Handout Packet for

OCEANOGRAPHY 112

Jacobson

STUDY QUESTIONS CHAPTER 1
(and related material not covered in the text)

1. Match the following terms and statements:

___model	a. testable, but untested explanation
___scientific method	b. orderly process by which theories are advanced or rejected
___law	c. explanation verified to some degree
___hypothesis	d. more massive objects exert greater gravitational forces
___theory	e. an explanation with known limits

2. List the four fundamental forces of nature and give an example of each in action.

(1)

(2)

(3)

(4)

3. What is the relationship between force, work and energy?

4. Using the concepts of force, work, potential energy and kinetic energy, explain what happens when two magnets are pulled apart and then brought close enough to one another so that they pull together again.

5. What becomes of energy that is “used”?

6. What evidence exists for the Big Bang theory?

7. Where and how are atoms like oxygen and carbon (heavier than helium but lighter than iron) created?

   What about very heavy atoms like gold and uranium?

8. Place the terms on the right in order of occurrence:

(1) big bang	supernova
(2)_____	accretion (of hydrogen, helium and heavier elements)
(3)_____	oceans
(4)_____	big bang
(5)_____	solar nebula
(6)_____	formation of first atoms (mostly hydrogen)
(7)_____	density stratification
(8)_____	condensation (of only hydrogen and helium)
(9)_____	biosynthesis
(10)_____	outgassing
(11)_____	nebulae
(12)_____	first stars (lacking heavy elements)
(13)_____	solar system
(14)_____	earth melts
(15)_____	first protostars

9. How did the compositional differences between the outer and inner planets originate?

10. What heat sources melted the early earth?

11. How did density stratification change the earth?

12. The earth's primitive (protoplanet) atmosphere was rich in hydrogen, methane and ammonia. What became of this primitive, Jupiter-like atmosphere?

How was it replaced by an atmosphere rich in water vapor and carbon dioxide but devoid of free oxygen?

How did free oxygen enter our atmosphere?

13. How did the ocean form?

14. Why is biosynthesis unlikely to take place naturally today?

STUDY QUESTIONS CHAPTER 3

1. MATCHING:

___ liquid iron and nickel	a. mesosphere
___ primarily basalt	b. continental crust
___ commonly granite	c. oceanic crust
___ physically variable Fe and Mg silicates	d. asthenosphere
___ ridged (but not brittle) Fe and Mg silicates	e. inner core
___ partially molten Fe and Mg silicates	f. outer core
___ solid iron and nickel	g. lithosphere
___ physically homogeneous, compositionally variable	i. mantle

2. What is meant by isostatic equilibrium?

3. How do the composition, density, and thickness of oceanic and continental crust compare.

What are the isostatic implications of this? (In other words: How does that affect how they float?)

4. List and briefly discuss at least four lines of evidence for continental drift?

(1)

(2)

(3)

(4)

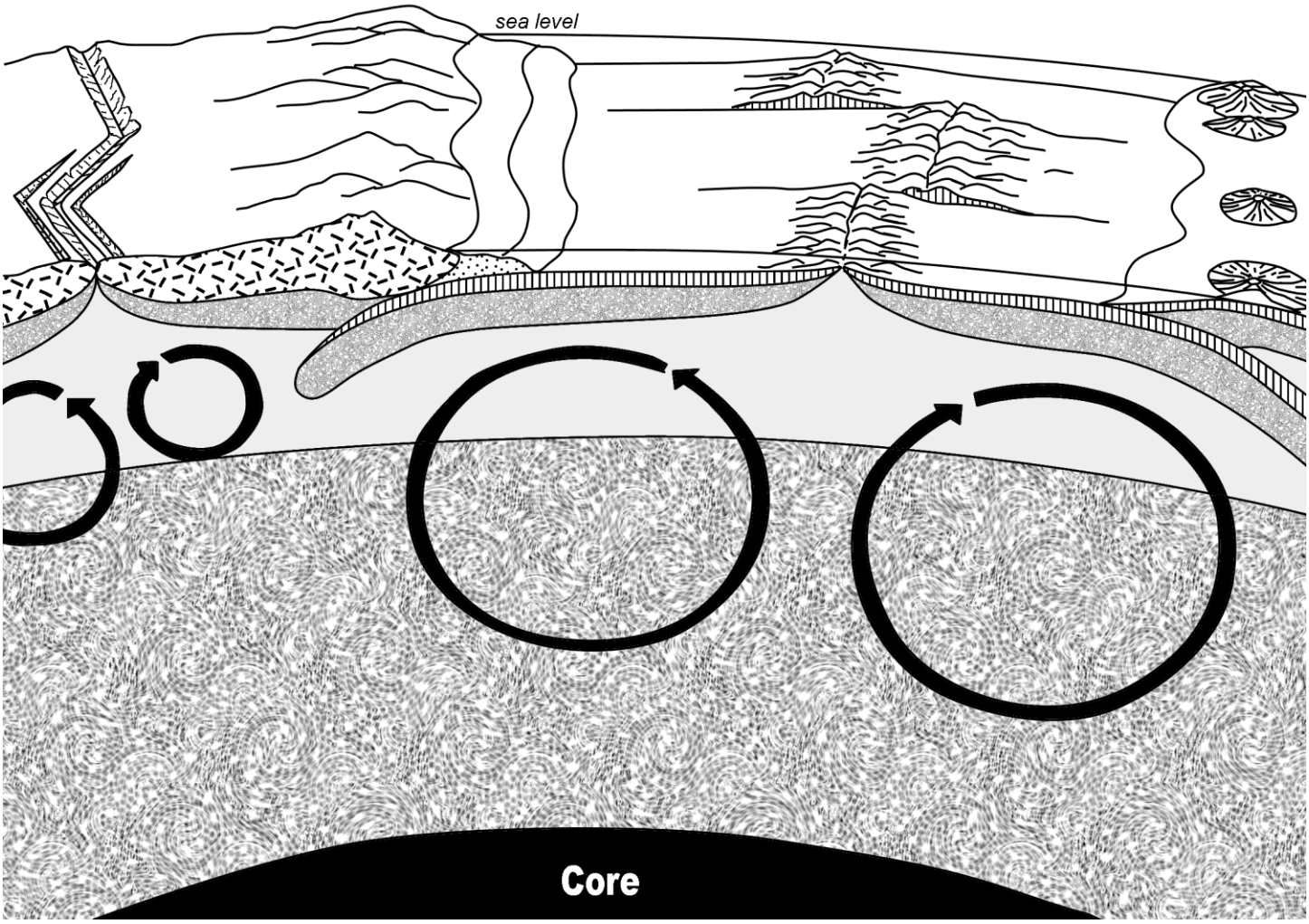
5. In the space provided, sketch and label a diagram illustrating how sea-floor spreading operates. In your diagram indicate the position of proposed convection cells (currents), oceanic ridges, rift valleys and basaltic volcanism. Also indicate where the oceanic crust is relatively old and young, where sediments would be relatively thick and thin, where the densest oceanic crust would be found and, with arrows, the direction in which the crust is moving with respect to the oceanic ridge.

6. Describe how new oceanic crust is created.

   How is it destroyed?

7. Compare the distribution on earthquakes in Fig. 3.15 with the plate boundaries in Fig. 3.16. What important relationship do you see?

8. Label the diagram below with the following terms (see figs. 3.9, 3.13, 3.14, 3.17, 3.20, 3.22, and 3.23-3.24): diverging plate boundary, converging plate boundary, transform plate boundary, subduction zone, spreading center, mid-ocean ridge, core, mantle, continental crust, oceanic crust, lithosphere, asthenosphere, convection cell, island arc, volcanic arc. Also draw-in magma bodies and lava flows where they might be expected to occur. How many different plates are shown?



9. Each type of plate boundary is associated with various features and activities. In the table below check-off which apply:

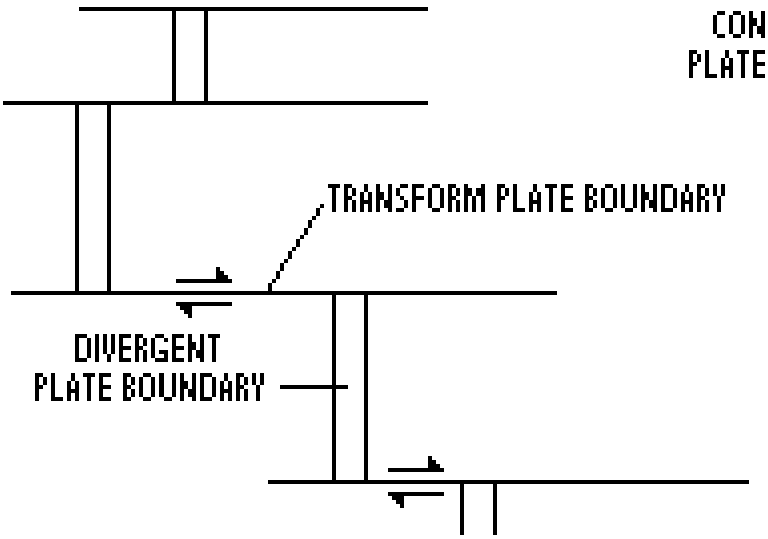
FEATURE/ACTIVITY	DIVERGENT	TRANSFORM	C O N V E R G E N T		
			OCEAN-OCEAN	OCEAN-CONTINENT	CONTINENT-CONTINENT
oceanic ridge					
rift valley					
basaltic volcanism					
andesitic volcanism					
deep-sea trench					
island arc					
volcanic arc					
shallow earthquakes					
deep earthquakes					
subduction zone					

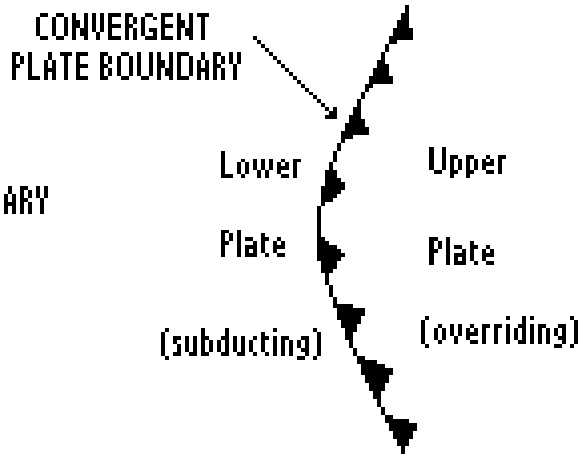
10. If the Pacific Plate is moving about 5 centimeters per year, how many kilometers will it travel in a million years?

