LSC Use Only Proposal No:	UWUCC Use Only Proposal No: 11-123c.
LSC Action-Date: AP-3/22/12	UWUCC Action-Date: App-4/19/12 nate Action Date: App. 5/01/12

Curriculum Proposal Cover Sheet - University-Wide Undergraduate Curriculum Committee

Contact Person(s) **Steve Hovan**	Email Address **hovan@iup.edu**
Proposing Department/Unit **Geosciences**	Phone **x2379**

Check all appropriate lines and complete all information. Use a separate cover sheet for each course proposal and/or program proposal.

1. Course Proposals (check all that apply)

New Course	Course Prefix Change	Course Deletion
X Course Revision	Course Number and/or Title Change	Catalog Description Change

Current course prefix, number and full title: GEOS 104 Oceans and Atmospheres Lab

Proposed course prefix, number and full title, if changing:

2. Liberal Studies Course Designations, as appropriate

This course is also proposed as a Liberal Studies Course (please mark the appropriate categories below)

Learning Skills [X] Knowledge Area Global and Multicultural Awareness Writing Across the Curriculum (W Course)

Liberal Studies Elective (please mark the designation(s) that applies – must meet at least one)

Global Citizenship	Information Literacy	Oral Communication
Quantitative Reasoning	Scientific Literacy	Technological Literacy

3. Other Designations, as appropriate

Honors College Course Other: (e.g. Women's Studies, Pan African)

4. Program Proposals

Catalog Description Change	Program Revision	Program Title Change	New Track
New Degree Program	New Minor Program	Liberal Studies Requirement Changes	Other

Current program name:

Proposed program name, if changing:

5. Approvals	Signature	Date
Department Curriculum Committee Chair(s)		3/6/12
Department Chairperson(s)		3/6/12
College Curriculum Committee Chair		3/8/12
College Dean		3/12/12
Director of Liberal Studies (as needed)		4/9/12
Director of Honors College (as needed)		
Provost (as needed)		
Additional signature (with title) as appropriate		
UWUCC Co-Chairs	Gail S Sechrist	4/19/12

Received APR 11 2012 Liberal Studies

Received APR 5 2012 Liberal Studies

Received MAR 12 2012 Liberal Studies

Part II

I. New Syllabus of Record

[NOTE: GEOS104 will count as a "lab science elective requirement" only when combined with non-lab science course GEOS103 – Oceans and Atmospheres (lecture)]

GEOS 104 Oceans and Atmospheres Lab (0c-2l-1cr)

Prerequisites: No Geoscience Majors/Minors
Co-requisites: Enrollment in GEOS104 requires co-requisite or previous enrollment in GEOS 103

GEOS 104: Introduces students to the techniques oceanographers and meteorologists use to study the earth's oceans and atmospheres and reconstruct their evolution. Labs cover seawater processes, oceanic circulation, marine life, atmospheric structure and weather

II. Course Outcomes and Assessment (Expected Undergraduate Student Learning Outcomes)

Objective 1:
Demonstrate that geological processes on the Earth such as plate tectonics are interconnected to the physical, chemical and biological systems of the ocean.
Expected Student Learning Outcomes 1 and 2
Informed and Empowered Learners
Rationale:
The Earth has one connected ocean that is shaped by geological and physical processes. Course content and assignments are designed to show that various components of the Earth System are linked over long periods of geological time.

Objective 2:
Students will assess human use of oceanic resources and think critically about the historical impact and future development of these resources. Students will consider current events such as climate change, pollution and fisheries industry, and the global economic and political regulation of these resources.
Expected Student Learning Outcomes 1, 2 and 3
Informed, Empowered and Responsible Learners
Rationale:
Assignments and course content will engage students about knowledge that although the ocean is large, it is finite and resources are limited. By looking at current issues related to resource development, students can begin to appreciate the complexities of managing and regulating these resources.

Objective 3:
Students will diagram and analyze how the ocean and life in the ocean shape the features of the Earth.
Expected Student Learning Outcomes 1, 2 and 3
Informed, Empowered and Responsible Learners
Rationale:
Assignments and course content will require students to have general knowledge of the hydrologic cycle and how coastal processes shape the shorelines. Assignments will also engage student to assess human development and how it impacts the coastal environment.

Objective 4:
Students will learn about the role the oceans play in the carbon cycle and greenhouse warming. Students also will be required to critically analyze geological records of climate change to assess the varying roles of natural and human influence.
Expected Student Learning Outcomes 1, 2 and 3
Informed, Empowered and Responsible Learners
Rationale:
Assignments and course content will engage students to examine and assess how the ocean is a major influence on weather and climate by examining the important role that the oceans have played throughout geological records of past climate changes.

Objective 5:

Students will consider how much of the seafloor environment has been explored and how much remains to be discovered. Students also will discover the impact oceans have on the cultural, political and economic development of society.

