**1.**

(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]**

**2.**

(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]**

**3.** (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) <u>outside</u> 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]**

**4.** (a) (matt) black is a good emitter 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) The volume of boiling water.

**1**

(ii) any **one** from:

- (more) precise

  *do **not** accept better (reading)*

- accurate

- reliable

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

- removes human / reading error

  *accept easier to read*
  *accept take temperature more frequently*

**1**

(b) **B**

*marks are for the explanation*

temperature falls faster

*this mark point cannot score if **A** chosen*

**1**

because black is a better / good emitter

*ignore reference to better absorber*
*accept for both marks an answer in terms of why **A** is the white can*

**1**

(c) (i) faster than

**1**

(ii) darker / black surfaces absorb heat faster

*accept black is a better / good absorber*

*dark surfaces attract heat negates this mark*

**1**

(iii) air is a bad / poor conductor

**or**

air is a good insulator

*accept air is an insulator*

**1**

**[7]**

**6.** (i) *this mark only scores if a correct pair is chosen **and** a correct reason given*

**A** and **C**

*both required and none other*

**or**

**B** and **D**

*both required and none other*

only one (independent) variable

**or**

different shapes but the same colour

*accept only the shape changes*

**1**

(ii) **B** radiates heat faster

*converse answer in terms of **A** gains full marks*

**1**

**or**

B is a better emitter (of heat)

but B has a smaller (surface) area

**or**

B has a smaller (surface) area: volume ratio

*allow **2** marks for both lose the same quantity / amount of heat in the same time*

***or** both have same rate of heat loss*

*allow **1** mark for both lose the same quantity / amount of heat*

**1**

(iii) any **one** from:

- transfer a lot of heat (too rapidly)
- water temperature drops too rapidly

  *accept (significantly) more heat will be lost from the first radiator*
- water too cold for the next radiator

  *mention of absorption of heat negates mark*

**1**

**[4]**