    At that rate, how long will it take for San Diego to move to the present location of San Francisco? (738 km)

PLATE MAP EXERCISE

DIRECTIONS: Answer the following questions on a DataLink (#26550) based upon your interpretation of a plate map. Use the map provided here (p.11) and the diagrams in your textbook (especially figures 3.16-3.25 and 4.34) to answer the majority of the questions. Some questions may require the use of an atlas and/or the plate map in the front of your book or my web site. Symbols on plate maps are fairly standardized:





Arrows on transform plate boundaries (if present) indicate the direction of plate motion. Plate motion is always perpendicular to and away from a diverging plate boundary. The teeth on a converging plate boundary symbol always point in the direction that the subducting plate is moving, that is, towards the overriding plate.

MULTIPLE CHOICE:

1. Examine the world sea floor map in Figure 4.34 of your textbook. The linear, east-west feature just under #3 on the map is a
   a. fracture zone
   b. deep sea trench
   c. subduction zone
   d. divergent plate boundary

2. Hawaii is located
   a. on a spreading center
   b. over a transform fault
   c. on a hot spot
   d. above a subduction zone

3. What plate is being subducted and melted to produce the volcanoes in northern California, Oregon, and Washington?
   a. North American
   b. Pacific
   c. Juan de Fuca (Gorda)
   d. Eurasian

4. Which of the following is getting more narrow?
   a. Mediterranean Sea
   b. Red Sea
   c. Atlantic Ocean
   d. Gulf of California

5. The North American plate consists of

a. oceanic crust without any continental crust
b. continental crust without any oceanic crust
c. oceanic crust and continental crust
d. burger and fries

6. According to the plate map in Figure 3.16 of your text and page 11 here, India lies on the same plate as
   a. Asia
   b. Africa
   c. Vietnam
   d. Australia

7. A divergent plate boundary runs through
   a. Iceland
   b. New Zealand
   c. the Himalayas
   d. central California

8. If a hole could be drilled from Lima, Peru to the center of the earth, such a hole would encounter
   a. the South American plate first and then the Nasca plate
   b. the South American plate first and then the Antarctic plate
   c. the Nasca plate first and then the South American plate
   d. the South American plate, but would never encounter the Nasca plate at depth

9. The island of Hawaii is moving to the
   a. southwest
   b. northwest
   c. northeast
   d. southeast

10. Where would pelagic sediments be thickest? (Hint: Pelagic sediment thickness is related to sea-floor age.)
   a. 200km south of Hawaii
   b. 200km north of Iceland
   c. 200km south of Iceland
   d. 200km north of Easter Island ($109^{O}W$, $27^{O}S$)

11. In which area of converging plates would one **NOT** expect to find volcanoes?
   a. Japan
   b. between India and Asia
   c. western South America
   d. southern Italy

12. Which has the fastest rate of spreading?
   a. Southwest Indian Ridge
   b. Southeast Indian Ridge
   c. Mid-Atlantic Ridge
   d. East Pacific Rise

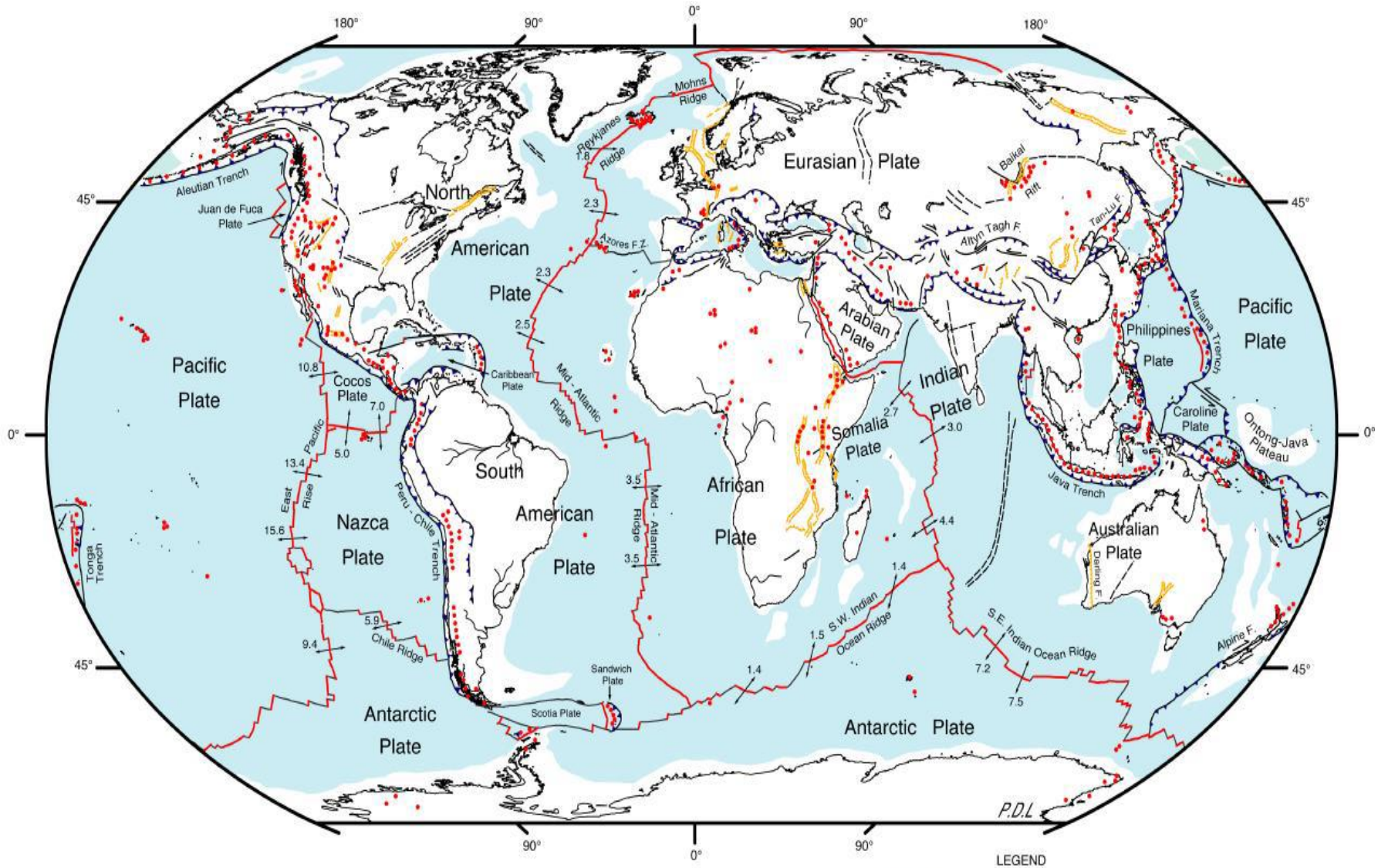
13. Before the Atlantic opened, which of the following was true?
   a. the Pacific was smaller
   b. New York and Casablanca were adjacent
   c. Buenos Aires and Casablanca were adjacent
   d. all of the above

14. Which plate is getting larger?
   a. African
   b. North American
   c. South American
   d. all of the above

15. Where would earthquakes be **least** likely to occur?
   a. western South America
   b. Japan
   c. Australia
   d. southern Italy

TRUE OR FALSE:

16. The continental margin of western Africa is passive.
17. Hawaii is situated on older oceanic crust than is Iceland.
18. San Diego is moving southward due to motion along the San Andreas fault.
19. Arabia will eventually be joined with Africa.



DIGITAL TECTONIC ACTIVITY MAP OF THE EARTH

Tectonism and Volcanism of the Last One Million Years

DTAM

NASA/Goddard Space Flight Center
Greenbelt, Maryland 20771

Robinson Projection

Mainly oceanic crust

October 1998

LEGEND

- Actively-spreading ridges and transform faults
- 1.4 — Total spreading rate, cm/year, NUVEL-1 model (DeMets et al., Geophys. J. International, 101, 425, 1990)
- Major active fault or fault zone; dashed where nature, location, or activity uncertain
- Normal fault or rift; hachures on downthrown side
- Reverse fault (overthrust, subduction zones); generalized; barbs on upthrown side
- Volcanic centers active within the last one million years; generalized. Minor basaltic centers and seamounts omitted.

G221.001

STUDY QUESTIONS CHAPTER 4

1. State the three types of continental margins (as discussed in lecture), where examples of each type can be found, and what features are associated with each type (i.e. shelf, slope, rise, trench, banks, troughs).

2. Discuss how the three types of continental margins (1. passive margin; 2. active margin; and 3. translational margin) evolve through time in relation to plate tectonics (see figs. 4.7 - 4.16 and class notes for information on translational margins).