Expected Student Learning Outcomes 1, 2 and 3

Informed, Empowered and Responsible Learners

Rationale:

Assignments and course content will inspire students to understand that the ocean is largely unexplored but inextricably connected to humans and reflect on ways the oceans may have influenced their own cultural and societal history. Through these connections, we hope to show relevance to the study of the oceans to all humans, not just those living near the coast or studying it from afar.

III. Course Outline:

GEOS 104:

A. The global environment	1 lab period
1. Geography & plate tectonics	
B. Marine geology	2 lab periods
1. Marine provinces & ocean bathymetry	
2. Marine sediments	
C. Seawater properties and oceanic circulation	3 lab periods
1. Seawater chemistry	
2. Seawater density and salinity measurements	
3. Thermohaline circulation	
D. Life in the oceans	1 lab period
1. Food resources and the food chain	
E. Midterm Exam	1 lab period
F. Composition and structure of the atmosphere	2 lab periods
1. Temperature, pressure and chemical changes in the atmosphere	
2. Using meteorological instruments	
G. Weather and weather events	1 lab period
1. Clouds and precipitation	
2. Mid-latitude storms	
H. Climate and climate change	2 lab periods
1. Global climate distribution	
2. Climate changes through time: natural versus human-induced	
I. Final exam	1 lab period

IV. Evaluation Methods

The final grade for this course will be determined as follows:

33% Quizzes. Weekly quizzes will cover previous lab concepts and information.

67% Two non-cumulative lab exams. Exams will consist of sample identification, quantitative calculations, short essays and map or cross-section-based questions.

V. Grading Scale

A 90-100%, B 80-89%, C 70-79%, D 60-69%, F <60%

VI. Undergraduate Course Attendance Policy

IUP attendance policy will be followed as outlined in the undergraduate catalog.

VII. Required Textbook

The IUP Oceans and Atmospheres Lab Manual (Course Packet). This lab manual was locally developed to coordinate with companion lecture course content and information. Nationally published lab manuals were consulted during the development process to ensure quality, parity and relevance to national trends in earth systems science.

Supplemental/Non-textbook reading

None – all students taking the laboratory course must complete the lecture course where they have non-text reading requirements

VIII. Special Resource Requirements

none

IX. Bibliography

Broeker, W. S., (1997) Thermohaline circulation, the Achilles heel of our climate system: Will man-made CO2 upset the current balance? Science, 278, p. 1582-1588.

Carbone, G., 2010. Exercises for Weather and Climate (7th Ed.), Upper Saddle River, New Jersey, Prentice Hall, 210p.

National Research Council. 2000. Reconciling Observations of Global Temperature Change, U.S. Govt. Printing Office, Washington, DC.

Ruddiman, W.F., 2001. Earth's Climate – Past and Future. W.H. Freeman and Co., 465p.

Tarbuck, E.J. and Lutgins, F.K., 2012. Earth System Science (13th Ed.), Englewood Cliffs, NJ: Prentice Hall, 739p.

Tarbuck, E.J., and Trujillo, A.P., 2010, Introductory Oceanography (10th Ed.). Englewood Cliffs, NJ: Prentice Hall, 461 p.

Part II (continued)

2. Summary of the proposed revisions.

1. Objectives – the course objectives were revised from the original syllabus of record and aligned with the Expected Undergraduate Student Learning Outcomes (EUSLO) and Common Learning Objectives found in the criteria for a non-laboratory Natural Science course.

2. Common Learning Objectives for a non-laboratory Natural Science course are met in the content portion of the course (not necessarily a specific revision but it should be noted that the objectives for the new curriculum have been met). These objectives are:
   - examine a body of knowledge of natural science that will contribute to an understanding of the natural world and an appreciation of the impacts that natural sciences have on the lives of individuals and the world in which they live
   - understand the differences between science as a knowledge base and science as a process that generates knowledge
   - develop an inquiring attitude consistent with the tenets of natural science
   - understand the empirical nature of science
   - understand the concept of bias and the efforts to which scientists go to avoid it
3. Updated textbook and added an additional non-textbook reading to a classic paper that discusses the early ideas about how the oceans formed.
4. Added seven more current citations to the bibliography.

Part II.
3. Justification/Rationale for the revision.

The course is a currently approved Liberal Studies Non-Laboratory Natural Science course and is being revised to meet the new curriculum criteria for this category.

4. Old Syllabus of Record

GEOS 104 Oceans and Atmosphere Lab

I. Catalog Description

GEOS 104 Oceans and Atmospheres Lab — 1 credit, 2 lab hours

Prerequisites: No Geoscience Majors/Minors — (0c-2l-1cr)
Corequisites: Enrollment in GEOS 103

Introduces students to the techniques oceanographers and meteorologists use to study the earth's oceans and atmospheres and reconstruct their evolution. Labs cover seawater processes, oceanic circulation, marine life, atmospheric structure and weather.

