Insulation

Tuesday, 21 April 2020

LO: **Explain** how to prevent unwanted heat transfer

Do Now (5 min):

1. State the law of conservation of energy.
2. State the word we use to describe energy that has been wasted
3. Describe the energy transfer when a moving object comes to a sudden stop
4. Name the piece of equipment used to measure the force needed to lift an object.
5. Give the following to 3 significant figures: 23.4100351

Challenge: Define conduction.

Key terms: conduction, radiation, thermal conductivity, insulation

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Do Now Answers:

1. The Law of Conservation of Energy states that ‘energy can be transferred usefully, stored or dissipated, but cannot be created or destroyed’.
2. Dissipated
3. Kinetic → thermal
4. A newton meter
5. 23.4

Challenge: Conduction is the movement of thermal energy through a solid. When particles in a solid heat up they vibrate with more kinetic energy. This particle then passes this kinetic energy on to the neighbouring particles and this passes the energy along the solid.

Key terms: conduction, radiation, thermal conductivity, insulation

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40%

- Describe two types of energy transfer (conduction, radiation)

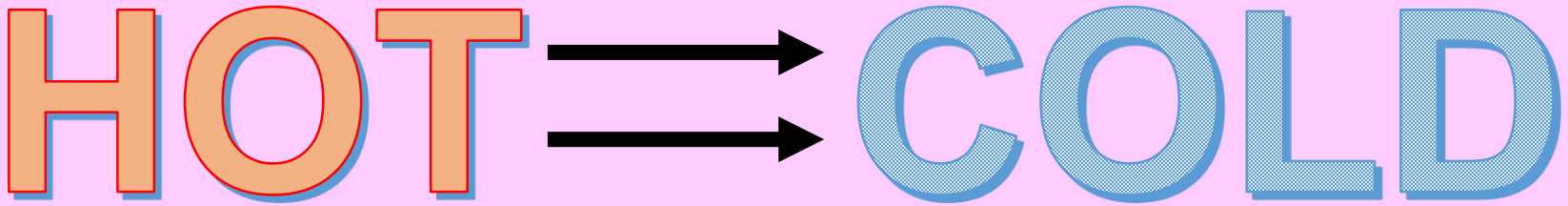
50%

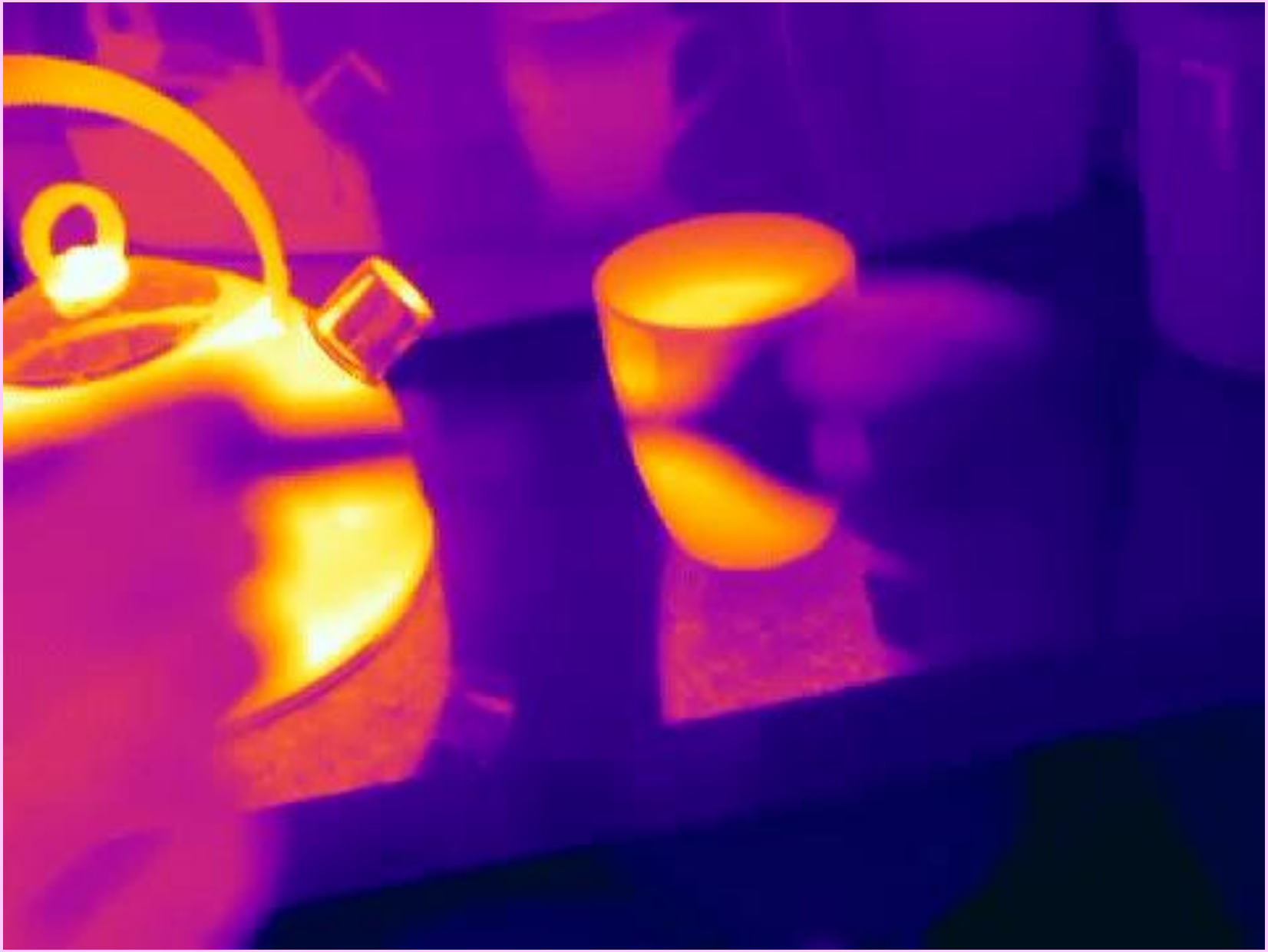
- Describe ways that energy loss can be reduced

