REVIEW … Key Concepts

Unit 3 – Heat and Temperature

1.0 Technologies for Obtaining and Controlling Heat

- Heat technologies have evolved over time
- Culture and technology are linked
- Evolution has integrated heat-related materials and technologies
- Choices about the environment involves individuals and society

2.0 Heat Affects Matter

- Transferring heat to and from matter can cause a change in state
- The **Particle Model of Matter** explains changes in state and volume
- **Temperature** is the measure of the average kinetic energy of the particles in a substance
- **Thermal energy** is the total kinetic energy of the particles in a substance – heat is transferred from an area of high kinetic energy to an area of low kinetic energy
- **Conduction** (in contact)**, Convection** (circular motion) **and Radiation** (waves)

3.0 Natural Phenomena and Technology Devices

- Thermal energy is produced by the Sun, decay, fire and geothermal
- **Passive** and **Active** solar heating systems use the sun's energy and are environmentally friendly
- **Thermostats** control temperature in heating systems
- Insulation helps block unwanted heat transfer (heat loss)

4.0 Benefits and Costs of Heat Technologies

- Non-renewable resources have a limited supply
- Fossil fuels are the major sources of heating, but degrade the environment
- Costs of using natural resources: **economic, environmental and societal**
- Energy Alternatives: **solar, wind, geothermal, nuclear and hydro-electric (gravitational)**

1.0 Technologies for Obtaining and Controlling Heat

❖ Heat technologies have evolved over time

Before 1600, people believed heat was a combination of fire and air. They thought it was an invisible fluid. What was the fluid called and explain the 'Theory' it was based on?

_____

_____

_____

_____

Explain the **Particle Theory of Heat**

_____

_____

_____

❖ Culture and technology are linked

How is culture and **heat technology** linked?

_____

_____

_____

Describe the difference between the units associated with heat. **joule, watt, kilowatt, gigajoule**

_____

_____

_____

_____

What is the difference between **‘needs ‘**and **‘wants’**?

_____

_____

_____

_____

❖ Evolution has integrated heat-related materials and technologies

What activities are directly related to **heat related technologies**?
(eg. staying comfortable in our homes)

_____

_____

_____

Complete the **Heating Technology Timeline**

7000 **B.C.** _____ 

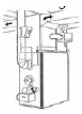
100 **B.C.** _____

A.D. 1200 _____ 

1300**s** _____ 

1700**s** _____ 

late 1700**s** _____

1800**s** _____ 

1906 _____ 

❖ Choices about the environment involves individuals and society

What does it mean when we are asked to make **sustainable** choices?

_____

_____

_____

2.0 Heat Affects Matter

❖ Transferring heat to and from matter can cause a change in state

Describe the changes that take place with the transfer of heat to and from water.

_____

_____

_____

_____

❖ The **Particle Model of Matter** explains changes in state and volume

List the four main principles in the **Particle Model of Matter**

_____

_____

_____

_____

Kinetic energy is the energy of movement. Describe the particles in each state of matter.

Solid _____

Liquid _____

Gas _____

Complete the following Chart that helps to show the relationship between **heat, the particle model and changes of state.**

	Solid	Liquid	Gas
Space between particles			
Volume			
Shape			
Adding heat			
Removing heat			

- **Temperature** is the measure of the average kinetic energy of the particles in a substance
- **Thermal energy** is the total kinetic energy of the particles in a substance – heat is transferred from an area of high kinetic energy to an area of low kinetic energy

Explain the difference between **thermal energy**, **heat** and **temperature** in terms of kinetic energy.

_____

_____

_____

_____

How is temperature measured?

_____

_____

Complete the **Timeline**, by adding in the dates that are missing …
History Of Thermometers

Date	Event
200 **B.C.** →	The first thermometers were called *thermoscopes*.
_____	*Santorio Santorio* was the first inventor to put a numerical scale on the instrument.
_____	*Galileo Galilei* invented a rudimentary water thermometer, which, for the first time, allowed temperature variations to be measured.
1701 →	*Ole Romer* created one of the first practical thermometers, using red wine as the temperature indicator.
_____	*Daniel Gabriel Fahrenheit* was the German physicist who invented the alcohol thermometer.
_____	*Fahrenhei*t invented the first mercury thermometer.
_____	*Fahrenheit* introduced the temperature scale that bears his name - Fahrenheit Scale.
_____	The 1st precise scale was developed by *Anders Celsius.*
1848 →	*Lord Kelvin* invented the Kelvin Scale.
_____	The *electrical-resistance-thermometer* was invented in Germany.
_____	*Sir Thomas Allbutt* invented the first medical thermometer used for taking the temperature of a person.
_____	*Theodore Hannes Benzinger* invented the ear thermometer.
_____	*David Phillips* invented the infra-red ear thermometer.
1990**s** →	*Dr. Jacob Fraden*, invented, the Thermoscan® Human Ear Thermometer.

❖ **Conduction** (in contact)**, Convection** (circular motion) **and Radiation** (waves)

What happens to the volume of different materials when heat is added? (Give two examples)

_____

_____

_____

_____

_____

_____

Complete the Chart for each type of **Heat Transfer**

	Conduction	Convection	Radiation
States of matter	solid	liquid, gas	
Volume change (heat added)			increases
Volume change (heat removed)	decreases		
Particle motion			waves
Conduction / Insulation		Heat transferred by convection current – needs space	
Reflect			shiny
Absorb	In contact		

3.0 Natural Phenomena and Technology Devices

❖ Thermal energy is produced naturally

Illustrate and describe 4 **natural sources of Thermal Energy** that are available to us.