II. Course Objectives

1. Students will learn methods of oceanic and atmospheric data collection and observation.
2. Students will examine and interpret simple data sets to better understand oceanographic, meteorologic and climatologic processes.

III. Course Outline

A. The global environment (1 labs)
    1. Geography& plate tectonics
B. Marine geology (2 labs)
    1. Marine provinces & ocean bathymetry
    2. Marine sediments
C. Seawater properties and oceanic circulation (2 labs)
    1. Seawater chemistry
    2. Thermohaline circulation
D. Life in the oceans (1 lab)
    1. Food resources and the food chain
E. Midterm Exam (1 lab)
E. Composition and structure of the atmosphere (2 labs)
    1. Temperature, pressure and chemical changes in the atmosphere
    2. Using meteorological instruments
F. Weather and weather events (2 labs)
    1. Clouds and precipitation
    2. Mid-latitude storms
G. Climate and climate change (2 labs)
    1. Global climate distribution
    2. Climate changes through time: natural versus human-induced
H. Final exam (1 lab)

Oceans and Atmospheres Lab

GEOS 104. Oceans and Atmospheres Lab 0c-21-1cr

Prerequisites: No Geoscience Majors/Minors
Co-requisites: Enrollment in GEOS104 requires co-requisite or previous enrollment in GEOS 103

GEOS 104: Introduces students to the techniques oceanographers and meteorologists use to study the earth's oceans and atmospheres and reconstruct their evolution. Labs cover seawater processes, oceanic circulation, marine life, atmospheric structure and weather

Answers to Liberal Studies Questions

A. Multiple instructors will teach sections of the course, however they will use a common course syllabus, outline, a collaboratively designed single course-pack manual, and common quizzes and exams between sections. Faculty instructors interact weekly to update common course components.

B. Wherever possible, lectures and lab material for Oceans and Atmospheres will emphasize the contributions of women and racial & ethnic minorities. Examples will include those currently involved in active research programs (eg. aboard the Ocean Drilling Program vessel Resolution; Susan Solomon, Project Leader for the Ozone-CFC project) and in prominent government and administrative positions (eg. NSF Program Director; Margaret Leinen).

C. As noted on the syllabus, there is no non-textbook reading for this course. All students enrolled in the laboratory section are required to also enroll in the lecture sections (GEOS103) and follow non-textbook reading requirements for that course.

D. Far more than in our major's classes, Oceans and Atmospheres lab will emphasize the social context and ramifications of global ocean resources and human interaction with oceans and climate. Examples to be discussed include 1) Harbor structures and the impact they have on shoreline development (eg. Santa Barbara, Santa Monica) 2) Zebra Mussel infiltration into the Great Lakes ecosystem and efforts to control them 3) the "Law of the Sea" and the Exclusive Economic Zone treaty 4) global ramifications of possible Greenhouse Warming and Ozone Depletion 5) social and economic impact of current weather events. Discussions such as these will probably arise in almost every meeting of Oceans and Atmospheres Lab

EXAMPLE EXAM FOR GEOS104

Please provide answers to the following questions – ***YOU MUST SHOW ALL OF YOUR WORK***. You will have two full hours to complete this exam. Read each question carefully and BE SURE TO **ANSWER ALL PARTS** OF THE QUESTION!

