LABORATORY TEST FOR IESO 2010

Wednesday, September 22, 2010

INSTRUCTIONS:

1. Please write your name and nationality in English on the cover pages
2. This laboratory test is conducted with an objective to test the skill of identifying specimens consisting of 5 minerals, 5 igneous rocks, 5 sedimentary rocks, 5 metamorphic rocks and 5 volcanic rocks as well as 10 fossils, 5 geological structures, and 6 geomorphological features.
3. The time allocated for identifying each specimen is 2 minutes.
4. Please write your answer legibly. Illegible answers will be counted as incorrect.
5. Please write your answers only on this laboratory test sheet, by choosing/matching the correct answer provided in the 'Choices' column of the 'Answer sheet'.

ANSWER SHEET

A. Minerals **5 points**

No.	Sample Code	Name of Mineral	Choices
1	**I**		A. Gypsum
2	**II**		B. Apatite
3	**III**		C. Biotite
4	**IV**		D. Garnet
5	**V**		E. Muscovite
			F. Sulfur
			G. Quartz
			H. Phlogopite
			I. Plagioclase
			J. Anhydrite
			K. Orthoclase
			L. Hornblende
			M. Pyroxene
			N. Olivine
			O. Calcite

ANSWER SHEET

B. Rocks **40 points**

No.	Sample Code	Name of Rock	Choices
1	**1**		A. Andesite Breccia
2	**2**		B. Gneiss
3	**3**		C. Volcanic Breccia
4	**4**		D. Rhyolite
5	**5**		E. Red Slate
6	**6**		F. Quartz Conglomerate
7	**7**		G. Crystalline Limestone
8	**8**		H. Mica Schist
9	**9**		I. Agglomerate
10	**10**		J. Sandstone
11	**11**		K. Pumice
12	**12**		L. Obsidian
13	**13**		M. Tuff
14	**14**		N. Pumice Breccia/Ignimbrite
15	**15**		O. White Marble
16	**16**		P. Phyllite
17	**17**		Q. Biotite Granite
18	**18**		R. Diorite
19	**19**		S. Pegmatite
20	**20**		T. Quartzite
			U. Syenite
			V. Basalt
			W. Andesite
			X. Granodiorite
			Y. Peridotite
			Z. Lapili
			AA. Chalky Limestone
			BB. Monzonite
			CC. Olivine Gabbro
			DD. Eclogite
			EE. Migmatite
			FF. Claystone

ANSWER SHEET

C. Fossils **16 points**

No.	Sample Code	Name of Fossil	Choices
1	**A**		A. Balanus B. Pelecypoda C. Turitella D. Ammonite E. Heliophyllum F. Brachiopoda G. Arachnida H. Echinodermata I. Busycon J. Murex K. Zaphrentis L. Nautilus M. Coral N. Scaphopoda O. Acropora P. Trilobita Q. Ostracoda
2	**B**		
3	**C**		
4	**D**		
5	**F**		
6	**H**		
7	**I**		
8	**J**		

ANSWER SHEET

D. Geological Structures **10 points**

No.	Sample Code	Type of Structure	Choices
1	**SG 01**		A. Normal Fault B. Thrust Fault C. Oblique Fault D. Dextral strike-slip fault E. Sinistral strike-slip fault F. Unconformity G. Nonconformity H. Plunging Anticline I. Fold J. Joint
2	**SG 02**		
3	**SG 03**		
4	**SG 04**		
5	**SG 06**		

ANSWER SHEET

E. Geomorphology **6 points**

No.	Sample Code	Name of Geomorphologic Unit	Choices
1	**A**		A. Incised River
2	**B**		B. Eroded Dome
3	**C**		C. Estuary
4	**D**		D. Karst Topography
5	**E**		E. Alluvial Fan
6	**F**		F. Cuesta
			G. Barrier Islands
			H. Meandering River
			I. Delta
			J. Eroded Anticline
			K. Spit
			L. Eroded volcano

