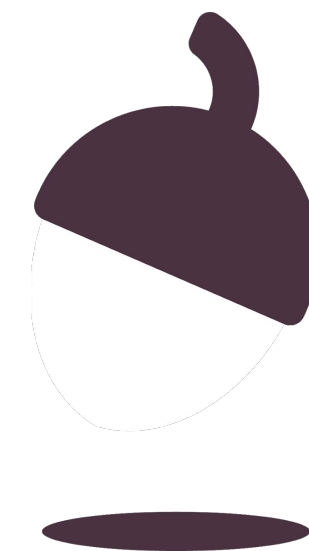


Combined Science - Physics - Key Stage 4 - Waves

Infrared Worksheet

Miss Walrond



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Q1.

(a). A student wants to keep their coffee hot. They have a choice of putting it in a silver drinks container or a black drinks container. Which would you recommend to the student and why? [3]

(b). A different student has an iced coffee and wants to keep this cold. Which drinks container would you recommend to this student? [3]



Answers



Q1. Answers

a. The silver container [1]

Silver is a poor **emitter** of infrared [1], so the temperature of the coffee won't change / the coffee will remain hotter for longer [1]

b. The silver container [1]

Silver is a poor **absorber** of infrared [1], so the temperature of the coffee won't change / the coffee will remain hotter for longer [1]



In lesson questions



Independent Task - Infrared and Coloured surfaces

- 1) Two identical water tanks are placed outside on a summer day. One tank is silver and shiny, the other is painted matt black. Explain which will heat up the water fastest?

_____ *is the best absorber of infrared so...*

- 1) Explain why buildings in warm countries are often painted white.

White is a _____ absorber of infrared so



Independent Task - Infrared Investigation

- 1) Write down the independent and dependent variables for an investigation into how the colour of a surface affects the rate of infrared emission. You will have two tin cans which you will fill with hot water.
- 2) Write down at least 2 control variables.
- 3) Explain why these control variables are important.



Independent Task - Results from the experiment

Copy and complete the table of results.

Colour of the Can	Starting Temperature (°C)	Final Temperature (°C)	Change in Temperature (°C)
Black	90	63	
Silver	90	72	



Independent Task - Conclusion

Write a conclusion for this experiment.

The experiment showed that the _____ can had the greatest change in temperature.

This means



Worked example - Examination question

(a). Stefan experiments with different ovens in his kitchen. He compares a microwave oven and an infrared oven for heating beakers of milk to $80\text{ }^{\circ}\text{C}$. He heats the milk in glass beakers in both ovens. Look at his results.

			Time to heat milk to $80\text{ }^{\circ}\text{C}$ in minutes	
Beaker	Material	Colour	Microwave oven	Infrared oven
A	glass	white	2	25
B	glass	black	2	20
C	glass	transparent	2	22

Answers as discussed in this slide have not been seen or verified by OCR.

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Worked example - Examination question

Stefan makes sure his experiment is a fair test.

Suggest ways he can do this.

[2]

(b). How do microwaves heat the milk?

[1]

(c). The microwave oven takes the same time to heat the milk in the different beakers. Explain why.

[1]

Answers as discussed in this slide have not been seen or verified by OCR.

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Worked example - Examination question

Beaker	Material	Colour	Time to heat milk to 80 °C in minutes	
			Microwave oven	Infrared oven
A	glass	white	2	25
B	glass	black	2	20
C	glass	transparent	2	22

(d). Look at the information in the table about the infrared oven.

Explain why the different coloured beakers take different times to heat up the milk.

[2]

Answers as discussed in this slide have not been seen or verified by OCR.

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Answers



Review: Independent Task - Infrared and Coloured surfaces

- 1) **Black** is the best absorber of infrared so the black tank will heat the water fastest*
- 2) White is a **poor** absorber of infrared so it will stop the buildings from heating up too quickly. This will keep them cool inside.*



Review: Infrared Investigation

1) Independent variable - colour of the surface.

Dependent variable - change in temperature of the water inside the can.

2 & 3) Control variables:

- **Volume of the water** - it would take a greater change in energy to change the temperature of the water if there was more water.
- **Initial temperature of the water** - the hotter an object is the more infrared radiation it will emit.
- **Surface area of the can** - the greater the surface area the more infrared radiation that can be transferred.
- **Time that the cans are left for** - the longer the cans are left for, the more infrared radiation that can occur.
- **Material of the can** - different materials will cool down at different rates



Review: Independent Task - Results from the experiment

Colour of the Can	Starting Temperature (°C)	Final Temperature (°C)	Change in Temperature (°C)
Black	90	63	27
Silver	90	72	18



Review: Independent Task - Conclusion

*The experiment showed that the **black** can had the greatest change in temperature.*

*This means ... the black can is the **best** emitter of radiation.*

