

GS106 Spring 2002 Midterm Lab Quiz Study Guide and Answer Key

Suggested study method: know all of the key words and concepts listed below (use your text and class notes as your information source), go over the example problems and make sure you know how to work the math, study the main concepts as listed below.

Lab 1 Physical Properties of Water

Key Words

water
H₂O
dipolar covalent bond
105 degree bond angle
surface tension
specific heat
solvent
solute
density
volume
mass
milliliter
liter
gram
kilogram
D=M/V
water-volume displacement
 $1 \text{ cm}^3 = 1 \text{ ml}$

Lab 2 Heat and Temperature

Key Words

heat
temperature
conduction
convection
radiation
phase change
solid
liquid
gas
heat loss
heat gain
freezing
condensation
evaporation
degree celsius
degree Fahrenheit
degree Kelvin
heat absorption

heat reflection
latent heat of melting
calorie
thermal expansion
thermal contraction

Lab 3 Intro to Oceanography

Key Words

density
temperature
thermal expansion
salinity
salt concentration
density-driven circulation
latitude
longitude
contour map
temperature-density relations
salinity-density relations
ocean currents
upwelling
downwelling
surface currents
wind-driven currents
density-driven currents
vertical mixing
horizontal circulation
Gulf Stream (east coast US)
California Current
warm water current
cold water current

Lab 4 Seafloor

Key Words

plate tectonics
paleomagnetism
shelf
slope
abyssal plain

seamount
deep-ocean trench
mid-ocean ridge
deep sea canyon
paleomagnetism
normal polarity
reverse polarity
magnetic pole
magnetic reversal
seafloor stripes
spreading rate
divergent plate boundary
magnetic anomalies
positive anomaly
negative anomaly
map scale
pillow lavas
seafloor volcanism
seafloor basalt

Key Concepts / Lab Answer Keys

Lab 1 - Water Properties

Basic Calculations

Can you measure the density of an object?

example problem: if 1 cubic ft of water weighs 62.4 lbs, how much would 5.6 cu. ft of water weigh?

example problem: you have 24 grams of a metal with a volume of 8 ml, what is its density in g/cu. cm?

Can you use the water displacement method to determine the volume of an irregularly shaped mass? Can you calculate its density?

Can you solve for an unknown variable in an equation?

Activity B-1

the pin floating on water was not really floating, it was being suspended by surface tension of the water molecules. A block of wood floats because it has less density than water. The pin is made of metal with a greater density than water, but its small size in relation to the high surface tension of the water allows it to be suspended.

Activity B-2

The thread is suspended due to high surface tension of water. The detergent acts to break the surface tension and causes the thread to sink.

Activity B-3

The penny contained about 40 drops of water before the surface tension was broken and the water bubble collapsed off of the penny.

Activity B-4

The water on wax paper causes the light to refract and acts as a magnifying glass.

Unknown Liquid Determination Experiment

Students used physical properties to compare unknown liquids to a known sample of water. Physical properties included: solubility, rate of evaporation, smell, heat capacity, surface tension.

Lab 2 - Heat and Temperature

GS106 Lab 7 Answer Key

Temperature, Thermal Energy, and Phase Changes

Pre-Lab Reading Questions

Three mechanisms of thermal energy transfer

Radiation (Infrared, no matter involved)

Convection (transfer by moving matter)

Conduction (transfer with no moving matter)

Melting, Freezing Evaporation, Condensation are all examples of phase changes of matter

Phases of matter: solid, liquid, gas

Phase changes are a function of the amount of molecular kinetic energy contained in a substance.

Convection - process of heat transfer associated with the transfer of matter (moving matter carried heat energy)

Thermal coefficient of expansion - measures the relative degree to which a material will expand or contract when undergoing heat gain, or heat loss, respectively.

Conduction - thermal heat transfer without physical transfer of matter... heat energy is transferred by vibrational collision between atoms and molecules.

Pre-Assessment

Temperature - measure of average molecular kinetic energy - or the amount of heat in a given substance

Temperature is as defined above. Heat is the amount of molecular kinetic energy contained in a substance. Thermal energy is a fancy word to heat, and the ability to do work with heat.

1 - Temperature and Absolute Zero

Temperature, heat and thermal energy is as above.

Absolute Zero - minimum possible energy state in a substance, molecules have 0 kinetic energy, thermal energy level is at the minimum.