Oceanography

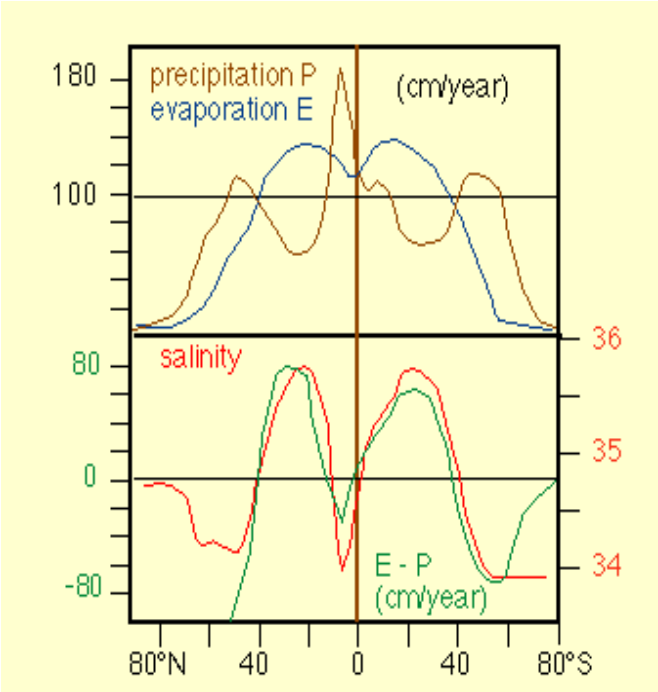
For the following questions please choose the best of the possible answers.

1. What causes ocean layering? (10pnt)
   a. Polar ice caps
   b. Currents
   c. Density differences
   d. Waves
   e. Evaporation and precipitation

2. The oceans can absorb a large amount of solar energy without significant increases in temperature. This is primarily because ….. (10 pnt)
   a. there is a huge volume of sea water.
   b. the evaporation latent heat of water is relativly small.
   c. the sea surface does not reflect the incoming heat.
   d. the Heat capacity of sea water is relativly high
   e. the large amount of salt in sea water.

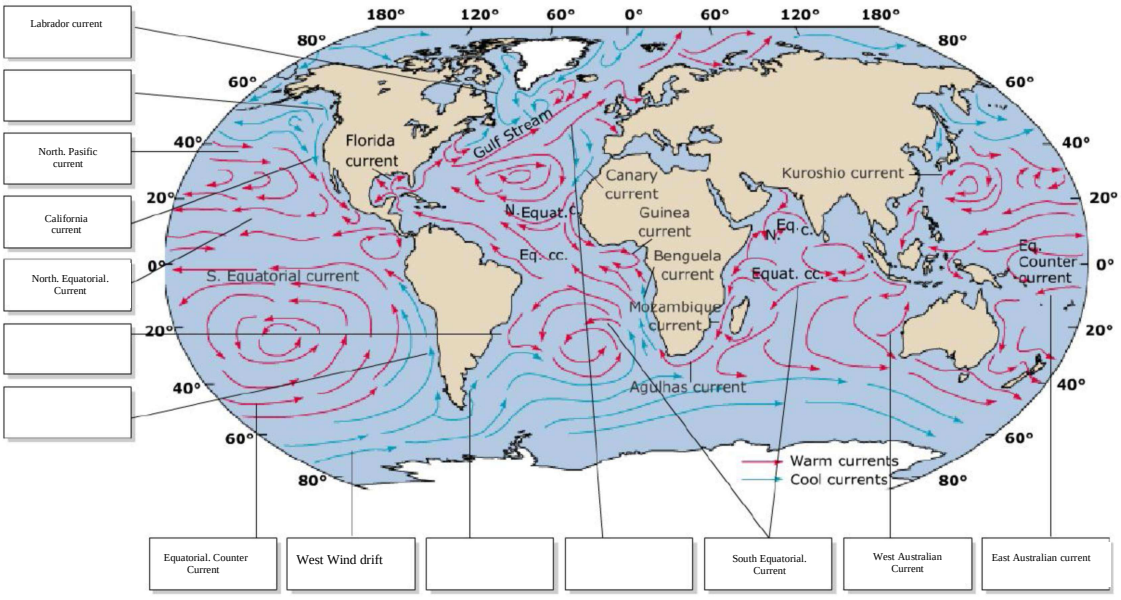
3. Which is the best statement about concentration of O_2 in the seawater? (10 pnt)
   a. The concentration of O_2 in the surface layer is higher than in deeper layers.
   b. The concentration of O_2 during winter is higher than during the summer.
   c. The concentration of O2 in the high latitude areas is higher than in tropical areas.
   d. Answer (a) and (b) are correct.
   e. Answer (a),(b), and (c) are correct.

