Science 10 Chapter 10 Worksheet

Chapter 10 – The kinetic molecular theory explains the transfer of energy

Be sure to use the website at http://www.bcscience.com/bc10/pgs/links_u4.html and scroll down to the Chapter 10 section.

Chapter 10.1 – Temperature, Thermal Energy, and Heat

1. The Kinetic molecular theory explains that all matter is composed of particles that move constantly in random directions. The energy of a particle or an object due to its motion is known as Kinetic Energy

2. Explain how particles move different when in different states (solid, liquid or gas).

solid	Liquid	gas
vibrate, stuck together	move freely	move quickly
less kinetic energy	more K.E	big gaps
		lots of KE

3. Temperature is the measure of the average kinetic energy of all the particles in a sample of matter.

4. Explain why holding a hot cup of coffee "feels hot" and holding a snowball "feels cold."

feels hot if it has more KE than you

feels cold if it has less KE than you.

transfer from high → low KE

5. There are three different major types of scales that are used to measure temperature. The one Canadians use when talking about the weather is the Celsius scale, while Americans describe their weather using the Fahrenheit scale. The third scale that is commonly used, especially in chemistry, is the Kelvin scale.

6. The total energy of all the particles in any state is termed thermal energy. The more kinetic energy, the more the thermal energy.

7. Stored energy of an object due to its position or state is called potential energy.

8. Heat is the amount of thermal energy that transfers from an object of high temperature to an object of low temperature.

9. The three ways heat can be transferred are conduction, convection, and radiation.

10. conduction is the transfer of heat from one substance to another or within a solid by direct contact of particles. The heat transfers from the object with a high temperature to the object with a low temperature.

11. Substances or materials that transfer heat easily are called (thermal) conductors and substances or materials that do not transfer heat easily are called insulator.

12. convection is the transfer of heat within a fluid and with the movement of fluid from one place to another.

13. What is the difference between conduction and convection?
    conduction - heat transfer by direct contact.
    convection - fluids move and transfer heat.

14. The movement of a fluid caused by density differences is called a convection current. An example of this is boiling water in a pot; the hot water rises to the top, cools, and then sinks to the bottom to be reheated.

15. electromagnetic radiation is the transfer or energy by waves moving outward from a source. This energy from this type of radiation is called radiant energy

16. Heat radiation is the warmth you feel from a fire and is called infrared radiation. The heat you feel when standing in the sun is from sdar. radiation and is made up of both visible light and infared light.

Chapter 10.2 - Energy transfer in the atmosphere

1. Explain why the Earth's atmosphere is so unique compared to the atmospheres of other planets.
    - 3 states of water
    - oxygen and CO_2
    - temperature is ideal

2. The two main gases in Earth's lower atmosphere are Nitrogen and Oxygen

3. Why might you find it hard to breath at higher elevations than sea level?
    less air pressure at higher elevations

4. List the five layers of our atmosphere in order from the closest to the Earth's surface to the farthest.

troposphere, stratosphere, mesosphere, thermosphere, exosphere

5. The lowest layer of Earth's atmosphere, the troposphere, is on average 10 km thick and is the densest of all the layers due to all the mass of the other layers on top of it.

6. Explain why weather takes place in the troposphere.

this is where all the water vapour is.

7. The average temperature of the troposphere ranges from -55° at the top of the layer to 15° at the bottom of the layer.

8. *The tropopause is the transition zone between the troposphere and the stratosphere.

9. Unlike the layer below it, the stratosphere has dry air with few clouds. Also unlike the layer below it, the stratosphere has an average temperature of -55° at the bottom of the layer and temperatures that can reach up to 0° at the top of the layer.

10. The stratosphere acts as a lid by holding in the moisture of the troposphere and also blocking out damaging solar radiation.

11. The stratosphere contains the all important ozone layer that absorbs much of the ultraviolet radiation from the sun. This not only protects us from burning in the sun, but also causes the stratosphere to warm up.

12. The layer above the stratosphere, the mesosphere, has temperatures that can reach as cold as -100°.

13. Explain how the mesosphere contributes to the shooting stars we sometimes see at night.

dust particles at high speeds collide with air/dust in mesosphere and release energy.

14. The layer above the mesosphere, the thermosphere can reach temperatures as high as 3000° due to solar radiation.

15. Explain how the thermosphere contributes to the northern lights we sometimes see at night.

solar radiation is absorbed by particles and releases a lot of energy => northern and southern lights

16. ~~Objects that are dropped that have different masses accelerate at the~~ _____ rate.

17. The top layer of Earth's atmosphere, the exosphere merges with outer space at approximately 600 km above the surface.

18. Remarkably, almost all the energy on earth comes from the sun, even though only a tiny portion of the solar energy reaches the Earth's troposphere.

19. Waves of solar radiation release their energy when they are absorbed by matter in any state. For the most part this energy is transferred into thermal energy. The amount of solar radiation that reaches a certain area is called insolation. Places on Earth that are located at higher latitudes, for example the Arctic, receive less insolation than locations near the equator.

