**Measurement and Units**

*Use the “Triangle Method” to rearrange 3 variable equations.*

m

v

d

|  |  |  |
| --- | --- | --- |
| **Quantity**  d = m/v  m = d v  v = m/d | **Unit** | **Abbreviation** |
| Time |  | s |
| Length or distance |  | m |
| Area |  | m2 |
| Volume |  | m3 |
| Temperature |  | ° C |
| Mass |  | g, kg |
| Density | mass/volume | g/ml |
| Force |  | N |

Metric prefixes kilo hector deka UNIT deci centi milli

1000 100 10 1 0.1 0.01 0.001

**Motion**

A Force is a push or a pull that produces m\_\_\_\_. It is measured in Newtons.

1 Newton = 1 kg∙m/s2

Understand “position versus time” graphs and “Velocity versus time” graphs

Speed = Units are \_\_\_\_

Velocity = Units are \_\_\_\_

Average speed = total distance / total time

Acceleration = Units are \_\_\_\_

The acceleration of g\_\_\_\_ = “g” = \_\_\_\_ m/s2

Acceleration is produced by (balanced or unbalanced) force(s)

\_\_\_\_ force is the sum of all the forces on an object. In terms of circular motion, \_\_\_\_ force pulls objects towards the \_\_\_\_. Without it, objects would travel \_\_\_\_ to the circular motion.

f\_\_\_\_ opposes motion. Give one example of each type of friction:

sliding: static:

fluid: rolling:

Coefficient of friction (u) = Ff / FN

* Freely falling objects only experience g\_\_\_\_ (*and air resistance … a form of friction*).
* The distance an object free falls … calculated with: d = \_\_\_\_\_
* Instantaneous velocity of a freely falling object that hits the ground; calculated with V = \_\_\_

**Vectors**

A vector is comprised of (1) a number (\_\_\_\_\_) WITH (2) a \_\_\_\_\_. Examples of vectors are: \_\_\_\_\_ vs distance; \_\_\_\_\_ vs speed; a\_\_\_\_\_; f\_\_\_\_\_.

Vectors in one direction … head to tail addition or subtraction. The sum of two vectors: \_\_\_\_\_.

The \_\_\_\_\_ is equal and opposite to the resultant. 2-dimensional diagrams use trigonometry.

For a given right triangle problem, one can find the x and y components as follows:

θ

X

Y

R

**x component** **Xx** = \_\_\_\_\_

**y component** **Yy** = \_\_\_\_\_

**Newton’s Laws**

1st → An object resists a change in motion unless an outside force acts upon it → i\_\_\_\_.

2nd → The a\_\_\_\_ of an object depends on the f\_\_\_\_ on it, and its own m\_\_\_\_.

Acceleration = Force ÷ Mass  Force = Mass ∙ Acceleration

3rd → Forces come in \_\_\_\_ & \_\_\_\_ pairs. If you push on a wall with a 10 N force, it will push back on you with \_\_\_ N, in the opposite direction. If you pull on an object with a 20 N force, you will be pulled with a \_\_\_ N force in the \_\_\_\_\_ direction.

Projectile Motion (2-dimensional motion)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Free Fall** | **Vertical Free Fall** | **Parabolic** | **Horizontal Cliff fall** | **Trajectory Cliff Fall** |
|  | | |  |  |

dy = Vyt + ½ gt2 dx = Vxt Vx = Vicos@ Vy = Visin@

**Momentum** = m\_\_\_\_ ∙ v\_\_\_\_ p = mv

The momentum of a 24-kg boulder moving at 3 m/s is \_\_\_\_.

When two or more objects interact (pull, push, crash, etc.), the *total momentum* of the system (all the objects) is conserved.

**Conservation of Momentum** → m1v1 = \_\_\_\_\_

**Impulse** \_\_\_ = ∆\_\_\_ → increasing impact time, decreases impact force (vice versa)

**Energy**

Energy is sometimes defined as the ability to do w\_\_\_\_. Not all energy can be converted into useful work – some will be transformed into h\_\_\_\_ (seemingly lost) due to f\_\_\_\_\_. When you do work on something, you use up energy and give energy to the object.

E and W are both measured in \_\_\_\_\_ (J)

There are many forms of energy, each of which can be converted into other forms.

K\_\_\_\_\_\_\_= ½(mv2) P\_\_\_\_\_\_\_\_ = mgh Electromagnetic

H\_\_\_\_ Sound E\_\_\_\_\_\_\_\_\_\_ Light

E\_\_\_\_\_\_ G\_\_\_\_\_\_\_\_\_\_\_

Nuclear Chemical

*Mass (E = mc2), where c = speed of light = 3 x 108 m/s*

P\_\_\_\_ Energy PE = mgh PE is greatest at the maximum h\_\_\_\_.

