Year 9 home learning booklet

- Insulation
- Open and closes systems

1. Read the power points for both lessons above.
2. Complete tasks in power points and check answers
3. Complete application tasks in this booklet and check answers

Key knowledge for insulation

How is most energy lost from a home?	Most energy lost from a home is wasted as dissipated thermal energy
Define conduction.	Heat transferred between objects in contact.
Define radiation.	Heat transferred by infrared radiation.
Why do we want to reduce the amount of energy wasted?	We want to reduce the amount of energy wasted because it keeps us more comfortable and saves money.
How are houses insulated	We insulate houses by filling the walls with a material through which heat is transferred slowly.
What factors increase the rate of thermal energy loss from a house?	• There's a larger temperature difference between outside and in. • The walls have a larger area. • The walls are made of a material which is a thermal conductor. • The walls are thin. • The walls don't contain insulation.

Key knowledge for open and closed systems

Define system.	An object or group of objects.
Define open system.	A system in which energy can be transferred to and from the environment.
Define closed system.	A system in which energy cannot be transferred to and from the environment.
How is energy commonly dissipated?	By heating or by radiating (e.g. as sound)
Is dissipated energy useful or wasted?	Dissipated energy is wasted energy.
Give two common methods of reducing dissipated energy in an open system.	Lubrication and/or thermal insulation.

Application Task – Insulation

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.		

Application Task – Open and Closed Systems

Complete the table below.

System	Useful energy store	Wasted energy store	Ideas for reducing wasted energy
Bike			
Car engine			
Kettle			
Coffee cup			

Answer the remaining questions

1. The ball is thrown up in the air with 100J of kinetic energy stored.
   How much gravitational potential energy does the ball have stored at the peak of its throw?

2. A ball stores 50J of kinetic energy as it is thrown in the air. At the peak, there are 45J of gravitational potential energy, how much energy is dissipated as sound and heat energy?

3. A kettle has a store of 400J of thermal energy in the heating filament. 345J is transferred by heating to thermal energy store of water. How much energy is dissipated as sound?

4. A kettle has 660J of electrical energy input. How much energy is transferred to thermal energy store of the filament?

5. A speaker stores 95J of kinetic energy. How much of the energy is radiated as sound?

6. A TV has 5000J of energy transferred electrically. 70J is wasted thermally, how much energy is transferred usefully?

7. A speaker has 95J of kinetic energy. 6J of energy is dissipated as heat, how much energy is transferred by radiation into sound?

8. A TV has 9000J of energy transferred electrically. How much energy is transferred usefully as light and sound?

Mark scheme for insulation application task

Example	Which house will dissipate less energy?	Why?
House A is in the UK where the temperature outside is only 7^{o}C, but inside it is 24^{o}C. House B is in Spain, where the temperature outside is 30^{o}C, and inside it is 35^{o}C.	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.

Mark scheme for insulation application task

System	Useful energy store	Wasted energy store	Ideas for reducing wasted energy
Bike	kinetic	Sound + thermal	Lubricating the wheels
Car engine	kinetic	Sound + thermal	Lubricating the engine parts
Kettle	thermal	Some thermal is dissipated + sound.	Silver foil Foam or rubber.
Coffee cup	thermal	Some thermal is dissipated	Silver foil. Plastic lid.

1. 100 J
2. 5 J
3. 55 J
4. 660 J
5. 95 J
6. 4300 J
7. 89 J
8. 9000 J