60%

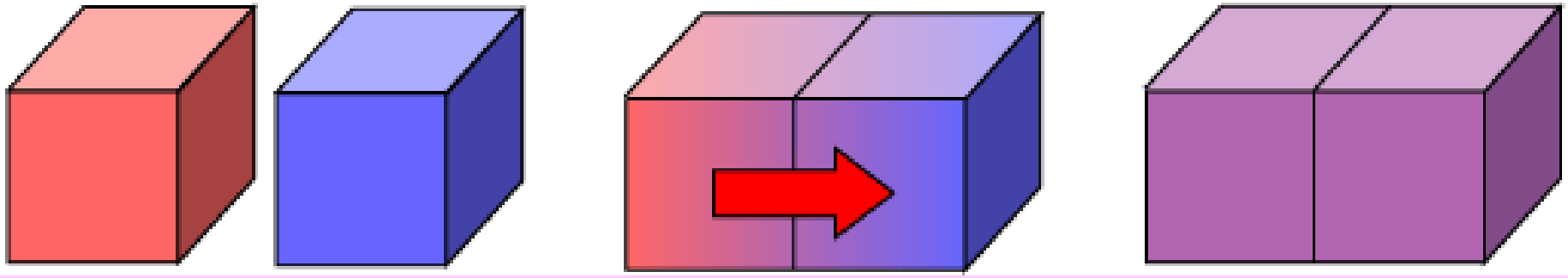
- Explain how energy loss can be reduced by linking this to either conduction or radiation.