K\_\_\_\_ Energy KE = ½ mv2 KE is greatest at the maximum v\_\_\_\_.

Theoretically, maximum PE = maximum KE, f\_\_\_\_ always causes energy to transform to heat.

**Total energy = PE + KE**.

Whenever there is “room to f\_\_\_\_”, PE exists. Whenever there is m\_\_\_\_\_\_\_, KE exists.

The work done on an object is equal to the f\_\_\_\_ on an object times the d\_\_\_\_ it moves in the direction of that force. (If you push North but the object only moves East and West, no work is done.) **Work = \_\_\_\_\_ ∙ \_\_\_\_\_** The unit of Work is \_\_\_\_\_**.**

**Power** is a measure of how fast work is done, or how fast energy is changed.

**Power = \_\_\_\_ / \_\_\_\_\_**

= Joules / Second = W\_\_\_\_\_

A motor which does 50 Joules of work in 2 seconds has a power of \_\_\_\_\_ Watts.

A light bulb which uses 240 Joules of energy in 6 seconds uses \_\_\_\_ Watts of power.

A “rate” is how fast something is done, or how much it changes over a certain time. Rates are usually a quantity divided by time (meters per second = speed, dollars per hour = pay rate, degrees per hour = heating rate.)

Figure out how much w\_\_\_\_ is done in each s\_\_\_\_\_, and you have p\_\_\_\_\_.

**Machines**

Machines are objects which change the way w\_\_\_\_ is done. They do not necessarily make the work “easier”. Neither do they change the amount of work done. They change the direction and/or amount of f\_\_\_\_\_ that is put it and force that comes out. They also change the direction and/or amount of d\_\_\_\_\_ that is put in and distance that comes out.

If you gain one thing, you must lose the other!!! If you gain force, you lose d\_\_\_\_\_ on the other end. If you gain distance, you lose f\_\_\_\_\_ on the other end.

Work output never equals work input because of energy transformations and heat “loss” (friction). This means that efficiency of machines is never 100%. \_\_\_\_\_ = useful work o\_\_\_\_ / total work i\_\_\_\_

The six simple machines are p\_\_\_\_\_, l\_\_\_\_\_, i\_\_\_\_\_\_, wheel and axles, w\_\_\_\_\_\_, & s\_\_\_\_\_\_.

**Levers** are categorized based on F = \_\_\_\_\_ R = \_\_\_\_\_ & E = \_\_\_\_\_

1st class (R – F – E): seesaw, 2nd class (F – R – E): wheel barrow, 3rd class (F – E – R): baseball bat

**Pulleys** are based on the number of ropes used. Often the numbers of ropes in the “tackle” = MA

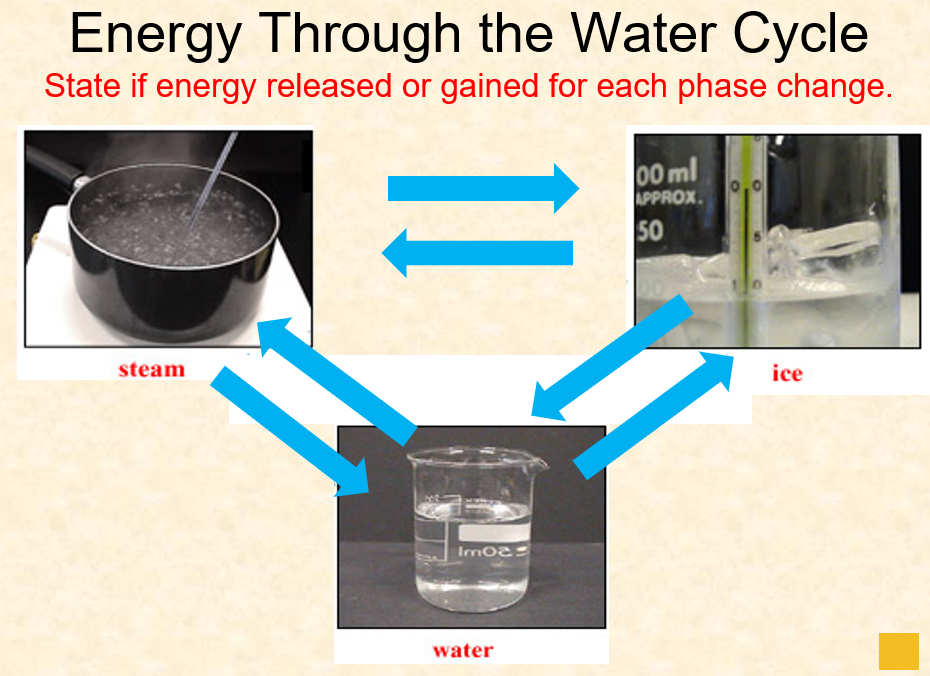
**M**\_\_\_\_ **A**\_\_\_\_ → indicates the usefulness of a machine