At room temperature, air has a moderate amount of molecular kinetic energy and heat... very high compared to absolute 0.

2- Heat Transfer by Radiation

Questions

Black paper is a good absorber of heat, white is the poorest absorber... the shiny is in between.

The best emitter in the the white paper.

A good absorber is a poor emitter.

I would rather wear white on a summer day, as it would be a poor absorber of heat, and would keep me relatively cool.

On cool mornings I would rather have dark fur, that would absorb the maximum amount of heat, and keep me warm.

3 - Heat transfer by Conduction

best conductor = metal, worst = wooden, middle = plastic

A plastic handle would not conduct as much heat, and thus you would be less likely to burn your hand.

I would rather use plywood to insulate my house, as it is a poor conductor of heat (and would keep the heat in the house during the winter).

4 - Heat Transfer by Convection

Net Effect: warm water is less dense than cold water, warm water rises and cold water sinks, the heat is transferred by physically moving the water with currents.

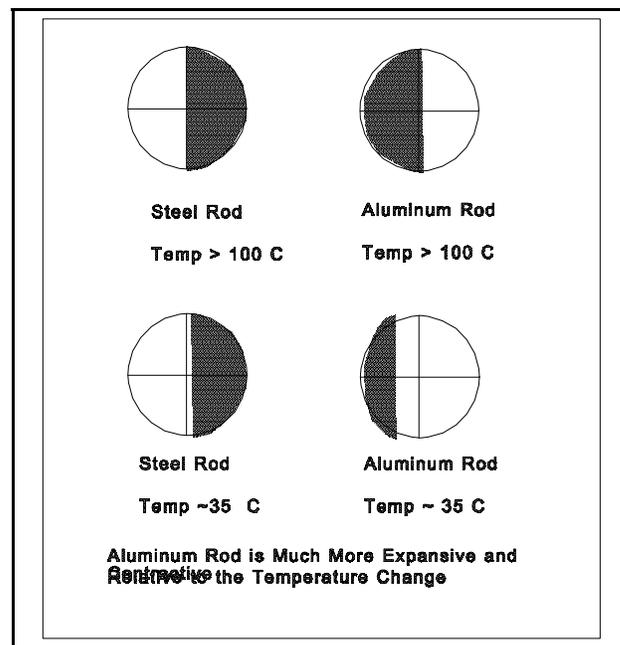
I wouldn't need to stir the water because convection currents will be stirring and distributing the heat for me.

Warm air rises by convection, cold air sinks... thus the heater by the floor makes most sense for effective heating of the room

6 - Thermal Expansion

Initial Questions

The rod appears opposite of it's true position because of the inverted optics of the microscope ocular.



Final Questions

Iron has the lowest coefficient of expansion (it is not very responsive to temperature change. Aluminum has a much higher coefficient of expansion.

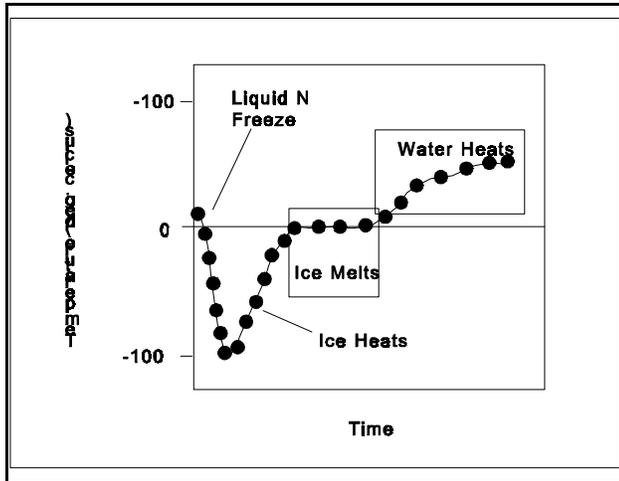
The rails buckled because there was not enough space between the rails to allow for thermal expansion in the hot

weather. This could have been avoided by leaving room between the rails to allow for thermal expansion and contraction.

Iron would be the best to avoid buckling, since it has the lower coefficient of expansion.

7 - Phase Change Experiment

Water is solid ice below 0 C, phase change from Ice-Water as temp. reaches 0 C, temperature of water rises again after all ice is converted to liquid water.