3. Describe some of the processes that help to level the continental shelves.

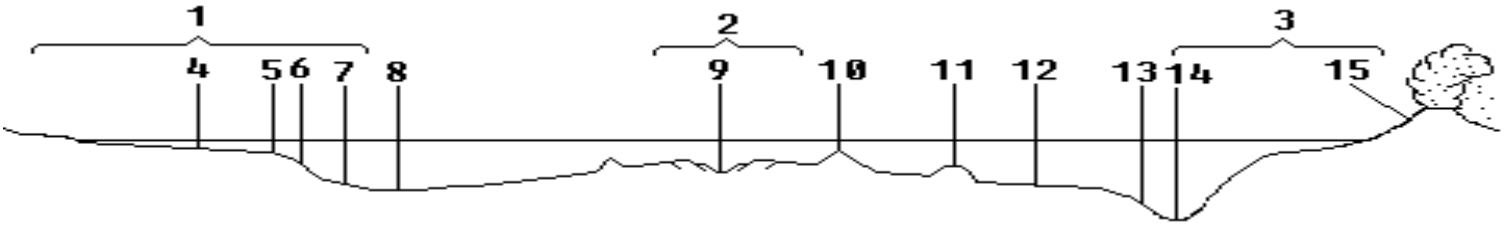
4. Where do submarine canyons occur?

   Give at least two explanations for their origin.

   How do they relate to the continental rises and deep-sea fans?

5. Find the number in the cross-sectional sketch below which corresponds to the following features:

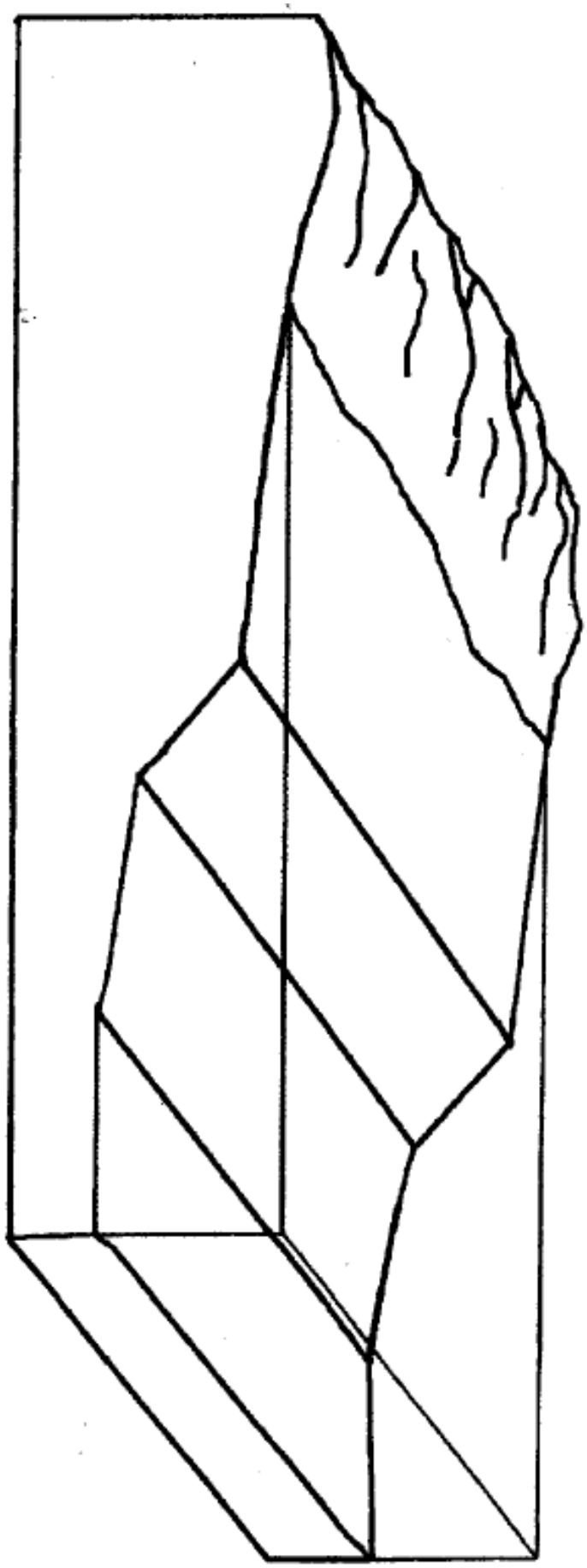
__rift valley
__continental shelf
__passive continental margin
__active continental margin
__deep-sea trench
__abyssal plain
__shelf/slope break
__oceanic ridge or rise
__continental slope
__seamount
__volcanic arc
__guyot
__continental rise
__where abyssal hills are found (2 possible answers)

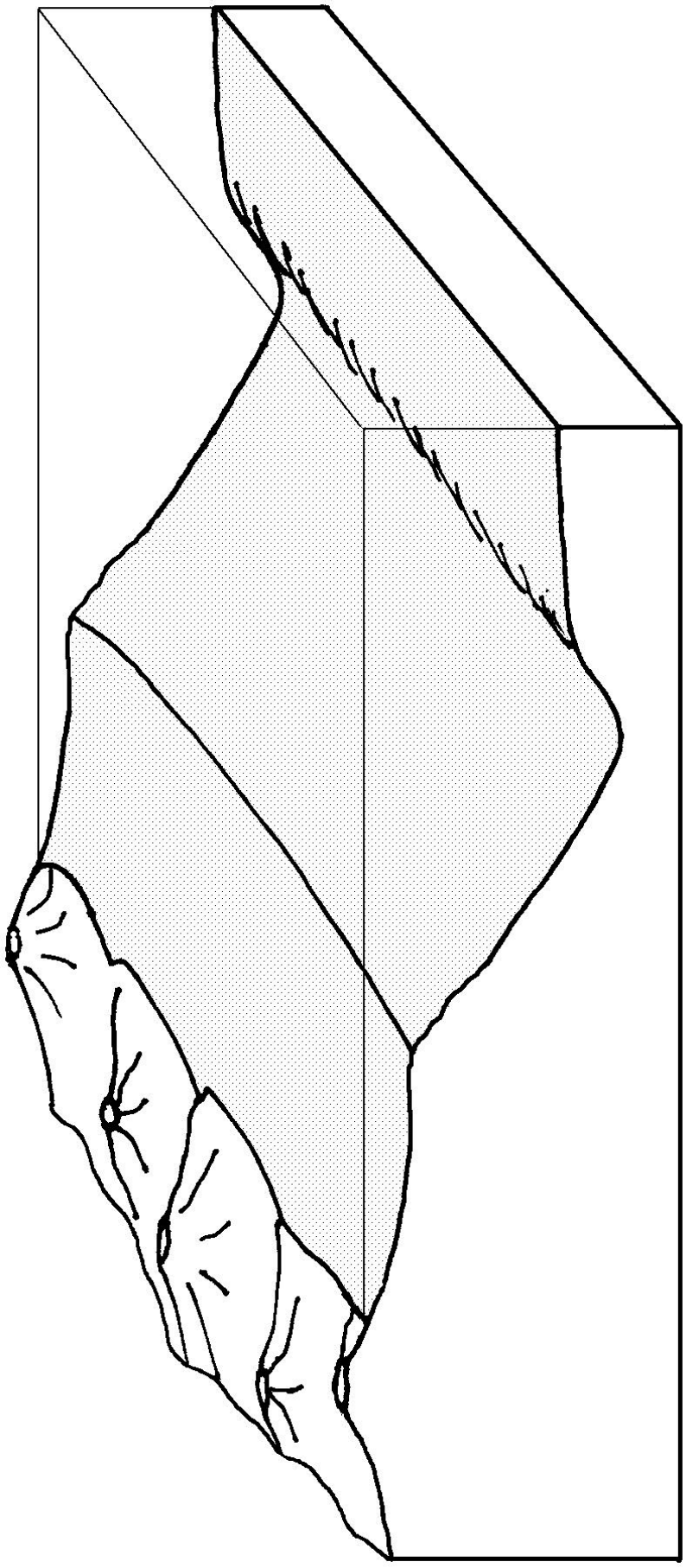


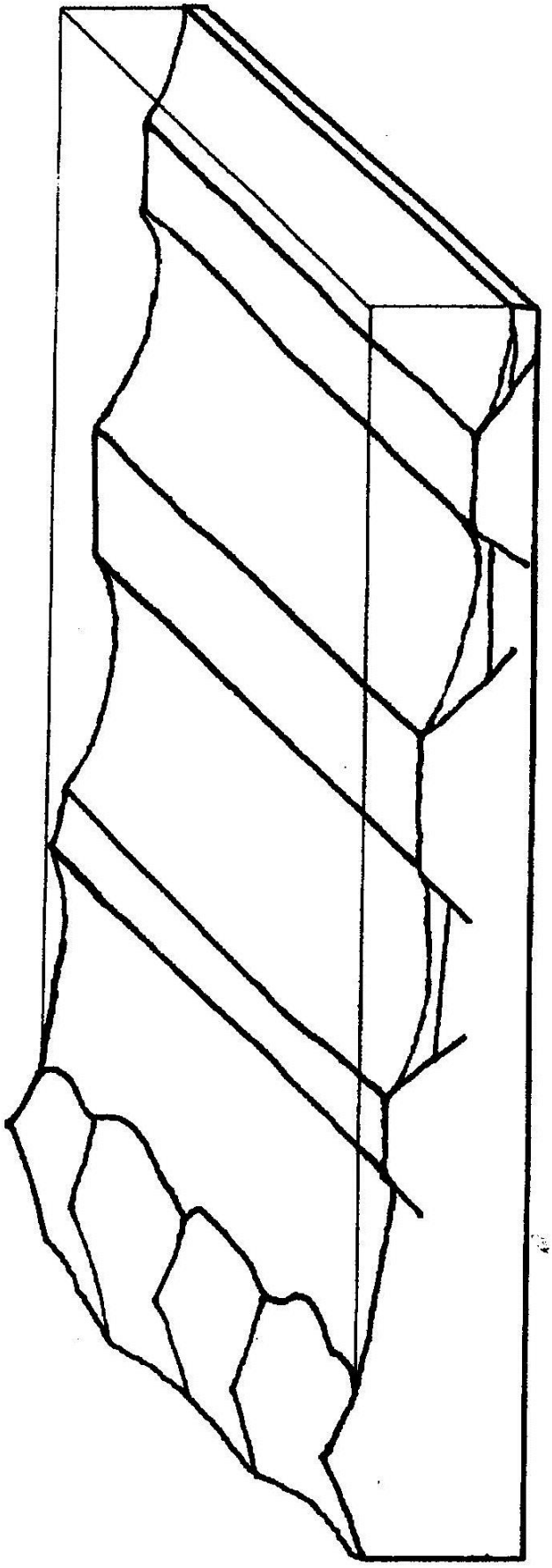
6. How are fracture zones formed?