MA = \_\_\_\_\_ force / \_\_\_\_\_ force or \_\_\_\_\_ distance / \_\_\_\_\_ distance

**Heat, Temperature, Expansion**

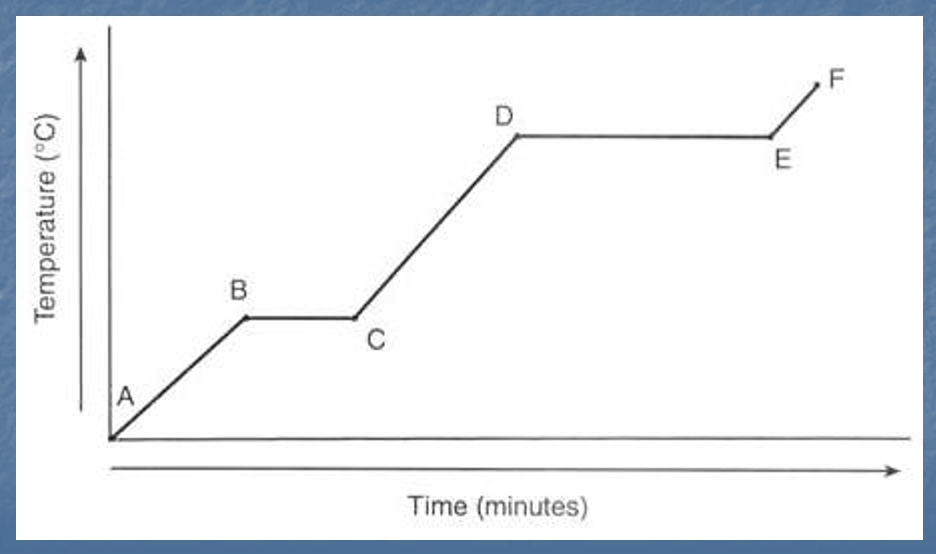
Heat incorporates ­­­­\_\_\_\_\_ and \_\_\_\_\_ (amount).

Heat flows from \_\_\_\_\_ to \_\_\_\_\_. This represents \_\_\_\_\_.



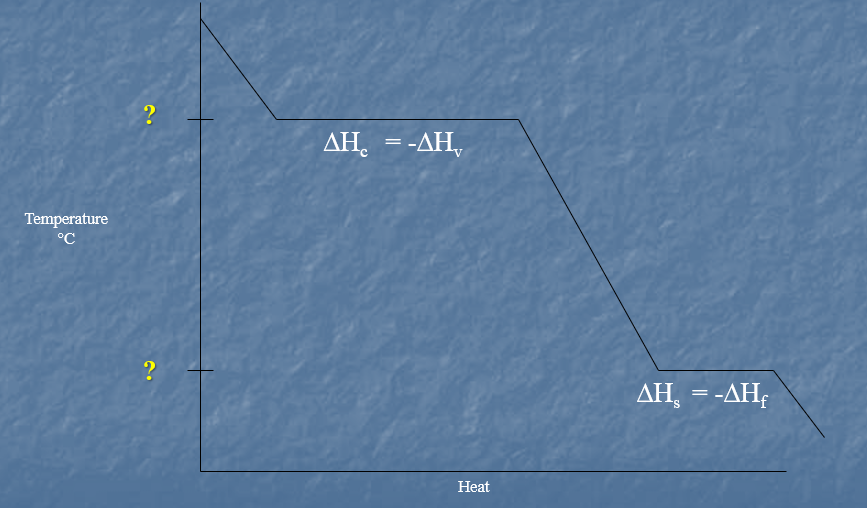
Phase Change Diagrams

* \_\_\_\_\_ ΔH = +
  + - Heating Curve
    - Heat flows \_\_\_\_ the system from the surroundings
* \_\_\_\_\_ ΔH = ─
  + - Cooling Curve
    - Heat flows \_\_\_\_ the system into the surroundings



Label the type of phase change diagram.