1. If the number is in scientific notation, change it to standard notation and vice versa (2 pts total)

   6,170,000 = _____ 9.4×10^{5} = _____

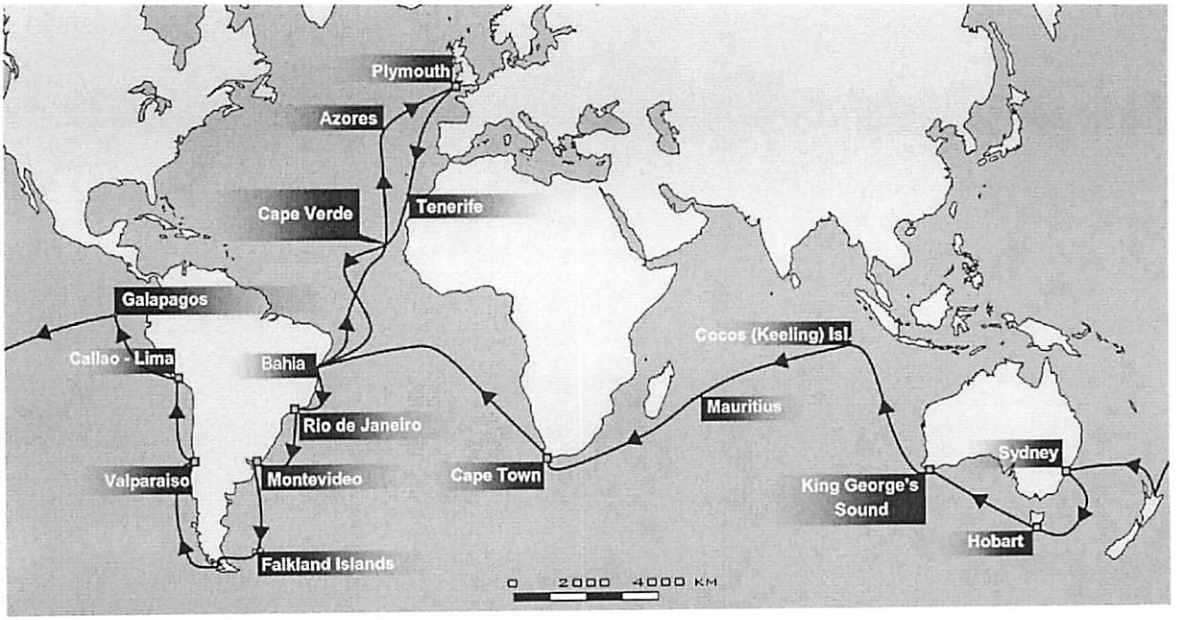
   0.000935 = _____ 7.1×10^{-3} = _____

2. You live on a tiny spherical planet in a galaxy far, far away. Now suppose you were bored and decided to walk around the equator of this planet. You discover that the circumference of the planet is 3600 miles. Since you walked 360°, then each degree of latitude is 10 miles. If you were to then walk due north away from the equator for 16° 45', how many miles would you have walked? (2 pts).

3. How many inches are there in 4.7 miles? (1 pt)

4. How many centimeters are there in 3.8 km? (1 pt)

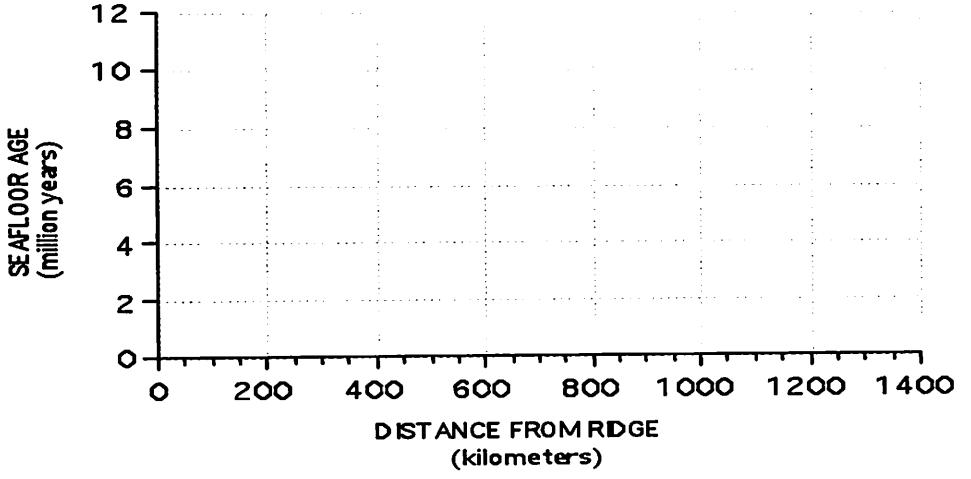
5. Charles Darwin was, perhaps, most famous for his theory of natural selection. Much of the data that he gathered for this theory was done so during a 5-year long cruise aboard the *HMS Beagle*, a ship of the Royal Navy. The journey is shown on the map below, along with a short account of Darwin's travels. Using your knowledge of geography that you've acquired thus far in this course, please fill in the blanks. Use the list on the last page of the exam for possible choices. Please note that not all choices will be used! (7 pts)



On December 27, 1831, the *Beagle* departed from Plymouth, which is a part of _____(continent). It sailed south through the _____ Ocean to Bahia where Darwin was enraptured by the tropical forest. The ship followed the _____ ocean current along the eastern coast of this continent, reaching the southern tip on December 18, 1832. Much of the next 2 years was spent in this southern location surveying & exploring the region, which includes the _____ Desert. From here, the *Beagle* traveled north along the _____ ocean current. At Valparaiso, Darwin bought horses & explored the _____ Mountains, where he & the crew witnessed the eruption of a volcano & experienced an earthquake. On September 15, 1835, the ship arrived at the Galapagos Islands in the _____ Ocean. From here, they sailed west to the city of Sydney, which is located on the continent of _____. Here, Darwin traveled inland & got a view of the _____ Desert. The Beagle made a brief stop in Hobart, on the island of _____, before arriving at Keeling Island in the _____ Ocean. Sailing west, the *Beagle* sailed past the large island of _____ before reaching Cape Town, a city on the continent of _____. From here, they headed north-west, following the _____ ocean current. The *Beagle* made another trip to Bahia to recheck some survey data taken there and finally headed north again to return to Plymouth.