4. The ocean budget depends on evaporation and precipitation. These effects influence surface salinity. Based on this figure, explain why salinity in tropical waters is lower than sub tropical waters. (20pnt)



5. Match the corresponding currents listed below by letter to the correct location on the following map. (20 pnt)

(A)	Alaska current
(B)	Peru current
(C)	North Atlantic current
(D)	Brazil current
(E)	Falkland current



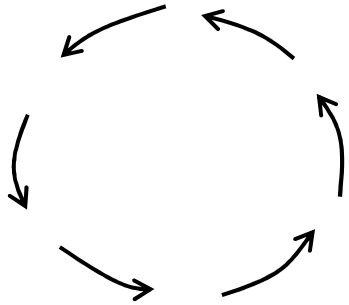
6. Recently it has been discovered that floating trash is concentrating in specific areas of the oceans. These areas are located in the gyres or areas of circulating currents. (See map above #55) The plastic trash is estimated to remain concentrated in these areas for many hundreds of years into the future before it breaks down photo-chemically. One gyre has an "Island of trash" twice the size of the state of Texas.

The picture below is a sketch of a gyre.

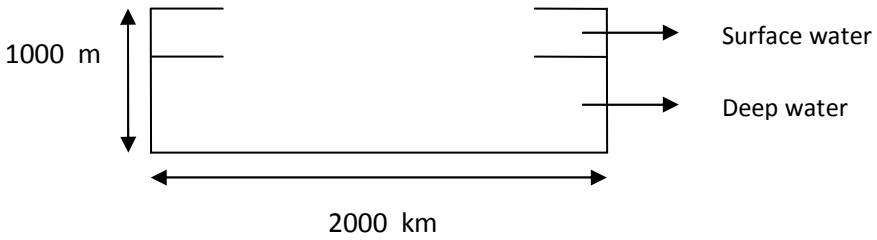
1) Where is this type of the gyre found?

A) in the Northern Hemisphere, or

B) in the Southern Hemisphere of the Earth. (Answer: A or B). (10 pnt)



2) According to the circle diagram above, complete the following sketch of water mass profile movement across the centre of the gyre. Show vertical motion of the water (if any). (20 pnt)



Intructions:

1. **Please write your name and nationality in English on the cover page.**
2. **The time allocated for this examination is three hours.**
3. **Please write your answer legibly. Illegible answers will be counted as incorrect.**
4. **Please keep your answers short and focus on the key points.**
5. **Please write your answers only in this test booklet.**
    a. **Encircle or mark the answer of your choice.**
    b. **Write essay-type answers where indicated by the question, and**
    c. **Use extra paper provided by the committee for calculation.**
6. **You may answer the questions in English, your native language, or a combination of both.**
7. **Read the entire question group carefully before starting to answer. Each question has a point value assigned, for example, (1 pt).**
8. **For some questions, you will be asked to provide answers on the figures. Please do so carefully.**
9. **Any inappropriate examination behaviour will result in your removal.**

METEOROLOGY

1. One of the following is **NOT** a term for atmospheric divisions/subdivisions (5 points)
   (a) thermosphere
   (b) ionosphere
   (c) cryosphere
   (d) heterosphere
   (e) homosphere.