The Sun

_____

Forest Fires

_____

Geothermal

_____

Decay

_____

❖ **Passive** and **Active** solar heating systems use the sun's energy and are environmentally friendly

Explain the component parts of the different applications of Solar Energy - used for heating and generating electricity.

	Passive	Active
Techniques and Technologies	_____ _____ _____	_____ _____ _____
Advantages / Disadvantages **or** **Costs / Benefits**	_____ _____ _____	_____ _____ _____

Describe what a **solar array** is and where it could be used _____

_____

_____

❖ **Thermostats** control temperature in heating systems

Illustrate the component parts of a **thermostat** and explain how it works

_____

_____

Describe how a **bimetallic strip** can be used as a switch.

_____

_____

Describe each of the two types of heating systems**: Local Heating** and **Central heating**

Local Heating System _____

_____

_____

Central Heating System _____

_____

_____

_____

Compare and contrast the differences and similarities between the two types of central heating systems.

Forced-Air	Hot-Water
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

The basic parts of a cooling system are: _____

_____

❖ **Insulation** helps block unwanted heat transfer (heat loss)

The **thermal conductivity** of a material reflects _____

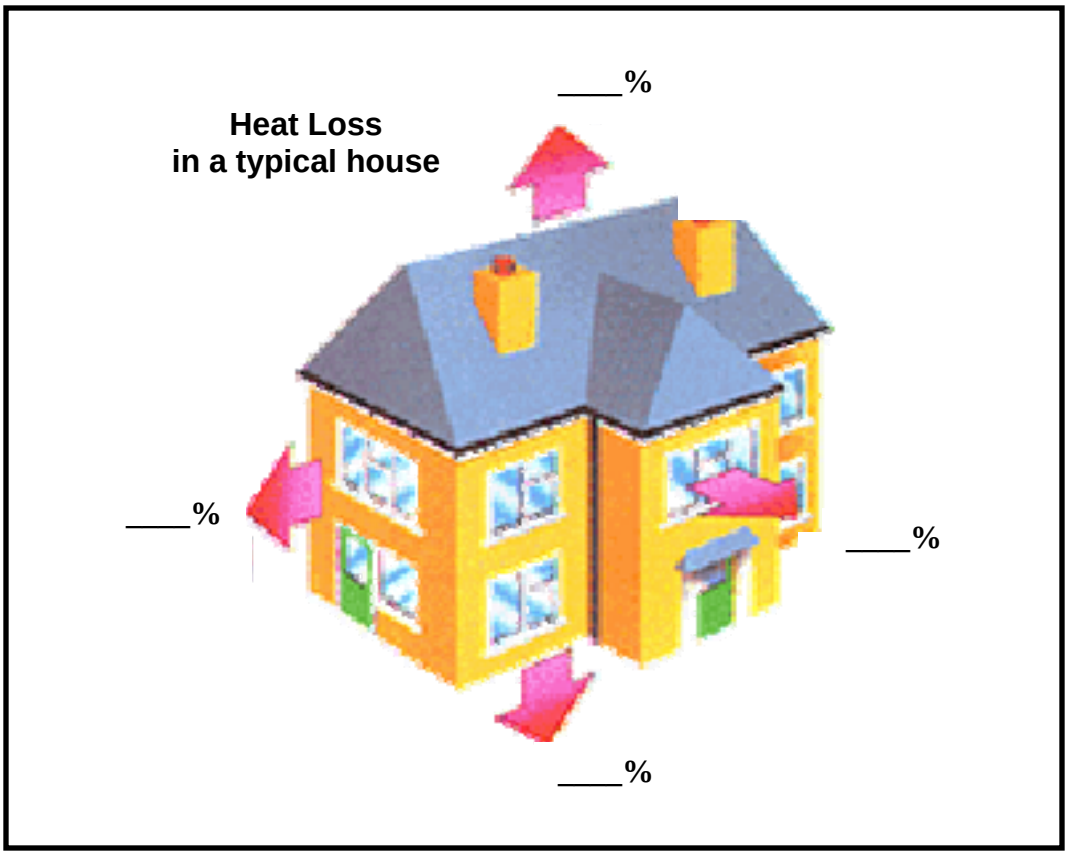
_____

R-Value indicates insulating value of a particular type of material. Explain what it means.

_____

_____

Identify the **% of heat loss** in a typical house.



Describe some types of **insulation material** that are used in Alberta

_____

_____

_____

_____

4.0 Benefits and Costs of Heat Technologies

❖ **Non-renewable resources** have a limited supply

What is the difference between **renewable** and **non-renewable** energy sources?

_____

_____

❖ Fossil fuels are the major sources of heating, but degrade the environment

❖ Costs of using natural resources: **economic, environmental and societal**

Explain the ***'COSTS'*** of using fossil fuels.

Economic Costs _____

_____

_____

Environmental Costs _____

_____

_____

Societal Costs _____

_____

_____

❖ Energy Alternatives:

Describe the ***costs and benefits*** of these **alternative thermal energy technologies.**

Solar _____

_____

_____

Wind _____

_____

_____

Geothermal _____

_____

_____

Nuclear _____

_____

_____

Hydro-electric (gravitational) _____

_____

_____

What does this symbol represent?

_____

_____

Describe ways in which energy can be used wisely in the following places:

Home	Transportation	Industry
_____	_____	_____
_____	_____	_____
_____	_____	_____