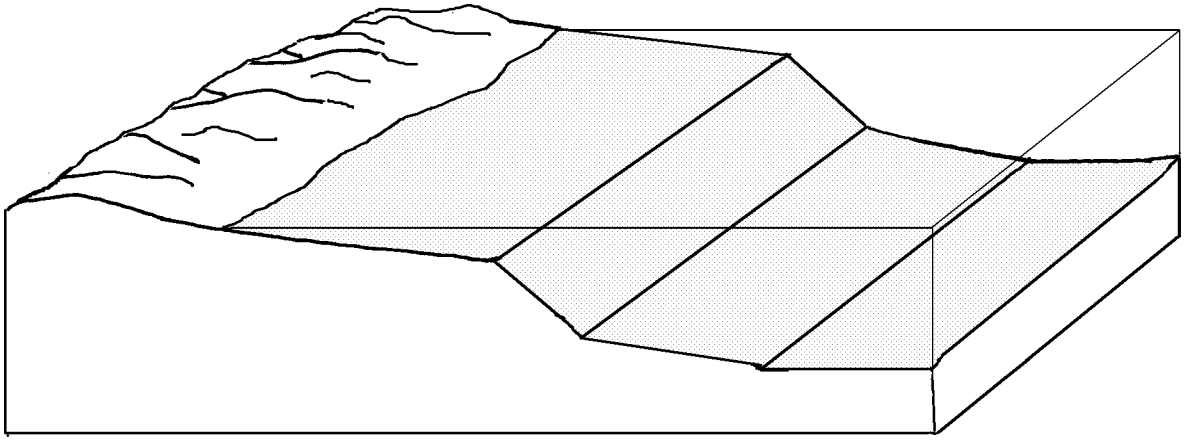
7. Sketch and/or label as many of these ocean basin features as possible on the world map below, then describe any characteristic activity (i.e. earthquakes, hot springs, volcanism, sedimentation) associated with them in the spaces provided.

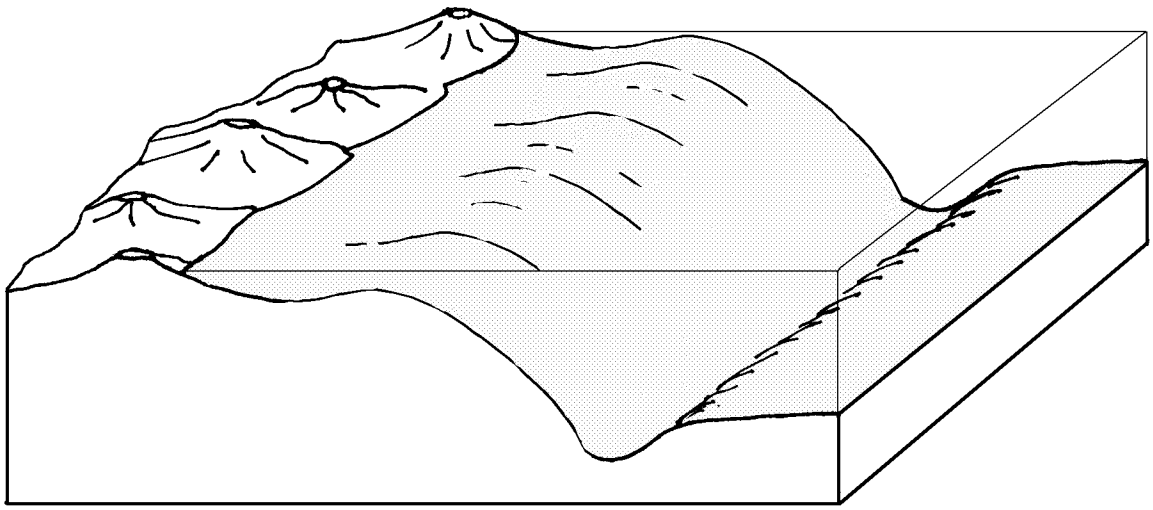
FEATURE	ACTIVITY
mid-ocean ridge/rise	
rift valley	
fracture zone	
abyssal plain	
abyssal hill	
seamount	
guyot	
island/seamount chain	
trench	
island arc	

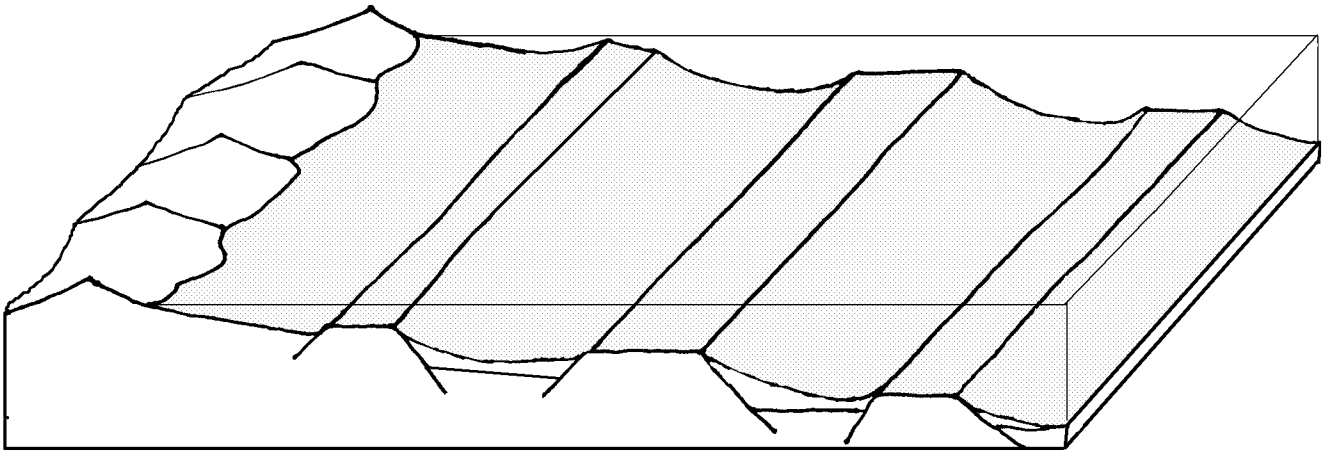












STUDY QUESTIONS CHAPTER 5

Predict the kind of sediment that would be expected to occur in the following situations:

1. The continental shelf around a glaciated continent.

2. On the continental rise at the mouth of a submarine canyon.

3. The top of a 30 my old, 2000 m deep seamount in the tropical south Atlantic.

4. In the center of the Atlantic, if the Mid-Atlantic Ridge did not exist and the depth there was 6000 meters. Assume there are no diatoms or radiolaria at the surface.

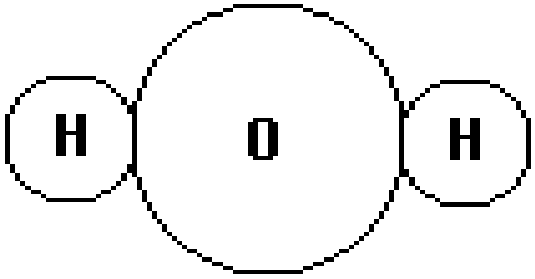
5. In an area where there is little water or air born terrigenous sediment available but where diatoms flourish.

6. If the Pacific was bordered by passive continental margins rather than active ones, what changes would occur in the distribution of sediment types there?

7. In what part of the Atlantic might you expect evaporites to occur? Hint: Narrow, linear seas, like the Red Sea, are more prone to drying-up than wide ones.

STUDY QUESTIONS CHAPTER 6

1. If a water molecule looked like this, would it still be polar?



2. How does water's polar nature give it the ability to form hydrogen bonds?

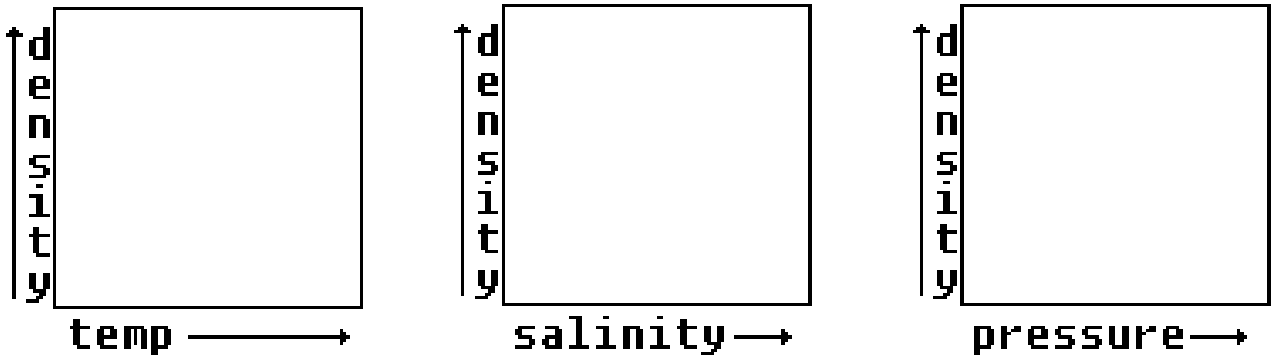
3. Explain how water's ability to form hydrogen bonds relates to its high heat capacity.