Key terms: conduction, radiation, thermal conductivity, insulation

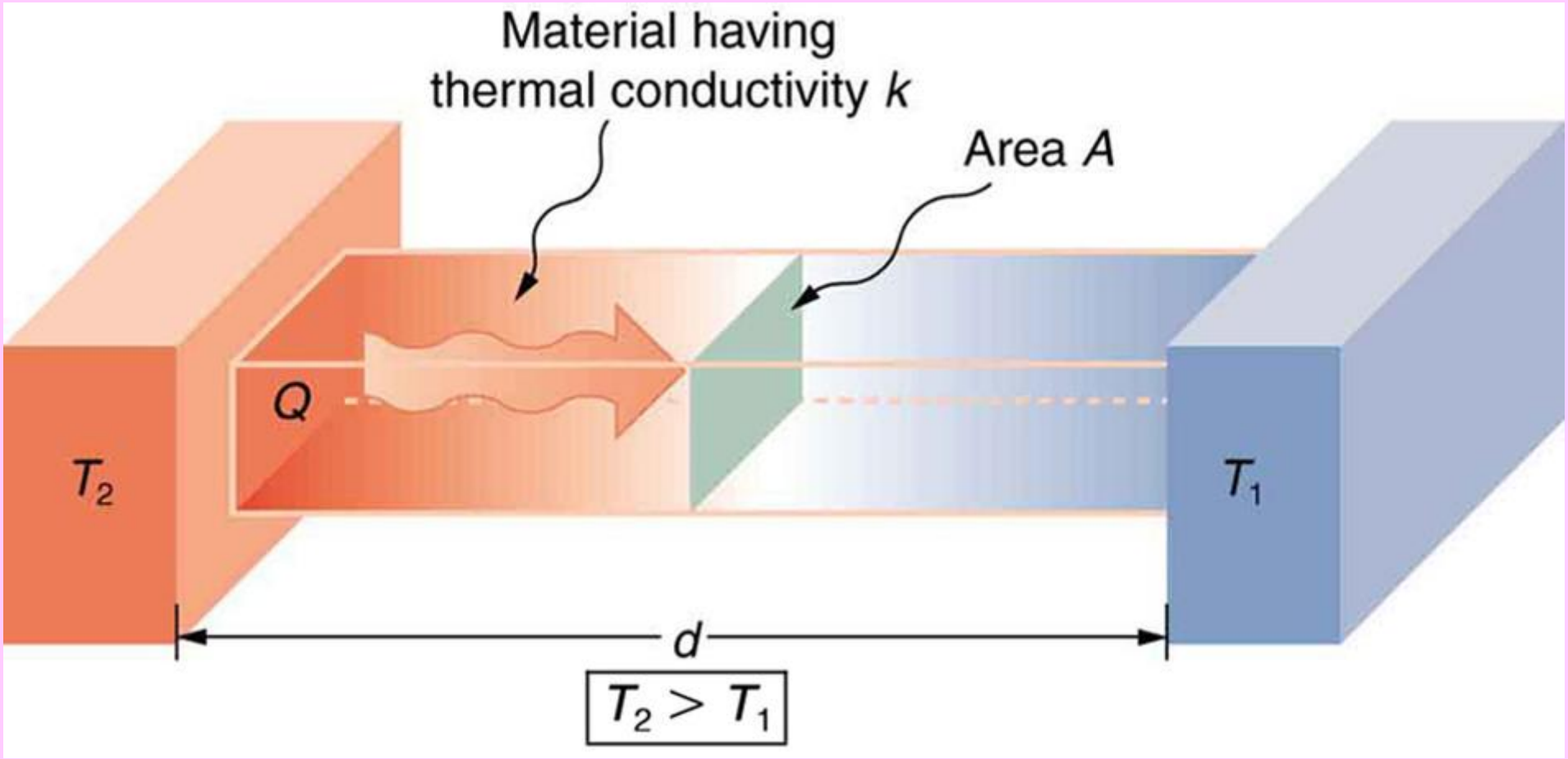

HOT
COLD



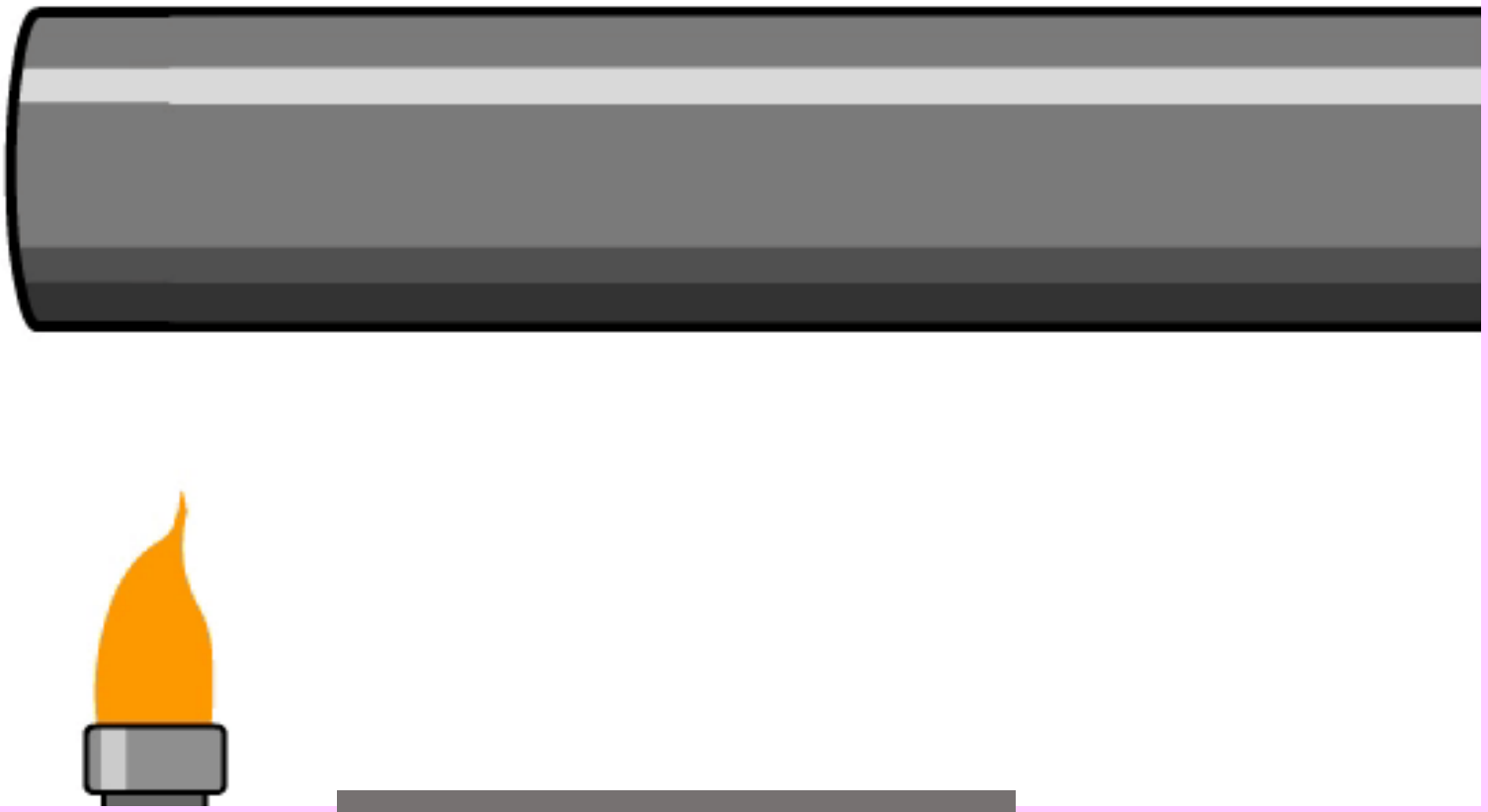
conduction



conduction

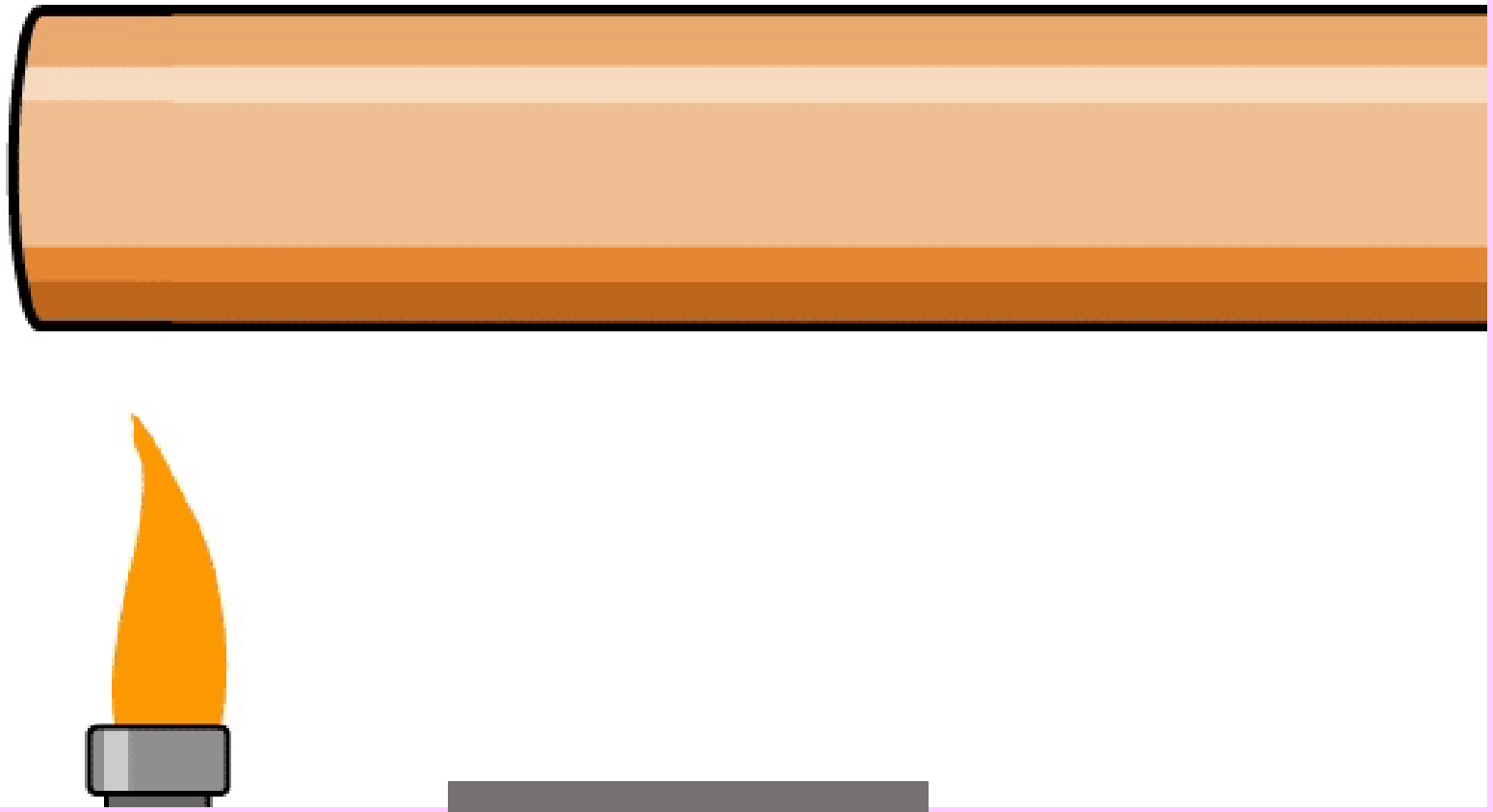


conduction



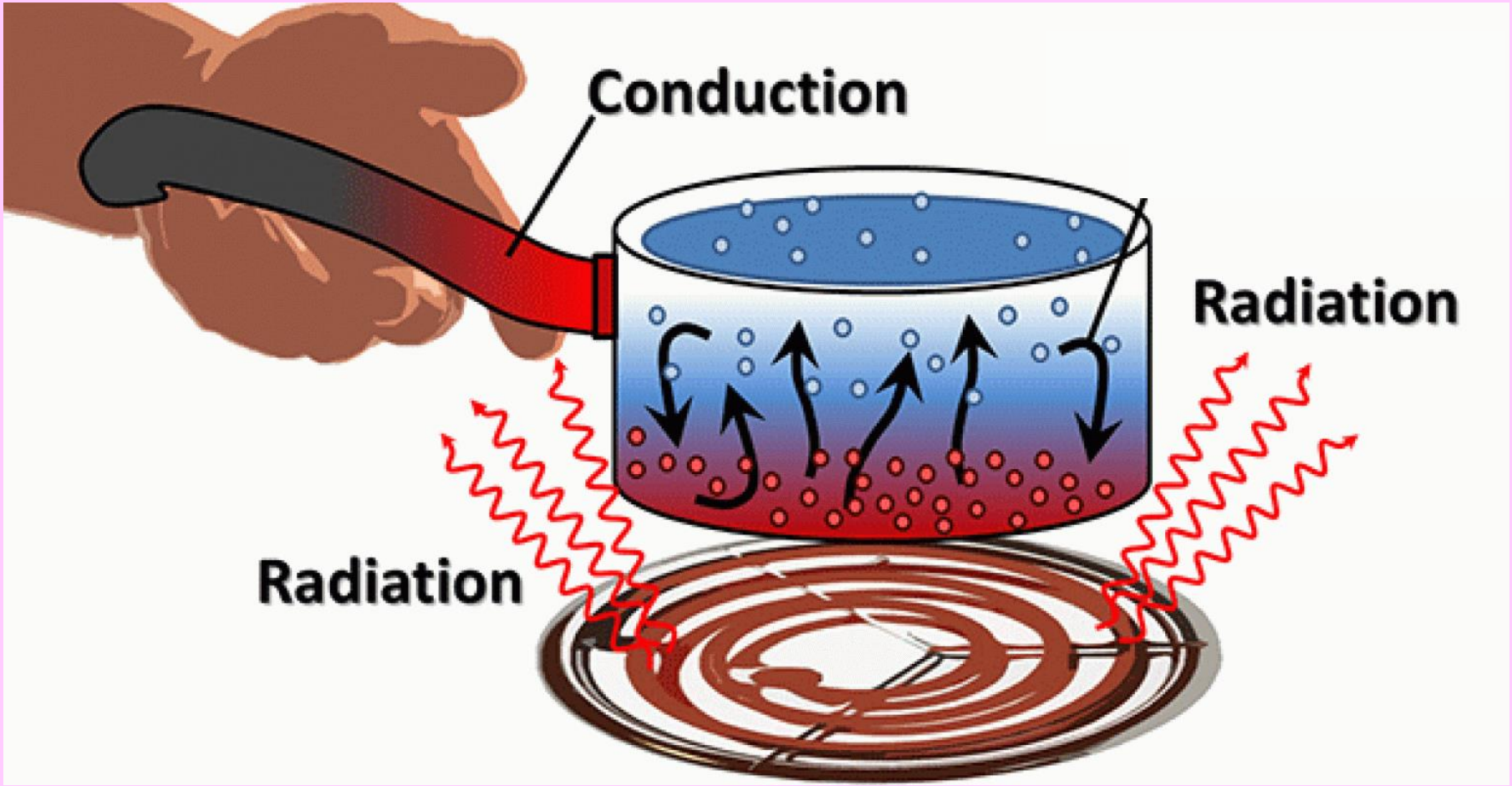
non-metals

conduction

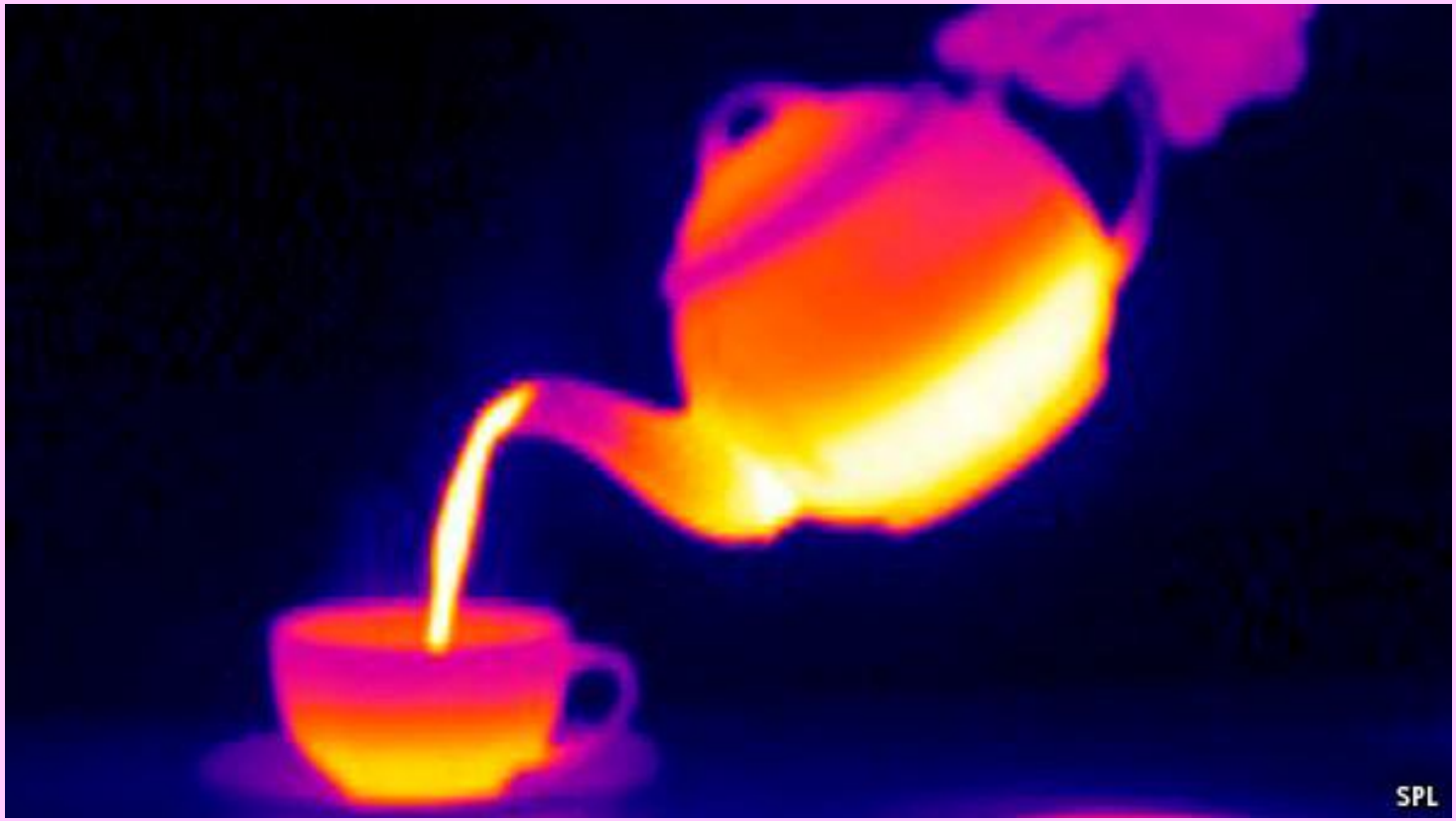


metals

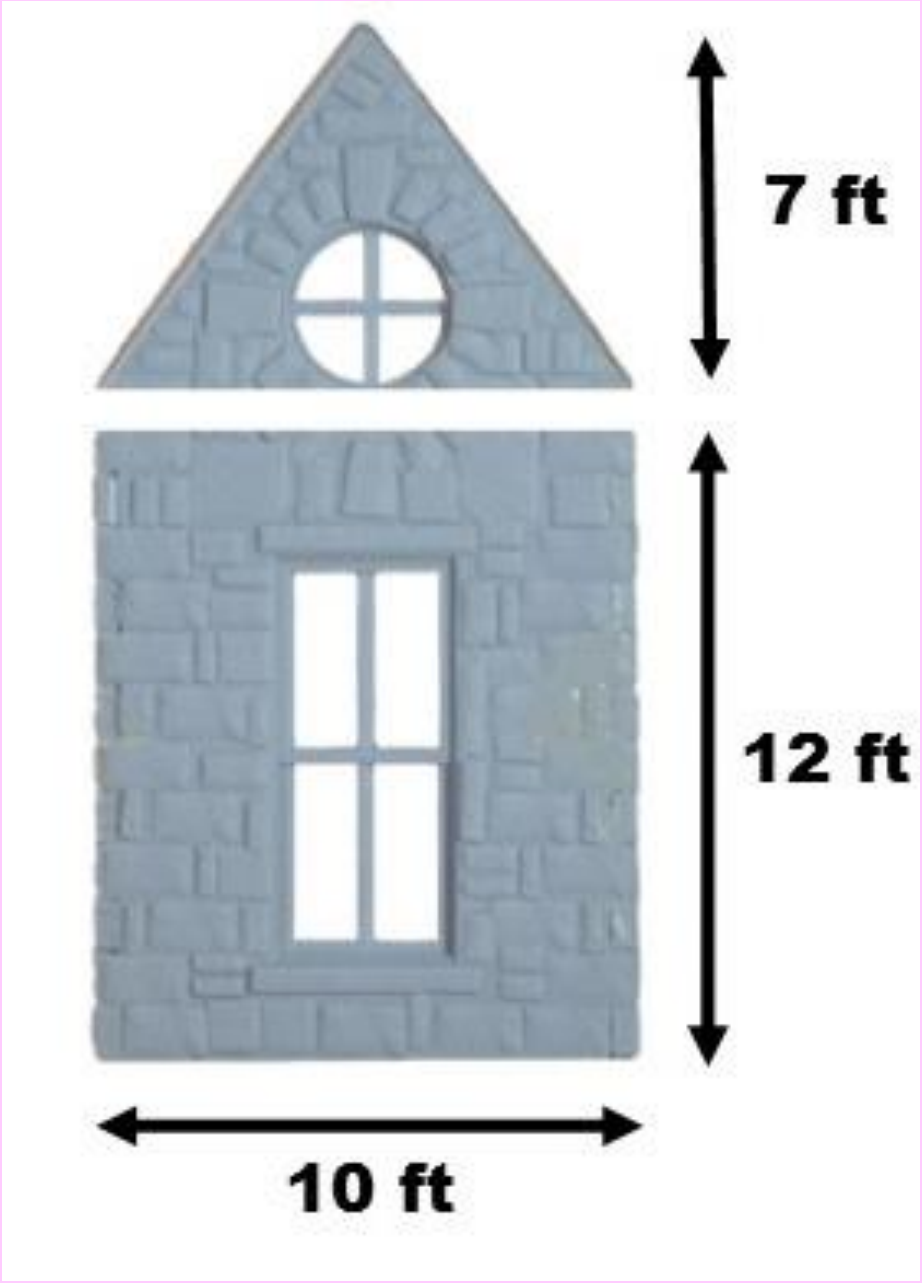
radiation



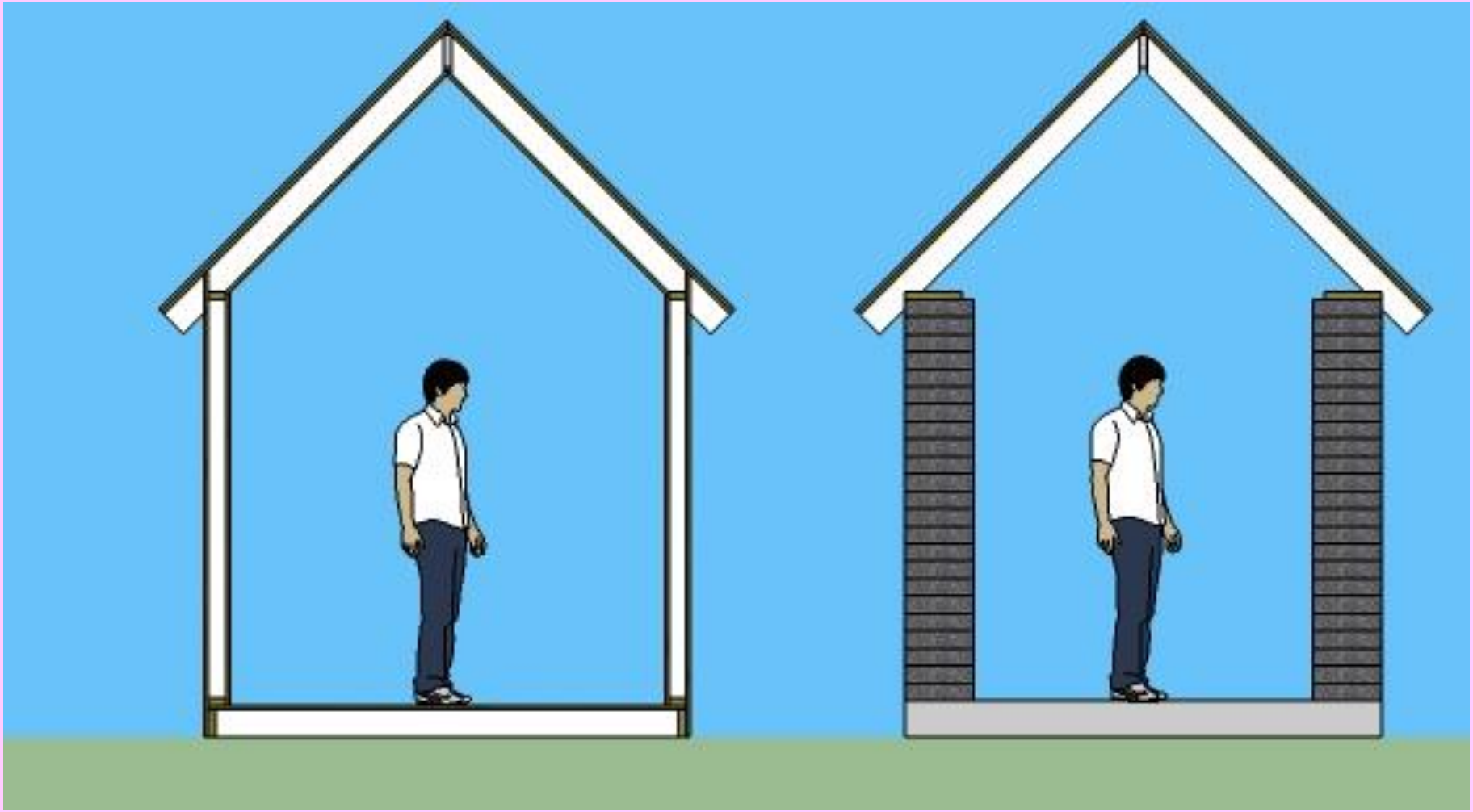
radiation

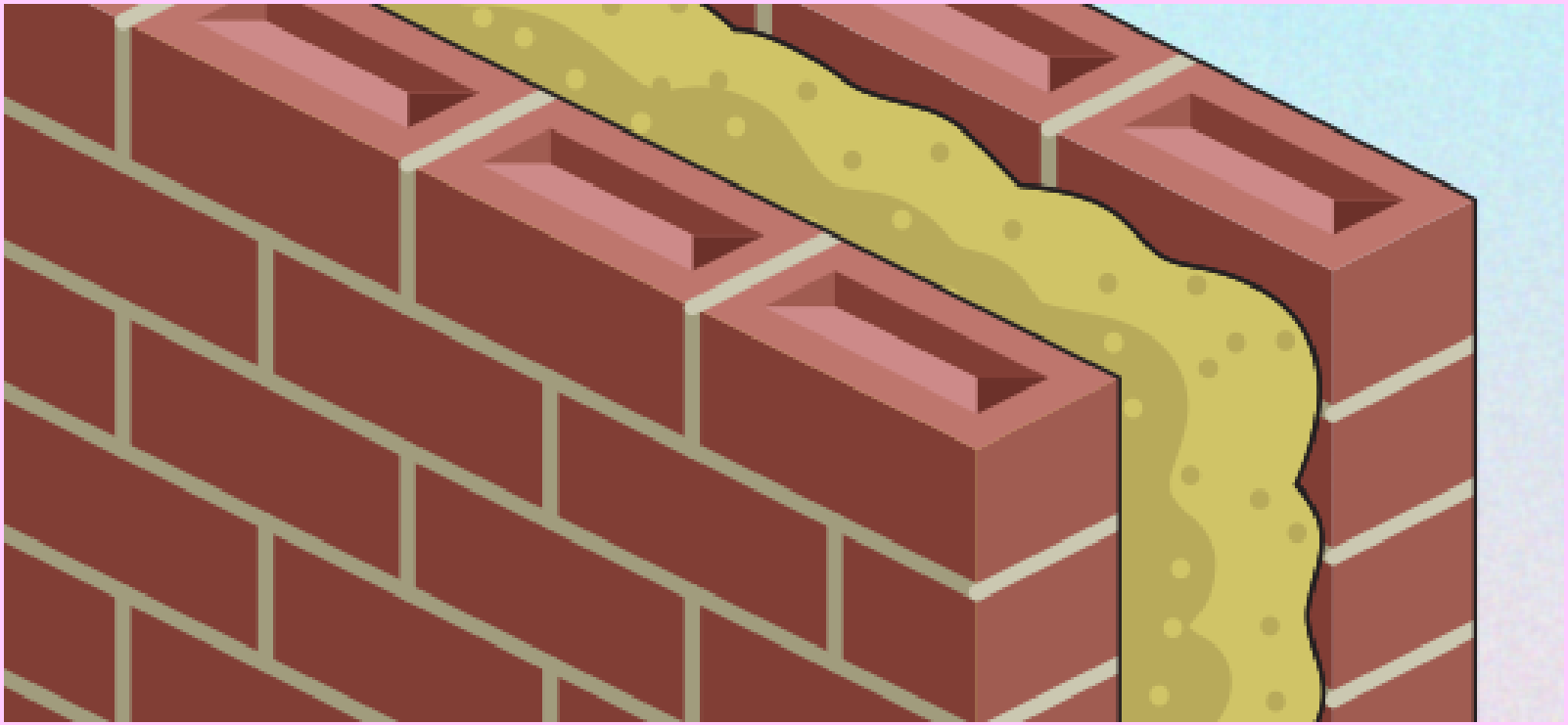



21°C


7 ft
12 ft
10 ft


Q
T_2
T_1





Which of these would cause the thermal energy store to **deplete quicker**?

1) Having thick walls
