MR SULLY UNFOLDS PHYSICS ANSWERS

Infrared and black body radiation

AQA 4.6.3 · RP10
Waves · Paper 2
Foundation & Higher · Required practical 10

Name _____ Class _____ Date _____

All objects emit and absorb infrared radiation. The hotter an object is, the more infrared it emits.

KEY IDEAS

- Dull, dark (matt black) surfaces are the best emitters and absorbers of infrared; shiny, light surfaces are the worst.
- **Physics only:** a perfect black body absorbs all radiation that falls on it, and is the best possible emitter.
- An object at constant temperature absorbs radiation at the same rate as it emits it.

Section A · Recall

Grade 4–5

1 Which type of surface is the best emitter of infrared radiation? [1]

Matt (dull) black

2 What happens to the amount of infrared radiation an object emits as its temperature increases? [1]

It increases.

Section B · Required practical

Grade 5–6

3 A student uses a Leslie cube (a metal cube with four different faces) filled with hot water.

Surface	Infrared detector reading
Matt black	8.6
Shiny black	6.1
Matt white	3.9
Shiny silver	1.2

a Name the independent and dependent variables. [2]

Independent: type of surface

Dependent: amount of infrared emitted (detector reading)

b Give two control variables. [2]

Distance from the detector to each face;

temperature of the water (all faces at the same temperature).

c State the conclusion of this experiment. [2]

Matt black emits the most infrared and shiny silver the least;

dark, matt surfaces are better emitters than light, shiny ones.

4 To test absorption, a drawing pin is stuck with wax to the back of a matt black plate and a shiny silver plate, the same distance from a radiant heater. Predict which pin falls first and explain. [2]

The pin on the matt black plate,

because matt black is a better absorber of infrared, so that plate heats up faster and the wax melts first.

Section C · Physics only

Grade 6–7+

5 What is a perfect black body? [2]

An object that absorbs all the radiation incident on it;

it doesn't reflect or transmit any.

6 Explain why the temperature of the Earth stays roughly constant. (Higher) [3]

The Earth absorbs radiation from the Sun and emits radiation into space.

When the rate of absorption equals the rate of emission,

the temperature stays constant.

Exam-style question

AQA style

7 Solar panels used for heating water are usually painted matt black and covered with glass.

a Explain why the panels are painted matt black. [2]

Matt black is the best absorber of infrared radiation,

so the panel absorbs more energy from the Sun and heats the water faster.

b Explain what would happen to the temperature of the panel if it absorbed radiation faster than it emitted it. (Higher) [2]

Its temperature would increase,

until it emits radiation at the same rate as it absorbs it.

Total: _____ / 19

How confident am I?	Not yet	Nearly	Got it
I can describe which surfaces are good emitters and absorbers	☐	☐	☐
I can describe the infrared practical	☐	☐	☐
I can explain black body radiation (Physics only)	☐	☐	☐