4. How many calories of heat would you have to remove from one gram of water at 35 degrees Centigrade to completely freeze it?

5. Which is higher - water's latent heat of vaporization or its latent heat of evaporation at 20^{o}C?

   Why?

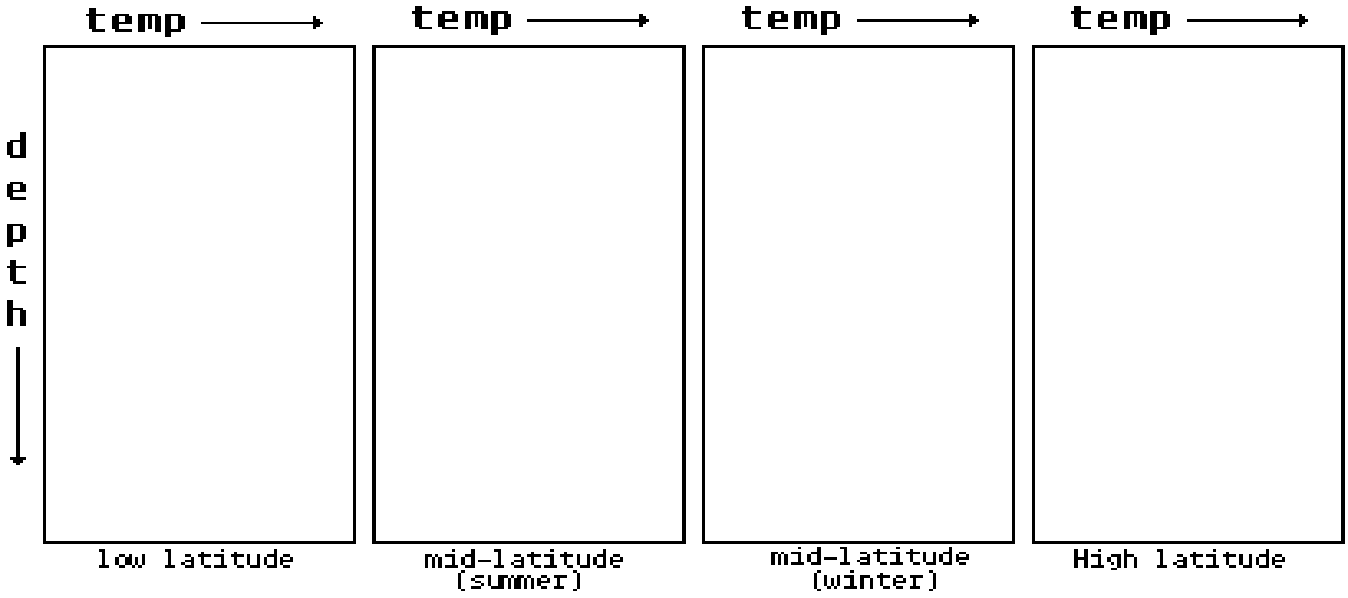
6. Sketch the graphs of water density vs. temperature, salinity, and pressure below.



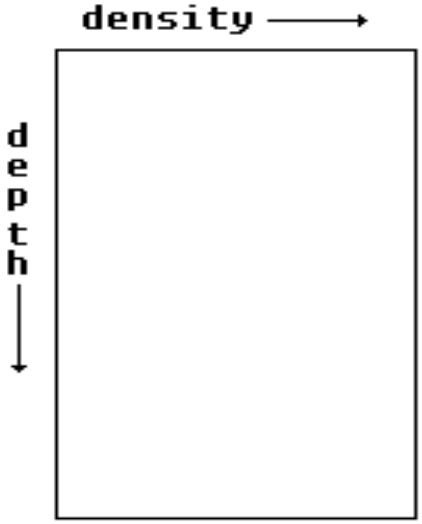
7. Calculate the pressure (in atmospheres) at 11,000 meters.
8. Over the range of temperatures and salinities that occur in the oceans, which has a greater influence on density - temperature or salinity? (See Figure 6.17)

9. From the equator to the poles, how would the density of the ocean's surface water change?

10. Plot the graph of temperature vs. depth at different latitudes and for different seasons, and show the location of the thermocline (if present).



11. Sketch the graph of seawater density vs. depth at an equatorial latitude (warm, low salinity surface waters) below and indicate the position of the pycnocline:

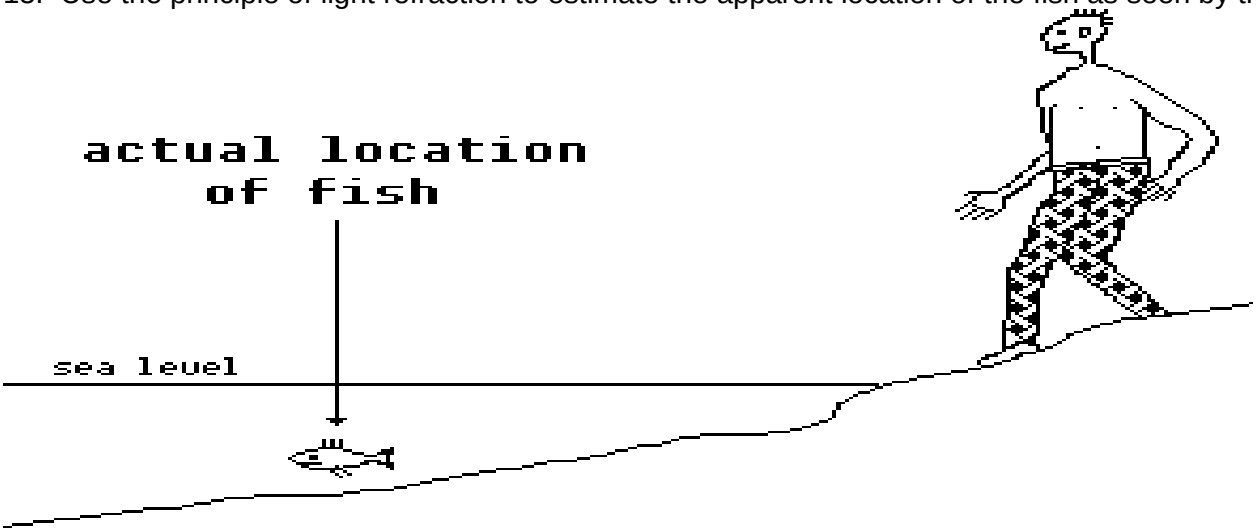


12. How is light absorption and scattering affected by different wavelengths of light and particle sizes?

13. Using the concepts of absorption and scattering, explain why, when viewed from above in deep water, clear seawater appears blue whereas turbid seawater appears more greenish.

14. If your wetsuit was striped with every color in the rainbow, describe how its colors would change at progressively greater depths.

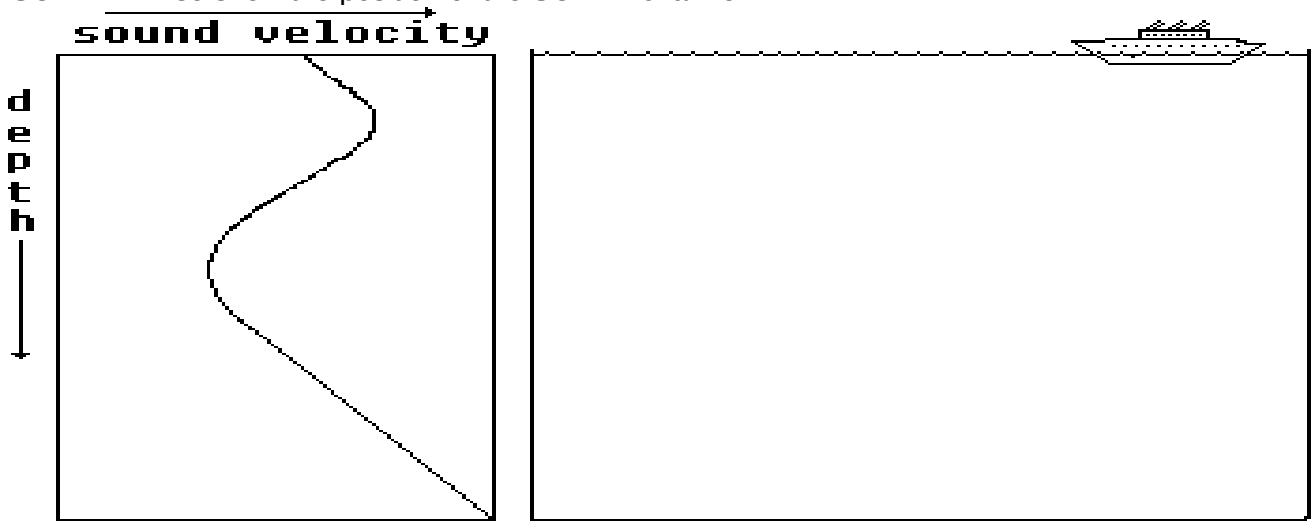
15. Use the principle of light refraction to estimate the apparent location of the fish as seen by the goon.