20. The angle of incidence is the angle between the rays from the sun reaching a surface and a line perpendicular to the surface. At the equator the angle of incidence is 0° The greater the angle of incidence the lower the insolation.

21. Once the Earth's surface absorbs some solar radiation, the surface re-radiates some of this energy as infrared waves. The atmosphere is heated by these types of waves and convection transfers the thermal energy throughout the atmosphere. The lowest part of the troposphere is heated by conduction, as the ground transfers heat to the particles directly above it, then colliding with particles in the troposphere, which in turn increases the temperature.

22. Describe what the term *radiation budget* means and why it's so important.

amount of energy received by sun
must equal
amount of energy released / radiated into space.
-we want to stay the same temperature.

23. The amount of radiation that is reflected by a surface is called albedo. Snow-covered areas and deserts have high albedo, while forests and soils have low albedo. It is important that the Earth has both types of surfaces so it does not get too hot or cold.

24. weather is the condition of the atmosphere in a specific place and at a specific time.

25. What does the term weather describe/include?

precipitation
wind
temperature
clouds
humidity
lightning / thunder
atmospheric pressure

26. Pressure is known as the force per unit area. Atmospheric pressure is the pressure exerted by the mass of air above any certain point on the Earth's surface and is measured using an instrument known as a barometer. The Pa is the SI unit for atmospheric pressure.

27. Describe how atmospheric pressure changes with altitude and why your ears pop when you drive up a mountain road.

Pressure difference
- air wants to move from high pressure in your ears to low pressure around it

28. Explain the difference between warm and cold air, and what happens to the atmospheric pressure when warm air pushes in cold air and vice versa.

warm - low density
cold - higher density.

warm air invades cold air
pressure ↓

cold air invades warm
pressure ↑

29. Atmospheric pressure varies with the amount of water vapour in the air. Measuring this is called humidity.

30. As the amount of water vapour increases in air, the lighter the air becomes. Humid or wet air exerts less atmospheric pressure than cold air. A decrease in atmospheric pressure suggests that warm/moist air is approaching, and that the temperature will increase. An increase in atmospheric pressure suggests that cold/dry air is approaching, and that the temperature will drop.

31. Specific humidity describes the total amount of water vapour in the air. As temperature increases, that capacity for air increases. When air has reached its capacity to hold water vapour at a specific temperature it has reached its dewpoint. Cooling air below this point causes water vapour to condenses.

32. Describe the term relative humidity.

how much water vapour is in the air compared to its maximum capacity for that temperature

33. Wind is the movement of air from an area of high pressure to an area of low. pressure.

34. Explain how high pressure systems arise and how wind flows in this type of system.

air mass forms over land producing dry air
dry air has high pressure and pushes down and outwards in a clockwise direction

35. Explain how low pressure systems arise and why they typically bring wet weather and counterclockwise winds.

low pressure when air mass forms over water / warm land. warm air rises and cools, producing precipitation
air moving from high to low pressure causes winds to form

36. Prevailing winds are winds that are typical for a certain region. Sea breezes are local winds caused by the different rates at which land and water transfer thermal energy.

37. Explain how onshore and offshore breezes differ.

onshore: daytime breeze as warm air rises over land, drawing in air from ocean
offshore: evening breeze as air cools over land and moves towards ocean

38. Earth has three major wind systems: polar easterlies, prevailing westerlies and trade winds.

39. Jet streams are narrow bands of fast flowing air moving west to east in the upper troposphere at boundaries between cold and warm air.

40. A front is simply the boundary between two air masses. An approaching front means a change in weather and the extent of the change depends on the difference between the two air masses. Fronts usually bring precipitation. When warm air meets cold air, the warm air rises and as it cools water vapour in the air condenses, forming clouds

41. Thunderstorms occur when water vapour in rising warm air condenses, releasing thermal energy. This form of extreme weather is often characterized by lightning, thunder, strong winds and rain.

42. Describe what a tornado is and explain how it occurs.

Violent, funnel shaped wind storms that touch the ground
High altitude horizontal winds meet thunderstorms and become vertical.

43. Explain what hurricanes are, how they develop and why they typically occur near the equator.

hurricanes are storms that form over oceans, they gather more water vapour and warm air, generating more wind and become more powerful

Vocabulary to Know

Write a concise definition of each of these terms found in this chapter.

Albedo -

Angle of incidence -

Atmosphere -

Atmospheric pressure -

Conduction -

Convection -

Coriolis effect -

Dew point -

Electromagnetic radiation -

Exosphere -

Front -

Heat -

High pressure system -

Hurricanes -

Infrared radiation -

Insolation -

Kinetic energy -

Kinetic molecular energy -

Low pressure system -

Mesosphere -

Ozone layer -

Prevailing winds -

Radiant energy -

Sea breezes -

Solar radiation -

Stratosphere -

Temperature -

Thermal energy -

Thermosphere -

Thunderstorm -

Tornado -

Troposphere -