 and 30 inclusive
- overhead field drops to zero at / after 50 metres
- underground field drops to zero at / after 30 metres
- (strength of) field decreases with distance for <u>both</u> types of cable
  if suitably amplified this may score both marks

2

(d) ethical

1

[11]