16. What happens in the SOFAR channel?

Why?

17. If the speed of sound varies as shown, where should a submarine be to evade detection by the ship's SONAR? Also show the position of the SOFAR channel.



How Water Changes State:

Key Terms:

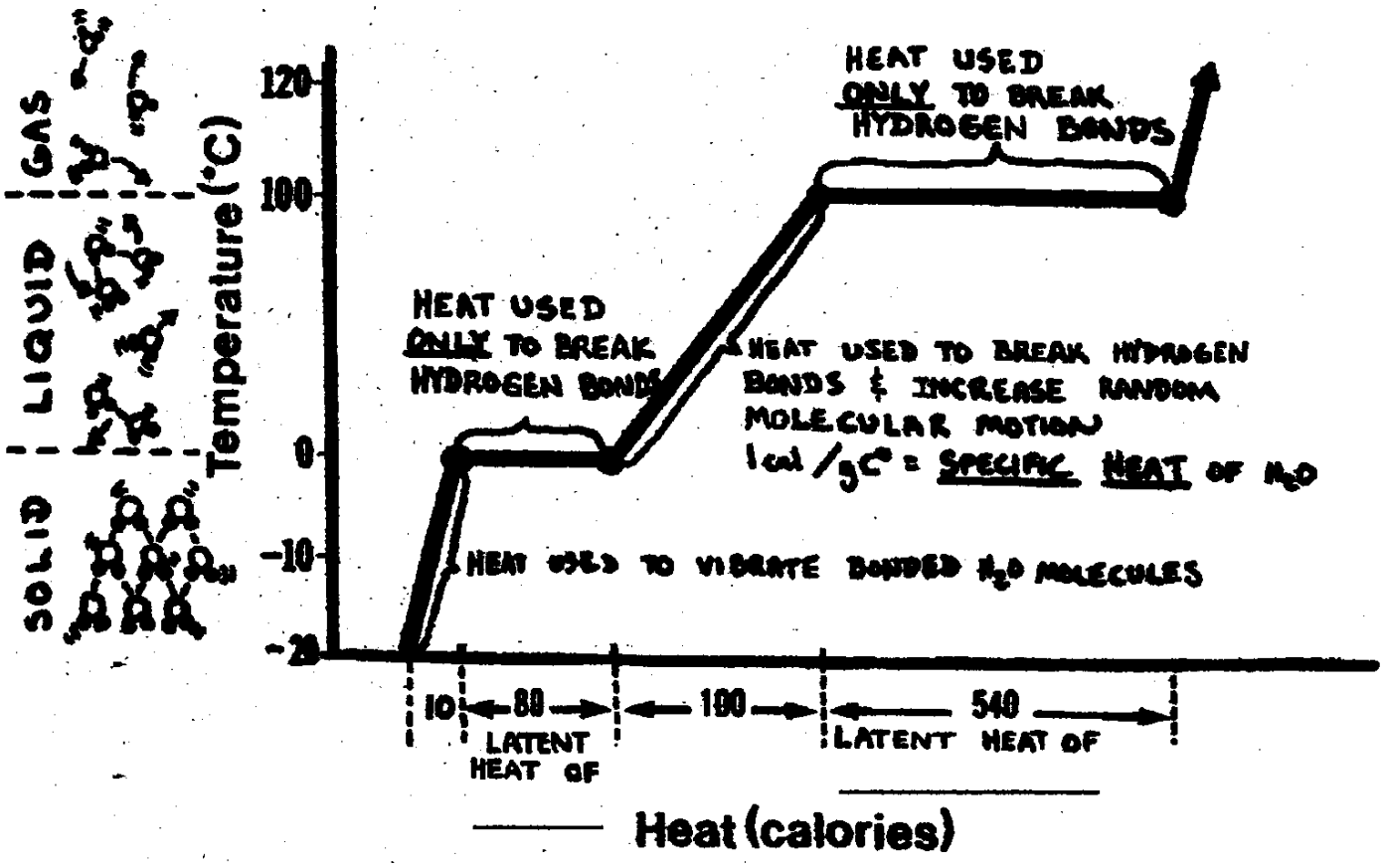
WORK = _____ x _____

ENERGY = Ability to do _____.

HEAT = The total amount of _____ contained in matter as _____ molecular _____.

CALORIE = The ____ by which ____ energy is measured. One calorie = heat required to raise 1g of H_2O 1°C

TEMPERATURE = A measure of average molecular _____.



OCEANOGRAPHY ARTICLE SUMMARY REQUIREMENTS

Basically these are graded by how much I think you have learned about physical oceanography from the assignment. I therefore check to see that nine criteria have been met:

1. Your source is reputable. Look in magazines (not web pages!) that are of scientific scope, but written for the general public. Scientific American, Discover, Science Spectra, Earth, Geo, Omni, National Geographic, Oceans, Sea Frontiers, and Popular Science are but a few of the good ones. Avoid "news" type articles that *report* on topics rather than *explain* them (i.e. newspapers, Science News, National Geographic News etc.) If you find your article online, make sure it is the full text article from the published magazine. To get full text scientific articles online go to our library's database list at **http://libguides.grossmont.edu/databases** and select one of the databases under the "Sciences" tab.

2. Your article is understandable. Many magazine articles on Oceanography are published in highly technical journals written for experts doing research in the field. Unless you are brilliant and/or uncommonly science literate, I recommend avoiding journals such as "Nature" and "Science".

3. The main focus of the article is physical oceanography. Physical oceanography encompasses a great diversity of topics that often spill over into other subjects such as geology, meteorology, astronomy, biology, and ecology. Your article may touch upon some of these other subjects, but only in so much as they relate to the features and processes of the ocean's bottom, coastlines or water itself. For example: (1) An article on comets would be appropriate if it focused on how the water in comets may have helped fill the oceans; but such an article would not be appropriate if it focused on how new comets are discovered by astronomers. (2) An article on coral would be appropriate if it focused on how physical aspects of the ocean (wave action, chemistry, temperature, bottom conditions etc.) influenced or were affected by coral growth; but such an article would not be appropriate if it focused on how corals reproduce. The main focus of the article should be on the *physical nature* of the ocean.

4. The magazine article is of sufficient length. Depending on the number of illustrations in the article, it should be a **minimum** of 3-5 pages. The longer the article - the more you learn, and the better your grade.

5. The magazine article is relatively current. Nothing older than three years please.

6. Your summary must **EXPLAIN CONCEPTS.** Don't just describe "what's there" or worse yet – report data. Conceptual summaries make liberal use of words like "because", "causes", "therefore", "hence", "so" and "thus", that relate ideas and information and bind them into larger constructs. Descriptive information should appear in your summary only if it supports larger concepts. If your article is purely descriptive, find another!

7. The summary is written in your own words. Significantly plagiarized summaries will be given zeros! With rare exceptions, do not quote anything from the article. I can't tell if you have learned anything if you have merely copied phrases from the article. You have learned a concept when you are able to state it in your own words. Note that because this is an article summary and not a research paper, there is no need to refer to the source within the body of your summary, since we know all the information came from the same article. Thus, beginning statements with phrases like "the author states" or "the article reports" is an unnecessary waste of words. Be succinct - just tell me what *you* learned.

8. Your summary must be sufficiently long. Generally this is two pages, but sometimes one is enough.

9. Your reference must be stated. I won't even give you a grade unless you indicate what your source was. If you

p
r
i
n
t
e
d

a

c
o
p

STUDY QUESTIONS CHAPTER 7

1. Draw a diagram that shows how water dissolves salt (NaCl).

2. List three substances found in seawater that do not contribute to salinity?

3. What is the average salinity of seawater?

4. Which natural processes increase salinity?

   Which natural processes decrease salinity?

   Where in the ocean do all these salinity-affecting processes occur?

5. What are some of the sources for the ions that contribute to salinity?

6. How does the composition of river water (see table below) compare to that of seawater (Table 7.1) and what bearing does that comparison have on the origin of salinity?

Constituents in River Water

Constituent	Symbol	% Total Weight of Constituents
Bicarbonate	HCO_3^{-1}	35.15
Calcium	Ca^{+2}	20.39
Sulfate	$SO4^{-2}$	12.14
Silicon dioxide	SiO_2	11.67
Sodium	Na^{+}	5.79
Chloride	Cl^{-}	5.68
Magnesium	Mg^{+}	3.41
Oxides	$(Fe,Al)_2O_3$	2.75
Potassium	K^{+}	2.12
Nitrate	NO_3^{-1}	0.90

7. How is it possible that the salinity of the oceans has remained pretty much constant for the last 1.5 billion years even though salt has been continuously added to it by rivers?

8. Define residence time.

9. If element "X" enters the ocean at the rate of 700 kilograms per year, and the total amount of "X" in the ocean is 2,800 kilograms, what is the residence time of "X" in the ocean?

