

GCSE Physics

Black Body Radiation

Mark Scheme

Time available: 55 minutes Marks available: 48 marks

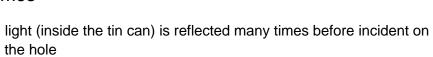
www.accesstuition.com

Mark schemes

(a)

1.

2.





	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	1
	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]
(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



3

1

1

1

1

2

1

1

[12]

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

(d) fox A

smaller ears

thicker fur

these minimise energy transfer dependent on first 2 marks

(a) infrared / IR

3.

correct answer only

(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
- (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

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

		(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	Access Tuition www.accesstuition.com
7	(a)	(matt) black is a good emitter of infrared / radiation	
	(a)	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 $2 \times 3800 \times 15$	
		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

4.

less (input) energy is wasted	s wasted
-------------------------------	----------

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



1

1

1

1

1

1

[9]

or

more (input) energy is usefully used accept heat for energy



(a)

(i) The volume of boiling water.

- (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

(b) **B**

marks are for the explanation

temperature falls faster this mark point cannot score if **A** chosen

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

(c) (i) faster than

(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 <u>bad / poor</u> conductor
 or
 air is a good <u>insulator</u>
 accept air is an insulator

6.



[7]

- 1 (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 B radiates heat faster (ii) 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 any one from: (iii) 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