2) Having walls with high thermal conductivity
3) Having walls with small area

Which of these would be more successful in **maintaining** the thermal energy store?

1) Having walls with large area
2) Having walls that are thick
3) Having walls with high thermal conductivity

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LO: **Explain** how to prevent unwanted heat transfer

How is most energy lost from a home?
Define conduction.
Define radiation.
Why do we want to reduce the amount of energy wasted?
How are houses insulated
What factors increase the rate of thermal energy loss from a house?

Look, cover, write, check

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How is most energy lost from a home?
Define conduction.
Define radiation.
Why do we want to reduce the amount of energy wasted?
How are houses insulated
What factors increase the rate of thermal energy loss from a house?

Spend 2 minutes quizzing the person next to you.

If their answer is perfect, let them ask you a question, if not, correct them and ask them to repeat the answer.

LO: **Explain** how to prevent unwanted heat transfer

Recall Quiz: (5 mins)

1. Most of the energy lost from our houses spreads out into the surroundings by (radiating as sound/heating).

2. Two reasons that we want to stop this happening are because reducing waste helps to… and…

3. Heat will be lost from a 35°C home more rapidly if the outside temperature is (30°C / 15°C).

4. The house will also lose more heat if the walls are (thick/thin) and have a (larger/smaller) area.

Key terms: conduction, radiation, thermal conductivity, insulation

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Recall Quiz: (5 mins)

1. Most of the energy lost from our houses spreads out into the surroundings by heating

2. Two reasons that we want to stop this happening are because reducing waste helps to keep us comfortable and save money.

3. Heat will be lost from a 35°C home more rapidly if the outside temperature is 15°C.

4. The house will also lose more heat if the walls are thin and have a larger area.

Key terms: conduction, radiation, thermal conductivity, insulation

LO: **Explain** how to prevent unwanted heat transfer

Application Task – I Do

Which house will lose the store of thermal energy more quickly?

House A:
Roof is insulated with fibreglass

House B:
No roof insulation

Key terms: conduction, radiation, thermal conductivity, insulation

LO: **Explain** how to prevent unwanted heat transfer

Application Task – I Do Answer

Which house will lose the store of thermal energy more quickly?