10. How does residence time relate to the reactivity of a dissolved ion?

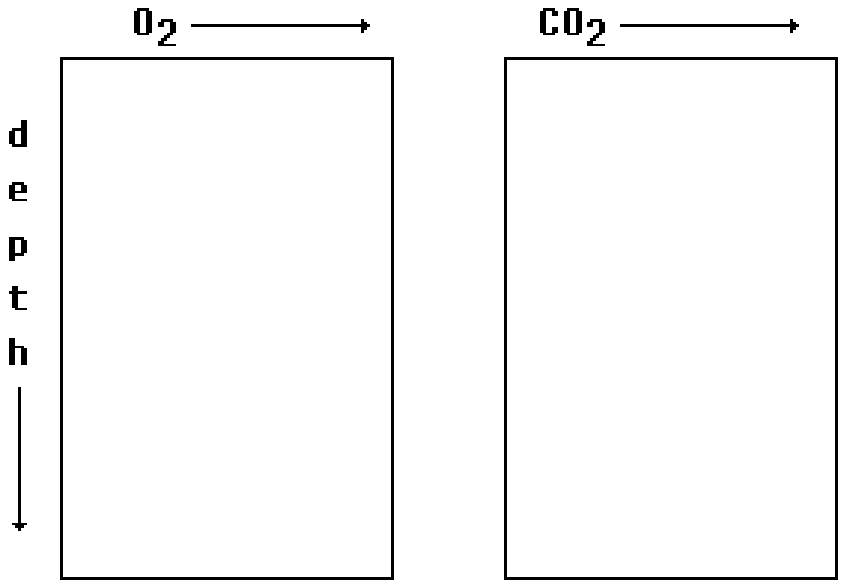
11. How do the concepts of residence time and mixing time apply to the principle of constant proportions?

12. Which would obey the principle of constant proportions, conservative constituents or nonconservative constituents?

    Why?

13. How is it possible that the salinity of seawater can be determined by only measuring chorinity? That is, why don't <u>all</u> the ions in seawater have to be measured?

14. Plot the typical graphs of dissolved oxygen and carbon dioxide vs. depth; and indicate the reasons for the high and low spots in these curves (see class notes and figure 7.8).



15. How do temperature and pressure affect the solubility of gases in seawater?

16. Discuss the chemical reactions that keep the pH nearly constant in seawater when H^+ ions are added or subtracted.

What is this process called?

STUDY QUESTIONS CHAPTER 8

1. How does the total amount of energy the earth receives from the sun compare to what it reradiates back into space?

2. Explain how the atmosphere is heated.

3. What changes would be made in Figure 8.3 if the concentration of carbon dioxide in the atmosphere increases?

4. Why are equatorial latitudes warmer than the poles?

5. How is heat transferred from the equator to the poles?

6. If water's latent heat of evaporation was much lower (say 58 cal/g at 20^{o} C instead of 585 cal/g) and water's heat capacity was much higher (say 10 cal/g C^{o} instead of 1 cal/g C^{o}) which would move more heat to the poles: the atmosphere or the ocean?

   Why?

7. On the diagram below indicate:

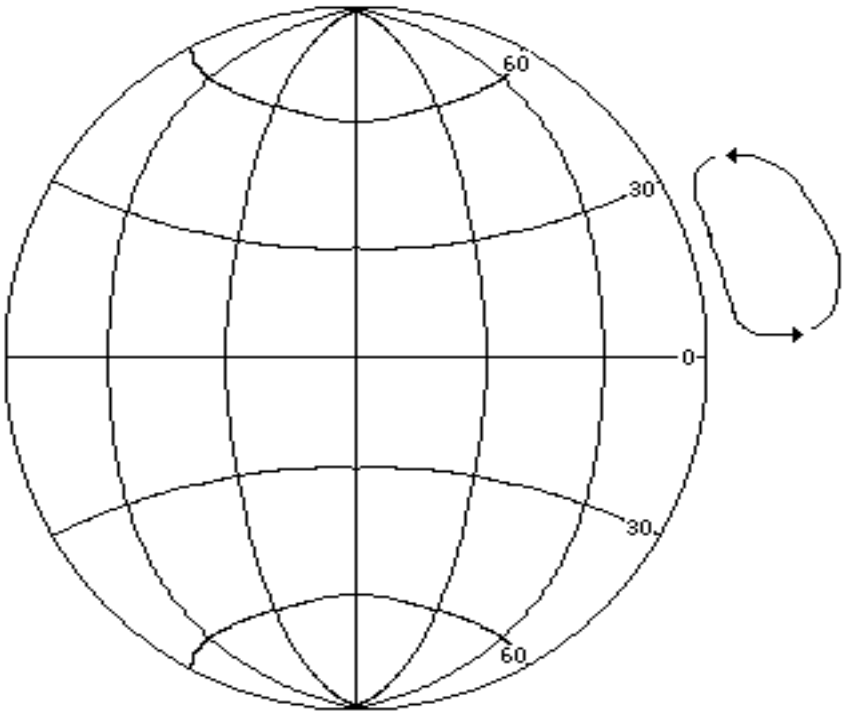
a. The general pattern of circulation in the atmosphere by drawing convection currents around the globe (the first one is drawn for you).

b. The position of high and low pressure belts.

c. With dashed lines, the direction winds would blow over the surface if Coriolis effect did not affect them.

d. With solid lines, the direction these winds actually blow over the surface as affected by Coriolis effect.

e. The location of the doldrums, horse latitudes, trade winds, westerlies, and polar easterlies.



8. How do the seasons and the high specific heat of the oceans relative to the continents affect the global distribution of pressure systems (see class notes)?

9. In what direction do winds blow around LOW-pressure systems in the northern hemisphere?

   Southern hemisphere?

In what direction do winds blow around HIGH-pressure systems in the northern hemisphere?

Southern hemisphere?

10. Where and in what direction does the polar jet stream flow?

How does it affect high and low pressure systems?

11. What are the similarities and differences between tropical cyclones and extratropical cyclones?

STUDY QUESTIONS CHAPTER 9

1. Using the concept of the Ekman Spiral, if an easterly wind is blowing in the northern hemisphere, in what direction will the surface current flow?

   In what direction will the mass transport flow?

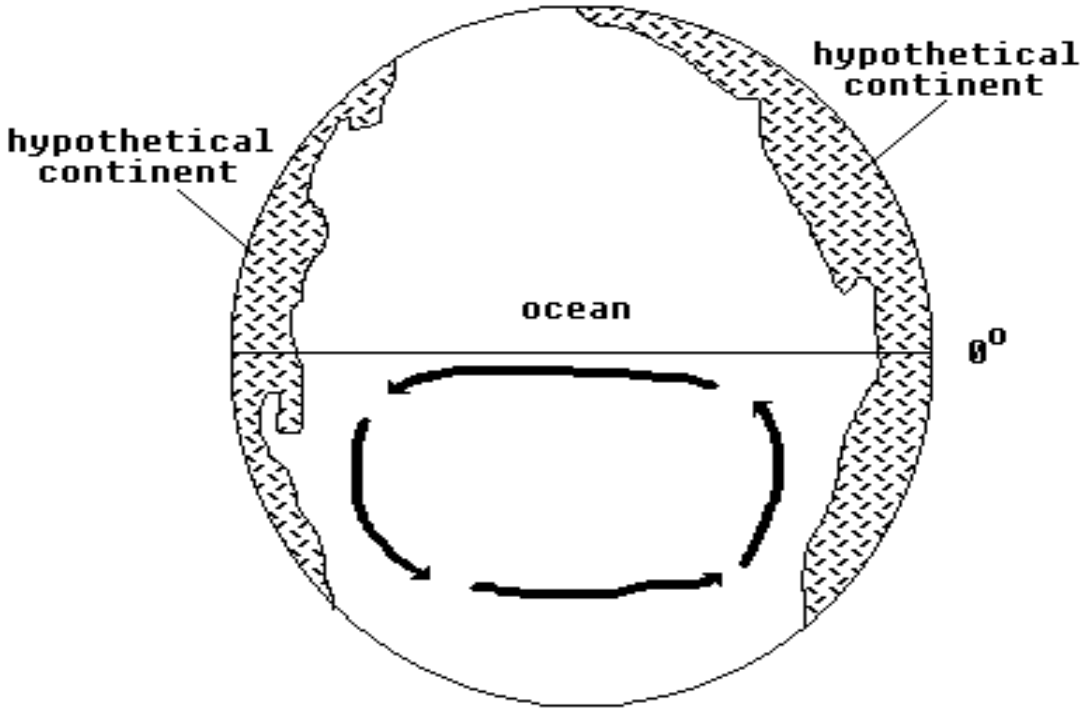
2. In the hypothetical gyre that follows:

   a. Identify the equatorial, western boundary, and eastern boundary currents.

   b. Estimate the relative temperatures and velocities (warm/cold; fast/slow) of these currents.

   c. Identify which winds drive them.

   d. Locate the position of the geostrophic hill and direction of geostrophic flow.



3. Be able to locate the following currents on a map showing them (see figure 9.8): California Current, North Equatorial Current, South Equatorial Current, Peru Current, Gulf Stream, West Wind Drift.

4. Where is the Equatorial Counter Current and what makes it flow?

5. Where is the Equatorial Undercurrent and what makes it flow?

6. Where is the Davidson current, in what direction does it flow, and why?

7. Does coastal upwelling tend to occur on the eastern or western margin of a continent? Why?

8. What is El Nino, and what are its effects?

9. Explain the theoretical model for thermohaline circulation.

   How is this theoretical model complicated by Coriolis effect and surface currents?

10. Sketch the pattern of deep ocean circulation in the Atlantic and label the water masses involved.

STUDY QUESTIONS CHAPTER 10

1. How does the orbital diameter of a particle of water at sea level in a deep water wave compare to the height of the wave that moved it?

2. What effect does wavelength have on orbital size?

3. What is the maximum steepness possible for a wave?

4. Calculate the celerity (in meters per second) of a wave that has a length of 100 meters and a period of 10 seconds.

5. What happens to wind energy that is applied to a fully developed wave?

6. What characteristics are indicative of waves that have traveled a long way from their source?

   What if the source were close?

7. Consider an intense but brief, stationary storm in the distant south Pacific that generates waves large enough to travel all the way to San Diego. What changes would we observe in the height and period of these waves throughout the duration of the swell?

8. How does the velocity of a wave train (group velocity) compare to the velocity of the waves that comprise it?

9. What causes waves to occur in sets?

10. What happens to the velocity, wavelength, height, steepness, and orbital shape of waves as they move into shallow water?