6. On the graph below, plot the following information that has been collected by the deep sea drilling program (2 pts):

Age of Seafloor (million years)	Distance from Spreading Axis
0.5	50
2.0	175
6.9	375
8.0	550
10.0	700
12.0	775

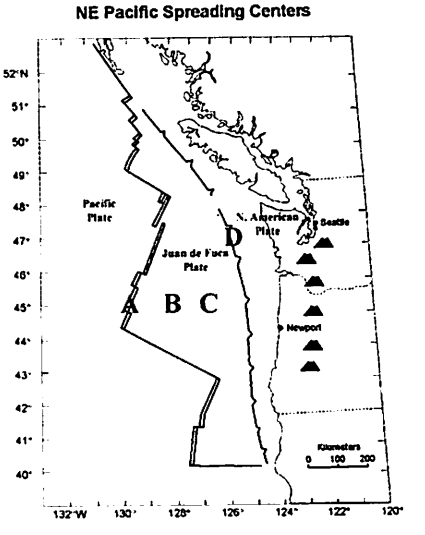


7. a) Draw a best fit line and **use that line** to calculate the average spreading rate away from the ridge axis. Show your answer in units of (cm/yr) (3 pts) SHOW YOUR WORK!!

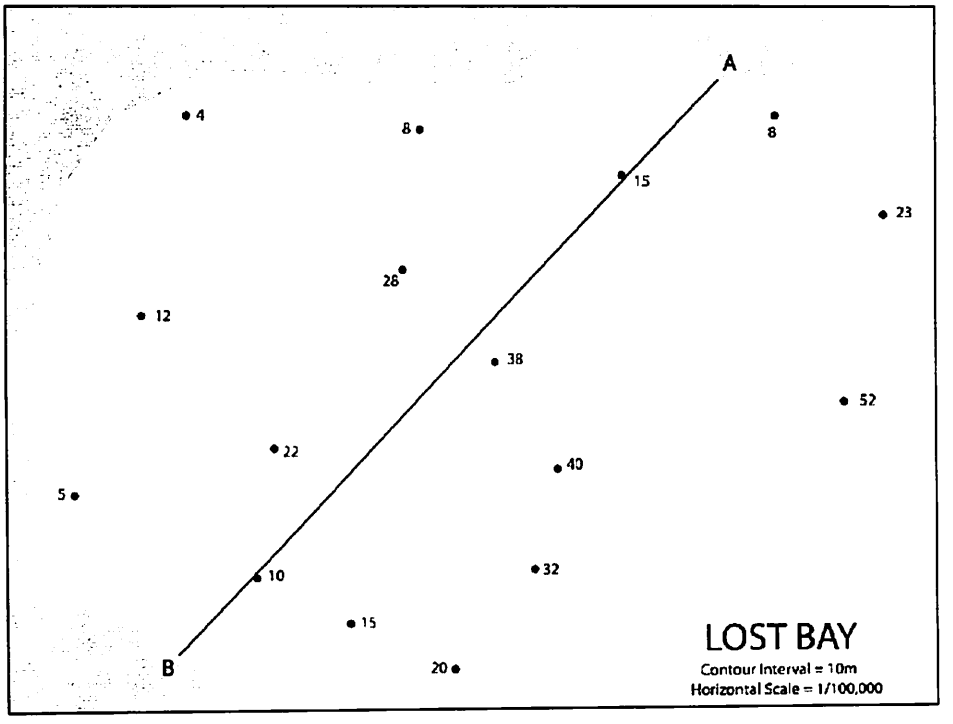
b) Using the best fit line, estimate the age of the seafloor at 400km from the ridge (1pt) (Show your work on the graph)

8. Based on the map to the right, circle the answer that best describes the age at each of the following points (1 pt)
   Location A is (older or younger) than Location B
   Location C is (older or younger) than Location B

9. On the map to the right, which of the following tectonic plate boundary process is occurring at location D? (1 pt)
   a) seafloor spreading
   b) subduction
   c) strike-slip faulting
   d) hotspot melting
   e) divergence



Use the following bathymetric chart and graph to answer the questions for this section



10. Using a **10 meter contour interval**, construct a bathymetric map of the soundings in the image above (2 pts).

11. In the space provided on the last page of the exam, construct a cross section or profile of the seafloor along the line that extends from A to B. Please feel free to remove the last page and fold it as you need. (2 pts)