Label all phases, states of matter, PE, KE

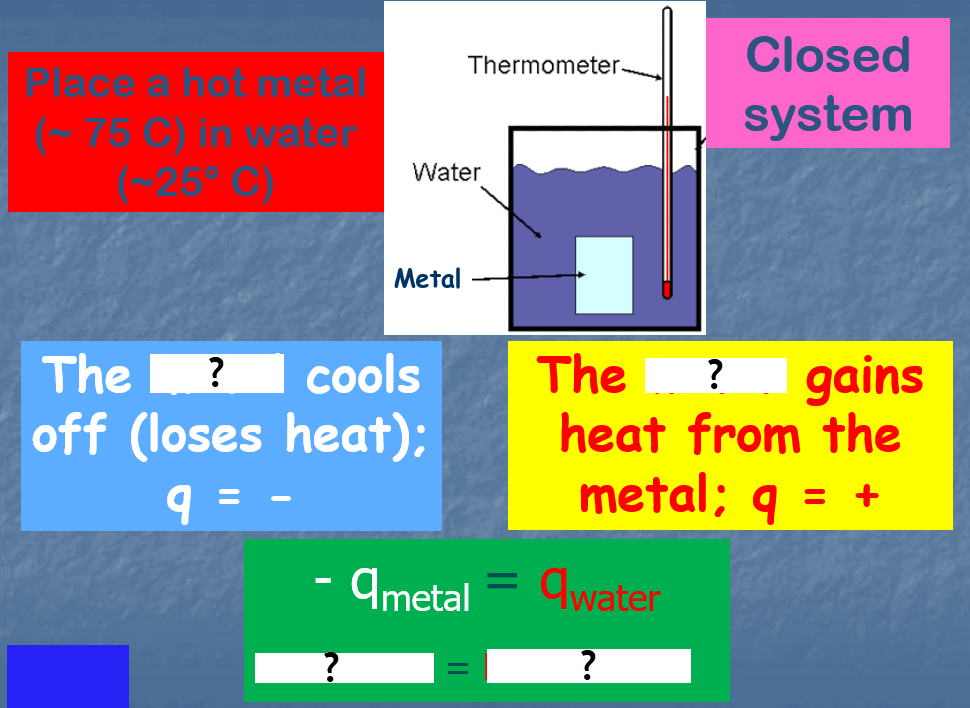


Label the type of phase change diagram.

Label all phases, states of matter, PE, KE

The \_\_\_\_\_ \_\_\_\_\_ capacity, or simply the specific heat (C) of a substance, is the amount of heat it takes to raise the temperature of 1 g of the substance 1⁰ C.

* \_\_\_\_\_ has the second highest specific heat of all liquids.
* \_\_\_\_\_ generally have low specific heats.
* A \_\_\_\_\_ is used to measure the specific heat of a substance.
* Equation?



Heat Transfer

Like matter, energy can be transformed from one form to another AND can move from one sphere to another. Thermal (Heat) Energy is transferred in one of three ways:

1. 2. 3.

??

Requires \_\_\_\_\_ for the transfer. Energy is transferred due to \_\_\_\_\_ in density or temperature. Causes air, water, land “\_\_\_\_\_”. The cooler material will \_\_\_\_, warmer material will \_\_\_\_. This is true for heat IN and ON the Earth.

\_\_\_\_\_ – the transfer of heat by \_\_\_\_\_ between molecules … requires \_\_\_\_\_ for the transfer.

* Conduction in gases is slower than in liquids and solids because the particles in a gas collide less often.

A thermal \_\_\_\_\_ is a material that conducts thermal energy well.

* \_\_\_\_\_ are good thermal conductors.
* A material that conducts thermal energy poorly is called a thermal \_\_\_\_\_.
* \_\_\_\_\_ is a very good insulator. Wool garments and plastic foam cups use trapped air to slow down conduction.

??

Energy that is “given off” by an object AND does \_\_\_\_\_ require matter for the transfer.

The Earth is most affected by the Sun’s radiation (the heat the Sun gives off (radiates)).

\_\_\_\_\_ 🡪 The reflectivity of a surface to radiant energy or light.

The higher the albedo the more it \_\_\_\_ radiation.

The temperature increase of a surface depends on albedo. A surface with \_\_\_\_\_ albedo would not gain as much temperature as a surface with \_\_\_\_\_ albedo.

The \_\_\_\_\_ process occurs when air rises or descends. No \_\_\_\_\_ is added to or withdrawn from air. Air \_\_\_\_\_ decreases with elevation (as air rises) and therefore \_\_\_\_\_. The expanding air loses kinetic energy as the molecules slow down, decreasing \_\_\_\_\_.

x2 + y2 = R2 Pythagorean Theorem … used for right triangles

3

5

4

37

53

1

2

30

60

√3

45

2

√2

√2

@

@

fparallel = mgsin@

f┴= mgcos@

sin A = opp / hyp cos A = adj / hyp tan A = opp / adj

You can break vectors down into their x and y components

To solve for two unknowns, use two equations.

When solving for variables, work with the same variable type: velocity with velocity, distance with distance, etc.

are velocity to distance)

y

x

R

θ

dx = Rcos θ

dy = Rsin θ