2. With regard to atmospheric electricity, which statement is correct? (5 points)
   (a) Lightning always strikes from cloud to ground
   (b) Cloud particles are always negatively charged
   (c) Lighting sometimes strikes from the top of the cloud to the ionosphere
   (d) Electrical charges (+ and -) are evenly distributed inside a thunderstorm cloud
   (e) All the above statements are true.

3. (A). The temperature and relative humidity of an air parcel at 1013 hPa are 30^0C and 53.65% respectively. Given 10^0C/km as the dry adiabatic lapse rate for the tropical region, determine the height of the condensation level. (10 points)

Temperature Degrees Celsius	Vapor (g) per Kilogram of Dry Air
50	88.12
40	49.81
30	27.69
20	14.85
10	7.76
0	3.84

(B). What is the temperature of the air parcel when it arrives at the mountain slope at a height of 2539 m? Assume that the saturated adiabatic lapse rate for tropical region is 6.5^0C/km. (10 points)

(C). Calculate the temperature and relative humidity of the air parcel after passing over the top of the mountain (height of 3308 m) and then moving down to the initial pressure level (1013 hPa) on the other side of the mountain. (15 points)

4. Wind speed measurements at the Equator in Pontianak, West Kalimantan, Indonesia, give an average value of 20 m/s. If the pressure difference between two nearest isobars, separated by a distance of 800 km, is 8 hPa and the air density is 0.364 kg/m^3, how large is the Coriolis force per unit mass in that site? (3 points)
   (a) 0.02 ms^{-2}
   (b) 1.37 x 10^{-4} ms^{-2}
   (c) 0 ms^{-2}
   (d) 1.37 x 10^{-6} ms^{-2}
   (e) 1.37 ms^{-2}

5. Refer to the diagram of a mature wave cyclone in Figure 6. Which one of the stations listed below has the least likelihood of rain and cloud cover? (6 points)
   (a) point A
   (b) point H
   (c) point B
   (d) point I
   (e) point G

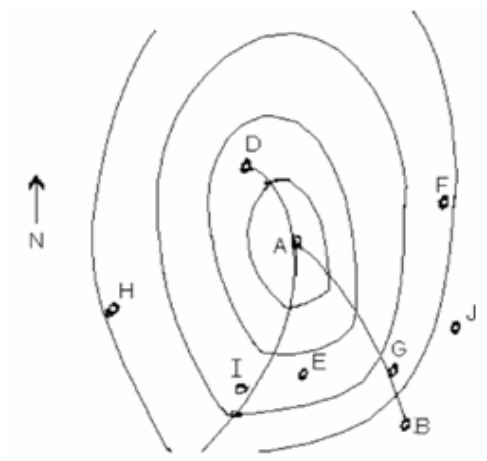


Figure 6. Mature wave cyclone diagram (contours are isobar)

6. At a location where the Coriolis parameter $f \approx 10^{-4}$ s^{-1}, a geostrophic wind speed of 5 ms^{-1} is observed blowing to the west. Which pressure gradient force per unit mass is corresponding to the geostrophic wind? : (6 points)
   (a) 5×10^{-4} ms^{-2}
   (b) 0.005 ms^{-2}
   (c) -0.00005 ms^{-2}
   (d) -5×10^{-4} ms^{-2}
   (e) 0.00005 ms^{-2}