The temperature is not changing during the melting process of ice to water... all of the energy is being used to complete the phase change, so the temperature does not increase... hence the kinetic molecular energy of the ice-water mixture remains constant until all ice is melted to water.

Post-Assessment

Star-Earth heat transfer is via infrared radiation... space is a vacuum, hence there are not molecules to transfer heat by convection or conduction, radiation is the only method of heat transfer through space.

from core to crust of earth.

Convection and conduction could be used to transfer heat

"Fire Escape" method relies on thermal conductance through metal doors.

Energy transfer in space = radiation

Boiling water is undergoing a phase change from liquid to gas, it should look like the phase change from solid to liquid... i.e. the temperature of the water-gas mixture will not increase as water boils.

Hot water will have a high rate of thermal transfer at first in the freezer, but the rate of heat flux will decline as the water temperature approaches equilibrium.

Lab 3 - Introduction to Oceanography

Part A Activity 1

See text for geographic distribution of world's oceans, seas, gulfs and bays.

Activity A-2

total global area = 510 million sq. km (360 million sq. km ocean + 150 million sq. km land)

% land = $150/510 \times 100\% = 29\%$

% ocean = $360/510 \times 100\% = 71\%$

water hemisphere = southern, land hemisphere = northern

% ocean calculations

40 N. Lat = $87.5 / 162.5 \times 100\% = 54\%$

ocean = 87.5 million of sq. km

land = 75 million of sq.km

total = 162.5 millions of sq. km

60 N Lat = $50 / 125 \times 100\% = 40\%$

ocean = 50 million of sq. km

land = 75 million of sq.km

total = 125 millions of sq. km

40 S lat = $162/177 \times 100\% = 92\%$

ocean = 162 million of sq. km

land = 15 million of sq.km

total = 177 millions of sq. km

60 S lat = $120/120 \times 100\% = 100\%$

ocean = 120 million of sq. km

land = 0 million of sq.km

total = 120 millions of sq. km

Pacific Ocean covers the greatest area

Activity B-1

Salinity vs. Density - the more saline (salty) the water, the greater the density. More dense water sinks faster than less dense water. Dense saline water will sink compared to less dense fresh water.

Salinity vs. Temperature - warmer water is less dense than colder water. Cold dense water sinks in relation to warm, less dense water

Latitude vs. temperature variation of sea water is the greatest control on ocean circulation.

Warm water is saltier than cold water due to increased evaporation and concentration of salts.

Cold water is less saline than warm water due to decreased evaporation and dilution of salts.

Fresh water influx from rivers near continental shorelines result in decreased salinities in the ocean (due to dilution effects).

Higher latitude waters are colder, denser than lower latitude waters.

Higher latitude waters are colder, saltier, compared to lower latitude warmer waters.

Lab 4 - Sea Floor

Pre-Lab

Continental Shelf - shallow area adjacent to continents, covered in continental sediments

Continental slope - abrupt deepening of ocean water at edge of shelf

Abyssal plain - expanse of deep, flat ocean floor beyond the reaches of the continental rise

Seamount - subsea volcano, high point on seafloor

Deep ocean trench- deepest portions of ocean associated with seafloor subduction zones

Mid-ocean ridge - volcanic highlands at seafloor spreading centers

Part A - refer to text maps for geographic location of seafloor features

general answers:

continental shelves are generally < 100 m deep adjacent to continents

Mid-Ocean ridges rise 1000's of meters above abyssal plains

Deep Ocean trenches are up to 10's of thousands of meters deep.

the width of the shelf on the east coast is much wider than width of shelf on west coast

abyssal plains are very flat, deep parts of ocean basins

seamounts represent subsea volcanoes, many in the Pacific are associated with hotspots

Part B - Paleomagnetism

There are 10 major polarity reversals in the past 5 m.y.

The last major reversal was 788,000 yrs. ago

2 m.y. ago a compass would have pointed south

Yes, based on the pattern, the earth is due for another reversal

Rates of seafloor spreading are on the order of 2-5 cm/year

The atlantic ocean basin opened approximately 300 m.y. ago

Pillow lavas form from the eruption of basaltic lava on the seafloor, at great depths and under great pressure, with quick quenching and cooling of the lava as it is extruded.

Pillow lavas on Marys Peak represent ancient seafloor basalts that have been uplifted into the Coast Range due to tectonic accretion and active plate subduction in the Pacific Northwest.