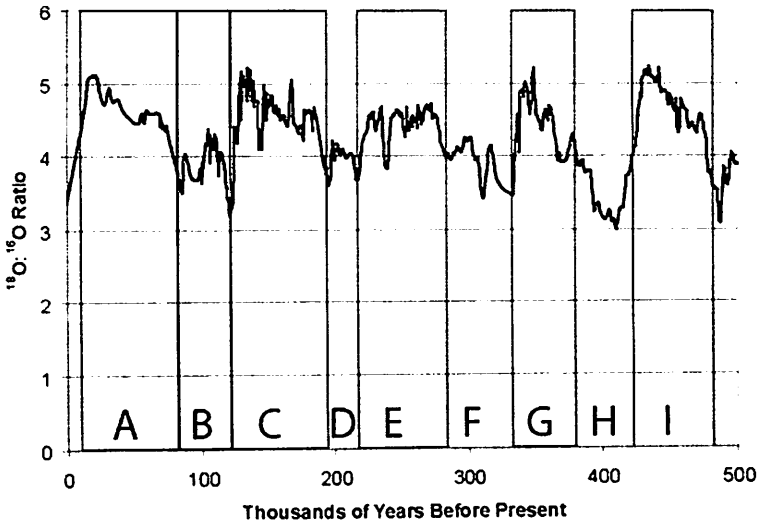
12. Given the horizontal scale on this map and the vertical scale on this profile, calculate the vertical exaggeration of this particular cross-section. (2 pts)

$$\text{Vertical Exaggeration} = \frac{vertical\,scale}{horizontal\,scale}$$

13. While out on a boat in the ocean, you decide to measure the water depth using an echo sounder. Knowing that sound travels at a speed of 1507 meters/second in seawater and that it took a sound pulse 0.6 seconds to travel from the ship to the bottom and back, calculate the depth of the water. (show your work) (2 pts)

$$D = V \times \left(\frac{T}{2}\right)$$

14. By looking at the graph of the oxygen isotope ratios over the past 500,000 years (below), circle **ONE** of the letters that indicates a relatively **warm period**. (1 pts)



15. Explain why we can use the $^{18}O:^{16}O$ as a proxy for changes in global temperature. Discuss specifically about how changes in the hydrologic cycle *result* in changes in the ratio in seawater (3pts)

16. What compositional property of the microfossils such as foraminifera makes it possible to record isotopic changes in
seawater? (1 pt).

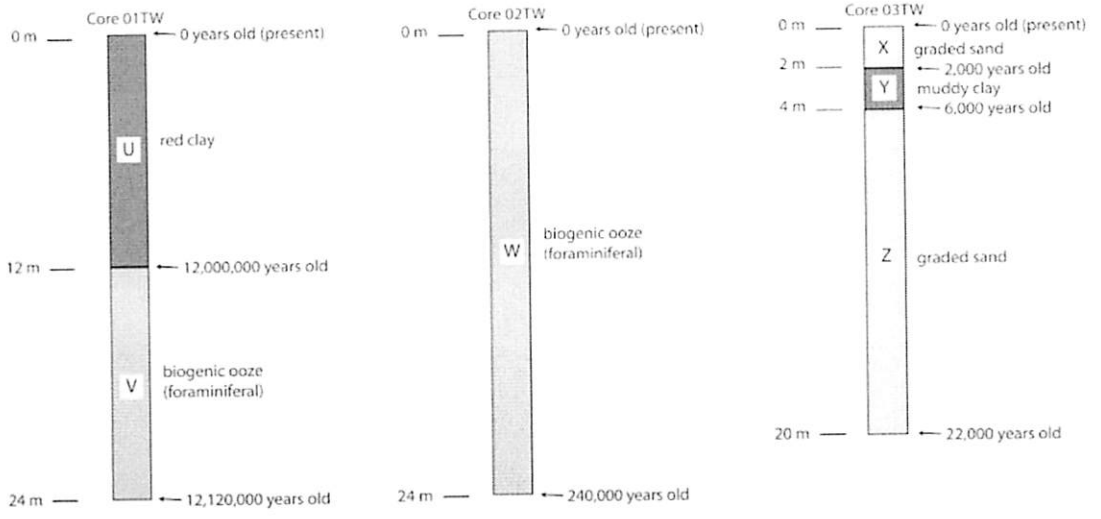
17. Oxygen isotopic composition is just one type of temperature proxy records found in the ocean. Identify another type of proxy data that records temperature. (2pts)

18. If the earth's global temperature continues to rise, the amount of ^{16}O in the oceans will (INCREASE or DECREASE) (circle one), resulting in an (INCREASE or DECREASE) of the $^{18}O:^{16}O$ ratio (1 pt).

