Mark schemes

1 (a) infrared / IR

correct answer only

1

(b) any **two** from:

- increase the power / watts

  allow increase the temperature of the oven or make the oven hotter
- decrease the speed

  allow leave the biscuits in for longer
- put biscuits through again

  increase radiation is insufficient

  ignore changes to the design of the oven

2

(c) (inside) surface is a (good) reflector or poor absorber (of IR)

Ignore bounce for reflect

surface is a (good) reflector of light does not score

surface is a (good) reflector of light and infrared / heat does score

1

(and) outside surface is poor emitter (of IR)

1

(so) increases the energy reaching the biscuits

allow reduces energy loss or makes oven more efficient

*do **not** accept no energy losses*

keeps oven hotter is insufficient

1

[6]

2 (a) the bigger the surface area, the faster the water cools down / temperature falls

answers must imply rate

accept heat for temperature provided rate is implied

*do **not** accept cools down more unless qualified*

1

(b) any **two** from:

the ears:

- have large surface / area

  not just has large ears

- radiate heat

  accept loses heat, but does not score if the reason given for heat loss is wrong

- keep blood cooler

2

(c) (i) radiation

1

(ii) conduction

1

[5]

3 (a) (i) vacuum

do not allow stopper

1

(ii) (absence of particles) means no (transfer of energy between) particles for conduction

*accept particles **or** atoms **or** molecules **or** electrons*

1

no movement of molecules for (transfer of energy by) convection

accept particles/atoms/electrons

if answer to (a)(i) is correct: then in (a)(ii) have stated 'conduction and convection both need a medium/particles/materials' = 2 marks

(If medium is specified, it must be correct, conduction can be solid, liquid or gas, convection must be liquid or gas)

if answer to (a)(i) is incorrect then in (a)(ii) have stated 'conduction and convection both need a medium...'= 1 mark, unless further qualified by stating about absence of particles, in which case get a second mark.

1

(b) (i) silvered surface

accept silver surface

1

(ii) silvered is a bad emitter/radiator

1

surface reflects heat/energy/radiation (at inner and outer surface)
or is a bad absorber (of energy)

accept bounces off

1

[6]

4 (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]

5 (a) (i) radiation

ignore thermal / infrared

1

(ii) black is a better / good absorber (of heat / radiation)

ignore reference to black being a good emitter

black absorbs heat is insufficient

*do **not** accept black attracts / absorbs the Sun*

*do **not** accept black attracts heat*

1

(so) temperature rises faster

must be an indication of heating up quicker

or

white is a worse / poor absorber (of heat / radiation) (1)

accept white is a better / good reflector (of heat / radiation)

(so if white faces) temperature would rise slower (1)

ignore any reference to light

1

(b) (i) 1.2 (hours) **or** 1 hour 12 minutes

no tolerance

1

(ii) increases (rapidly at first then increases at a slower rate)

*do **not** accept increases at a steady rate*

1

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

- (fill with) same mass / volume / amount of water
- same level of (sun)light / sunshine
  accept same heat / light source
  accept same place
- outside for the same (length of) time
- outside at same time (of day / year)
- initial water temperature
- the side of the bag facing the Sun
  *do **not** accept any factors to do with the construction of plastic bags eg thickness*

2

(ii) curved line drawn above given line
both lines must start from the same point
ignore if continues beyond one hour or levels off after 1 hour
*do **not** accept a straight line*

1

[8]

6 (a) radiates
absorbs / conducts
reflects
for 1 mark each

3

(b) C make sure the lamp is the same distance from both tubes
B switch on the lamp
A switch off the lamp
E wait for the temperature to stop rising
D read the thermometers
for 1 mark each

5

[8]

7 (a) (i) convection

1

(ii) conduction

1

(b) (i) 2

1

black is the best absorber (of thermal energy / heat)

accept black is the best emitter (of thermal energy / heat)

note that a comparative is needed (eg better or best)

1

(ii) the colour of the metal plates

1

(iii) any **one** from:

- more precise / accurate / reliable

  *do **not** accept better reading*

  *do **not** accept thermometer is unreliable*

- can measure continuously

- take many readings in a small time

- removes (human) reading error

  accept easier to read

- can compare / draw graphs automatically

- records data automatically

1

(c) (i) radiation

accept radiates

accept infra red (IR) waves

*do **not** accept heat waves*

1

(ii) to reflect (heat away from the fire fighter)

accept it reflects

accept it is a poor absorber (of thermal radiation / heat)

*do **not** accept deflect / bounce for reflect*

1

(d) **N**

*the mark is for the reason which does not score if **M** is chosen*

transfers / absorbs less heat

or

gives smallest increase in temperature

accept will keep fire fighters cooler

*accept **N** is cooler (after 15 minutes)*

*an answer **N** goes up to 52°C and **M** goes up to 100°C is insufficient*

1

[9]

8

(a) (i) Carries heat up (as convection current)

1

(ii) (1) By conduction or from molecule to molecule
(2) By radiation or as IR

2

(iii) Use shiny surface (inside or outside) or small area

1

(b) (i) Rise more quickly

1

(ii) Dull surface good absorber
(accept "attract" = "absorb" if context correct,
then penalise spg mark.

Shiny surface poor absorber

2

(c) (i) Fall more quickly

1

(ii) Dull surface good emitter
Shiny surface poor emitter

2

[10]

9

(a) light (inside the tin can) is reflected many times before incident on the hole

1

at each reflection energy / light is absorbed so (very) little light / energy leaves the hole

1

(b) the object absorbs all of the radiation incident on it
or
the object does not reflect or transmit any radiation
or
the object is the best possible emitter of radiation

1

(c) the intensity of every wavelength increases

1

the shorter the wavelength the more rapid the increase in intensity

1

the peak intensity occurs at shorter wavelength

1

(d) accept any value between 1600 (°C) and 10 000 (°C)

1

(e) the temperature has increased

1

as 200 years ago the energy / radiation from space = energy / radiation emitted (and reflected) into space

1

but now less radiation is emitted so there is a net absorption

allow energy for radiation

1

[10]

10 (a) dark matt

1

light shiny

1

(b) B A C

1

biggest temperature difference (80 °C)

dependent on first mark

1

(c) (i) (the can that is) dark matt

1

best absorber (of infrared radiation)

1

(ii) any **three** from:

- same area / shape of can
- surrounding temperature is the same for all cans
- same surface underneath cans
- same position in the room

3

(d) fox A

smaller ears

1

thicker fur

1

these minimise energy transfer

dependent on first 2 marks

1

[12]