House A:
Roof is insulated with fibreglass

House B:
No roof insulation

1. House B will lose the store of thermal energy more quickly because there is no insulation. This means that energy can be transferred more quickly to the surroundings.

Key terms: conduction, radiation, thermal conductivity, insulation

LO: **Explain** how to prevent unwanted heat transfer

Application Task – We Do

Which house will lose the store of thermal energy more quickly?

House C:
Walls are 1m thick

House D:
Walls are 0.5m thick.

1. House (C/D) will lose the store of thermal energy more quickly because… This means that (more/less) energy will be dissipated to the surroundings.

Key terms: conduction, radiation, thermal conductivity, insulation

LO: **Explain** how to prevent unwanted heat transfer

Application Task – We Do Answer

Which house will lose the store of thermal energy more quickly?

House C:
Walls are 1m thick

House D:
Walls are 0.5m thick.

1. House D will lose the store of thermal energy more quickly because the walls are thinner. This means that more energy will be dissipated to the surroundings.

Key terms: conduction, radiation, thermal conductivity, insulation

LO: **Explain** how to prevent unwanted heat transfer

Application Task – You Do

Complete the remaining questions on your Application Task sheet. Use your key knowledge to complete the table and explain which house will lose thermal energy more easily and why.

Example	Which house will dissipate less energy?	Why?
House A is in the UK where the temperature outside is only 7ºC, but inside it is 24ºC. House B is in Spain, where the temperature outside is 30ºC, and inside it is 35ºC.		
House A is a 10 bedroom mansion with a large area of walls, whereas House B is a 2 bedroom house with a smaller area of walls.		
House A has walls made from brick, whereas House B is made from aluminium.		
House A has thin walls, whereas House B has thick walls.		
House A has no loft insulation, but House B has a roof and walls insulated with fibreglass.		
House A has installed double glazing, but House B just has single-glazing.		

Key terms: conduction, radiation, thermal conductivity, insulation

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Application Task – You Do Answers

Example	Which house will dissipate less energy?	Why?
House A is in the UK where the temperature outside is only 7ºC, but inside it is 24ºC. House B is in Spain, where the temperature outside is 30ºC, and inside it is 35ºC.	B	House B will lose less energy because there is a smaller temperature difference between the inside and the outside of the house. This means that thermal energy will transfer more slowly.
House A is a 10 bedroom mansion with a large area of walls, whereas House B is a 2 bedroom house with a smaller area of walls.	B	House B will lose less energy. This is because it has a smaller area of walls and will therefore have less surface area to transfer thermal energy.
House A has walls made from brick, whereas House B is made from aluminium.	A	House A will lose less energy because aluminium is a good thermal conductor, whereas brick is a poor thermal conductor. Therefore house B will conduct thermal energy more quickly.
House A has thin walls, whereas House B has thick walls.	B	House B will lose less energy because the walls are thicker therefore the thermal energy has a bigger distance to travel.
House A has no loft insulation, but House B has a roof and walls insulated with fibreglass.	B	House B will lose less energy because it contains roof and wall insulation made of fibreglass. This material contain lots of trapped air, which is a good insulator. This means that thermal energy will be transferred less quickly.
House A has installed double glazing, but House B just has single-glazing.	A	House A will lose less energy. This is because it has double glazing, which contains a layer of trapped air between panes of glass. Air is a good insulator and therefore thermal energy is transferred less quickly

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Extended Writing Task: (8 mins)

Describe the laws which control energy transfers within a system and explain how wasted energy can be reduced.

- ❑ The law of conservation of mass states that energy can be… however, it can't ever be…
- ❑ An object high off ground has a lot of energy in the ___ store, one that's moving, in the ___ store and one which is powered by electricity, the ___ store.
- ❑ Energy can be transferred between these different stores in four ways: ___, ___, ___ and ___.
- ❑ The two main ways that energy is wasted are by ___ and ___. In these cases, energy is dissipated, meaning… Two ways to reduce wastage are...
- ❑ A moving object which dissipates less energy to its surroundings will move (faster/slower), because a (greater/smaller) quantity of energy will be able to be transferred to the kinetic store.

Key terms: conduction, radiation, thermal conductivity, insulation

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Extended Writing Task Model Answer

According to the law of conservation of mass, energy can't be created or destroyed, only transferred usefully, stored or dissipated to the surroundings. As an object is lifted off the ground, energy is transferred to the gravitational store. Once released, the fact that it moves means that a transfer to the kinetic store has occurred. We describe any electrical appliance as utilising energy from the electrostatic store.
See key knowledge for 4 types of transfer.
Energy is dissipated via heating or radiating (more specifically, by sound). We reduce these factors using lubrication or thermal insulation.
The less energy dissipated, the more energy available to be transferred to the useful store.
A bungee jumper falls from a cliff. As they do so, energy being stored gravitationally is transferred to the kinetic store (as they're moving). As they fall, they begin to slow down. This is because their kinetic energy store begins to decrease as it transfers to an elastic store in the bungee rope.

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Plenary:

True or false

1. If the temperature difference between outside and inside is large, the thermal energy will transfer more quickly.

2. If the walls are thick then the thermal energy will transfer more quickly.

3. If the walls are made from a material with a high thermal conductivity then the thermal energy will transfer more quickly.

4. If the walls are insulated then the thermal energy will transfer more quickly.

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Plenary Answers:

1. If the temperature difference between outside and inside is large, the thermal energy will transfer more quickly. True

2. If the walls are thick then the thermal energy will transfer more quickly. False

3. If the walls are made from a material with a high thermal conductivity, then the thermal energy will transfer more quickly. True

4. If the walls are insulated, then the thermal energy will transfer more quickly. False

Key terms: conduction, radiation, thermal conductivity, insulation