19. When oceanic cores are recovered from the deeper parts of the seafloor, they often contain a layer of wind deposited dust material (red clays). Yet, when sediments are examined beneath this layer, they commonly contain a significant amount of calcium carbonate. Briefly explain why and how this occurs with specific reference to the Calcium Carbonate Compensation Depth (CCD). (3 pts)

20. Explain why near coastlines, which are areas of extremely high biological productivity at the surface, we do not classify most continental shelf sediments as biogenic. (2 pts)

21. What is the rate of deposition of layer Z, the graded sand layer in core 03TW below? Please provide your answer in units of cm/kyr and show all your work (2 pts). (note: kyr = thousand years)



22. You recently returned from a deep sea adventure aboard a research vessel whose primary purpose was to collect core sediment samples from the bottom of the ocean. After opening the box containing all the cores, you realize that you have a serious problem because the labels you stuck on have fallen off. Can you match the cores with their locations to save your job?? Lucky for you that you've taken GEOS 104 back when you were a fledgling young scientist at IUP because you won't have any trouble identifying where each of the cores were taken based on their descriptions.

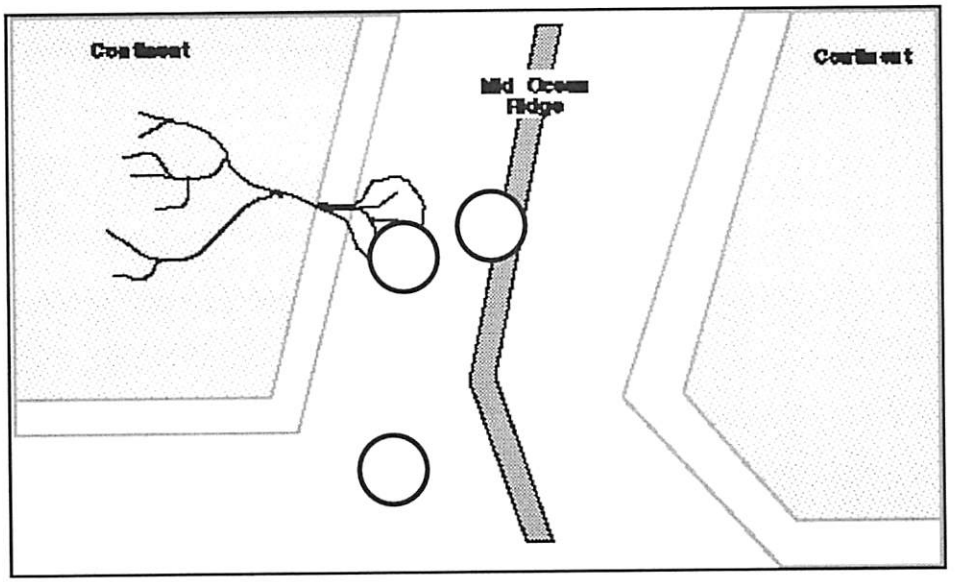
Descriptions

core A: 3 meters of reddish clay over 3 meters of $CaCO_3$ ooze and a few fragments of basaltic rock near the bottom of core