11. In what depth of water do waves first touch bottom?

12. In what depth of water do waves usually break?

13. What single factor controls the velocity of a deep-water wave?

14. What single factor controls the velocity of a shallow-water wave?

15. What equation can be used to calculate the velocity for any wave regardless of the depth of water it is in?

16. In what situation would plunging waves occur?

17. In what situation would spilling waves occur?

18. Distinguish between the following wave phenomena and give an example of where each might occur.

    dispersion

    refraction

    reflection

    diffraction

19. What condition is essential for the development of internal waves?

Google Earth Assignment

Using Google Earth (download at http://earth.google.com/download-earth.html) find an example of the following coastal features, print out a picture of it, and label it with the indicated information. These are two (2) points each up to a maximum of ten (10) points. You may want to do more than five (5) in case you make mistakes.

CONCEPTS FROM CHAPTER 10:

1. SWELL – The picture must show the long, orderly crest lines which are characteristic of swell, not just any waves. Make sure there are at least 3 crests clearly visible in the picture. Label the wavelength and, using the ruler in Google Earth (Tools>Ruler), measure and label the wavelength in meters for at least two pairs of waves. Under the picture, answer this question: Why does the wavelength change?

2. WAVE REFRACTION – Indicate where wave fronts travel fast and where they travel slow.

3. WAVE DIFFRACTION – Clearly label the diffracted wave(s) and indicate their direction of motion with an arrow.

4. WAVE REFLECTION – Clearly label the reflected wave(s) and indicate their direction of motion with an arrow. This one is very difficult to find.

CONCEPTS FROM CHAPTER 12:

5. SAND SPIT – Label the spit and, with an arrow, the dominant direction of longshore transport (beach drift).

6. BAYMOUTH BAR - Indicate with a(n) arrow(s) the direction(s) of longshore transport.

7. TOMBOLO – Indicate with a(n) arrow(s) the direction(s) of longshore transport.

8. BREAKWATER – Indicate any affect on deposition or erosion.

9. GROIN - Indicate with an arrow the dominant direction of longshore transport. Label places where sand deposition and erosion occurs.

10. JETTY - Indicate with an arrow the dominant direction of longshore transport. Label places where sand deposition and erosion occurs.

11. MARINE TERRACE – To recognize these coastal features you will have to view the coastline obliquely (down *and* from the side). Use the tilt control or hold the mouse wheel down and drag. Clearly label the terrace.

STUDY QUESTIONS CHAPTER 11

1. What causes tsunamis?

   What single factor controls their velocity?

2. What type of tide do we have in San Diego?

   What do we use for tidal datum in San Diego?

2. What causes the tidal bulge on the side of the earth opposite the moon?

3. How does the tide generating force due to the moon compare to that of the sun?

4. What is the period of the lunar tide? (Assume the moon orbits the earth every 29.5 days and that these tides are unaffected by the continents or friction.)

5. How does the sun's declination change with the seasons?

   Is it ever zero?

6. What affect does the precession of the moon's orbit have on its maximum declination per synodic month?

7. How do the declinations of the moon and sun help explain the diurnal inequality?

8. How do the elliptical orbits of the moon and earth affect tidal range?

9. How are the tides affected by the combined effects of the continents and Coriolis Effect?

10. When are ebb and flood currents fastest?

11. In what situations do tidal bores occur?

KEY TERMS: (You don't have to write down the definitions for these. Just know them.)

diurnal tide
semidiurnal tide
mixed tide
mean low water (MLW)
mean lower low water (MLLW)
tidal datum
minus tide
equilibrium tide
differential gravity
dynamic tide
tidal period
lunar day
1st quarter
3rd quarter
new moon
full moon
synodic month
spring tide
neap tide
declination
precession
apogee
perigee
anomalistic month
aphelion
perihelion
diurnal inequality
rotary tidal current
amhidromic point
cotidal line
ebb current
flood current
tidal bore

STUDY QUESTIONS CHAPTER 12

1. In what way is world-wide (eustatic) sea level affected by glaciation?

   Can glaciation produce local (non-eustatic) changes in sea level?
   Explain.

2. In what way is world-wide (eustatic) sea level affected by plate tectonic processes?

   Can plate tectonic processes produce local (non-eustatic) changes in sea level?
   Explain.

3. Explain why in some situations wave erosion tends to make the coast-line more irregular, whereas in other areas it tends to straighten the coastline.

4.

FEATURE	PRIMARY	SECONDARY	EMERGENCE	SUBMERGENCE	EROSION	DEPOSITION
fjord	X			X	X	
drowned rivermouth	X			X	X	
delta	X					X
barrier island	can be	either				X
dune coast	X					X
lava coast	X					
cratered coast	X					
fault bay	X					
fault coast	X					
reef coast		X		X		X
sea cave		X	X		X	
sea arch		X	X		X	
sea stack		X	X		X	
sea cliff		X	X		X	
wave-cut platform		X	X		X	
marine terrace		X	X		X	
beach		X				X
sand spit		X				X
baymouth bar		X				X
tombolo		X				X

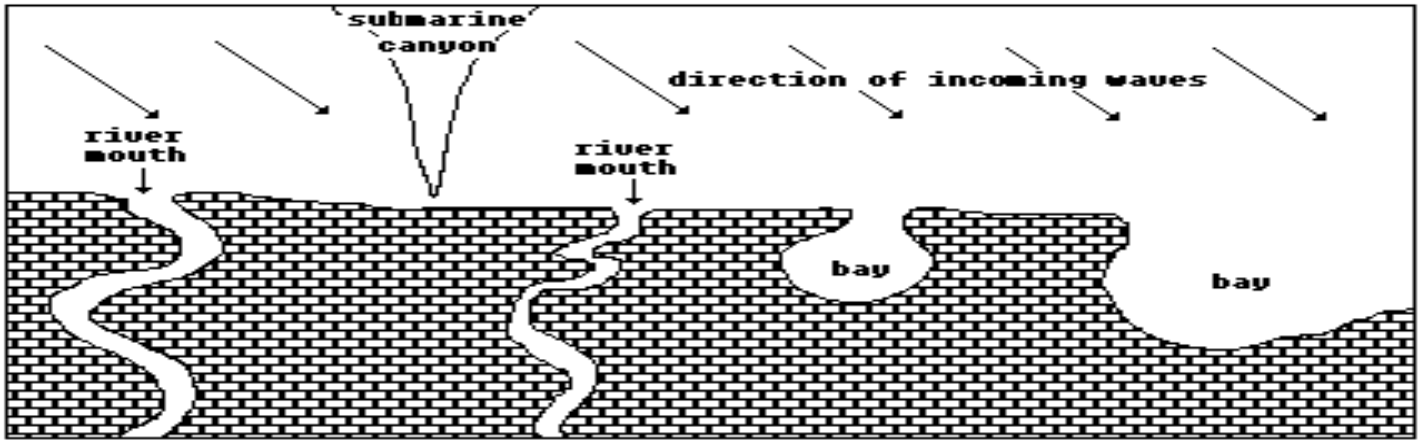
5. Circle the appropriate underlined responses in the paragraphs below:

In most situations where the sea floor is not too steep, waves move sand away from/towards the beach once they touch bottom. Once waves break they tend to move sand away from/towards the beach. If the distance between where the waves touch bottom and break is large compared to the width of the surf zone, then net sand movement is generally away from/towards the beach. If the distance between where the waves touch bottom and break is small compared to the width of the surf zone, then net sand movement tends to be away from/towards the beach. Sand suspended within the turbulence of the surf zone will generally be deposited offshore as a longshore bar.

The waves which hit San Diego beaches in summer generally come from nearby/distant storms and thus have long/short wavelengths, low/high wave heights and are relatively frequent/infrequent. Because of their wavelength, our summer waves will "touch-bottom" in relatively shallow/deep water, however, because of their height, these waves will break in relatively shallow/deep water. Hence the distance between where our summer waves touch bottom and break is small/large compared to the width of the surf zone, net sand movement is away from/towards the beach and our beaches narrow/widen during summer. This process is enhanced by the infrequency of summer waves which keeps sand on the beach face saturated/unsaturated and thereby increases/decreases erosion by backwash.

Our winter waves generally come from nearby/distant storms and thus have long/short wavelengths, low/high wave heights and are relatively frequent/infrequent. Because of their wavelength, winter waves will "touch-bottom" in relatively shallow/deep water, however, because of their height, these waves will break in relatively shallow/deep water. Hence the distance between where our winter waves touch bottom and break is small/large compared to the width of the surf zone, net sand movement is away from/towards the beach and our beaches narrow/widen during winter. This process is enhanced by the high/low frequency of winter waves which keeps sand on the beach face saturated/unsaturated and thereby increases/decreases erosion by backwash.

6. In the diagram below sketch-in the sand beach that would be formed from the longshore drift (=longshore transport) of sand brought down to the river mouths by the two streams. The absolute width of the beach is arbitrary, but the relative width must vary according to the affects of the submarine canyon and river mouth. Also include in your sketch a baymouth bar and a sand spit.



7. In the diagram that follows:

a. Indicate with arrows the location and direction of the longshore current and longshore transport.

b. Match the following structures with their corresponding number:
__jetty __breakwater __groin

c. Assume that the jetties, groins, and breakwater have only just been constructed, that the dam has not been built, and that the sand beach is shown in its natural configuration (i.e. prior to any adjustments due to the construction of these structures); indicate by number the locations where erosion will occur and the locations where deposition will occur:
_____erosion _____deposition

d. What will happen at location 10 if the dam is built?

e. What will happen at location 11 if the dam is built?