core B: 2 meters of $CaCO_3$ ooze over a few fragments of basaltic rock

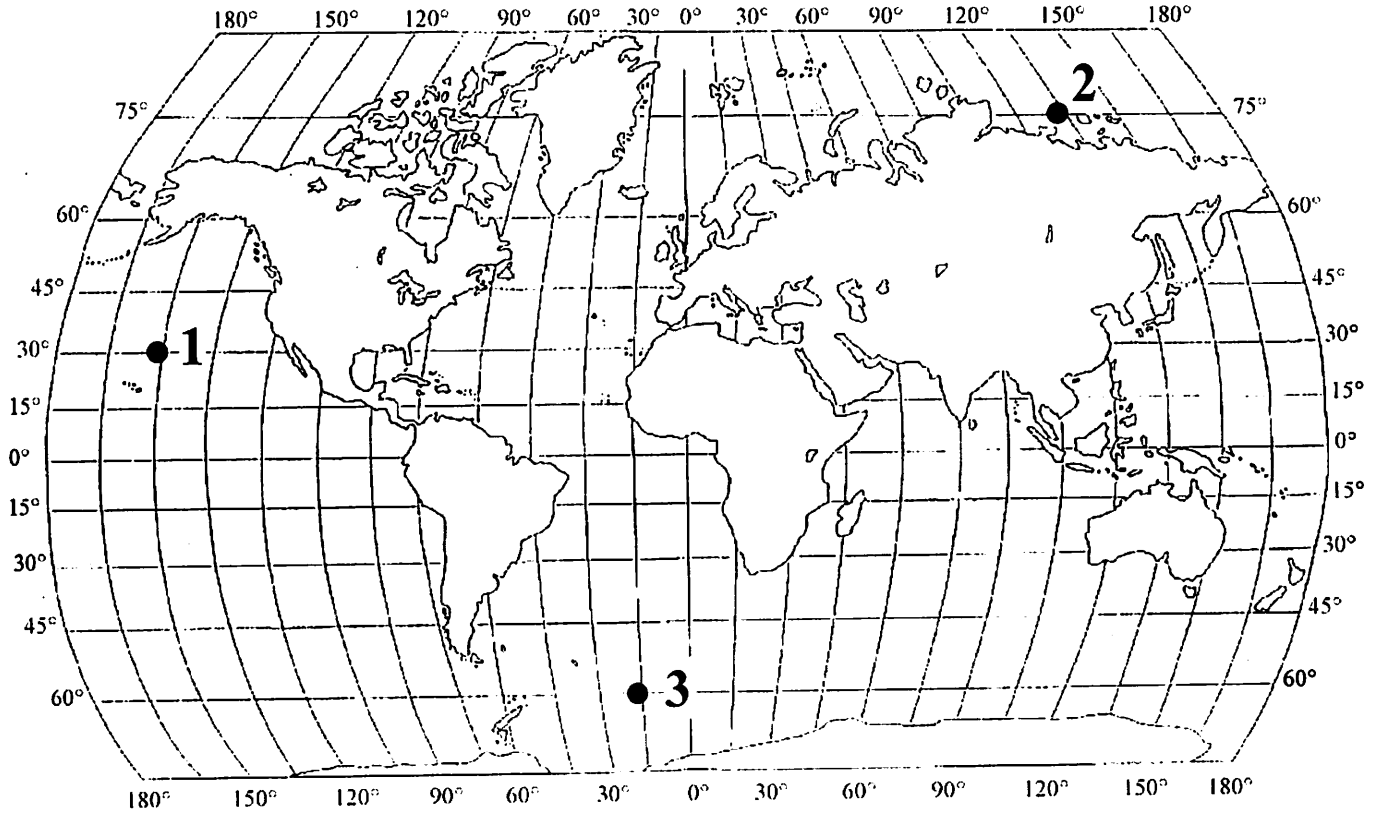
core C: 4 meter of sand grading from fine at the top to coarse at the bottom, followed by over 50 cm of muddy clay, and more than 60cm of graded sand.

Please place the letter corresponding to cores A, B, and C in the empty circles shown on the map to indicate their proper location. (1pt)



23. From the map below, indicate the latitude and longitude of each location (3 pt)

	Latitude	Longitude
1		
2		
3		



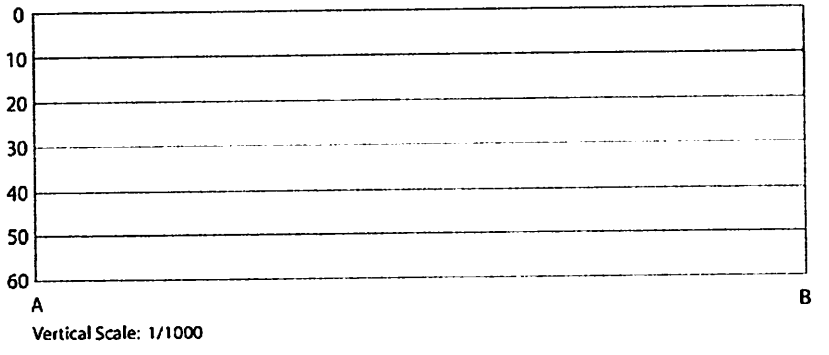
23. What is the latitude and longitude of the point on the earth exactly opposite of point #1? (2 pt)

Word choices for Question # 5

Continents	Oceans	Currents	
Africa	Atlantic	Agulhas (Mozambique)	Japan (Kuroshio)
Antarctica	Indian	Alaska	Labrador
Asia	Pacific	Benguela	North Atlantic Drift
Australia	Arctic	Brazil	North Equatorial
Europe		California	Oyashio (Kamchatka)
North America		Canaries	Peru(Humboldt)
South America		East Australian Drift	South Equatorial
		Falkland	West Australian Drift
		Gulf Stream	West Wind Drift

Mountains		Deserts	
Alaska Range	Ethiopian Highlands	Atacama	Patagonia
Alps	Great Dividing Range	Gobi	Sahara
Andes	Himalayas	Great Omdoam	Takla Makan (Taklimakan)
Appalachians	Rocky Mtns.	Kalahari	Arabian
Caucasus	Sierra Nevada	Mojave	Australian
Coast Range	Southern Alps		
Drakensburg	Urals		
	Verkhoyansk		

Islands	
Aleutians	Madagascar
Baffin	Newfoundland
Tahiti	New Guinea
Ellesemere	Tasmania
Galapagos	New Zealand
Greenland	Japan
Hawaii	Java
Iceland	



GRADING RUBERIC

Total Points	Letter Grade
45-50	A
40-45	B
35-40	C
30-35	D
<35	F