7. Look at the figure below

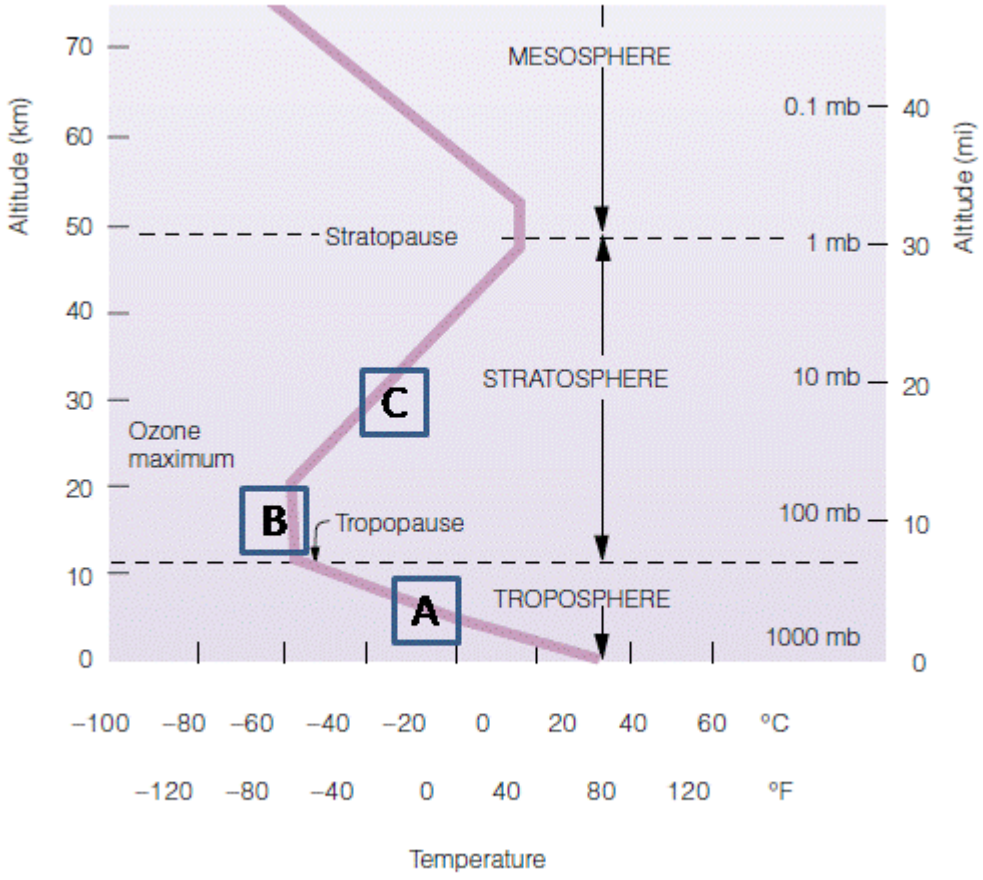


Figure 7. Illustration for essay question 7

Three air parcels A, B, and C are placed at altitudes of 5, 15, and 30 km as shown in the figure above. If the parcels are displaced vertically upward, predict the responses/trajectories of the parcels. (10 points)

Parcel	Responses*
A	
B	
C	

*) Provide your answers using the following symbols :

▲ : keeps moving upward

⊤ : stays at new altitude

↕ : oscillates around the original altitude

8. According to Ramage, the Maritime Continent of Indonesia is in a monsoon region. During the Indonesian west monsoon (season), the main wind over the Sangihe Talaud Islands (5^0 30' 23" N 126^0 34' 35" E) just south of the Philippines is mostly (3 points)
   (a) Westerly
   (b) Easterly
   (c) Southerly
   (d) Northeasterly
   (e) Southwesterly

9. Figure 8 below is the Indonesian annual rainfall type map. It shows that the western part of Sumatra (coastal area) has the equatorial rainfall type even though some areas are located some distance from the equator. Choose the best explanation for this phenomenon from the options below. (6 points)
   (a) Under the influence of the Indonesia-Australia Monsoon
   (b) Combination effects of the orography of the Bukit Barisan mountain range and the Indian Ocean
   (c) Because of the South China Sea
   (d) Because of the activity of tropical cyclones
   (e) Under the influence of the Indonesian through flow.

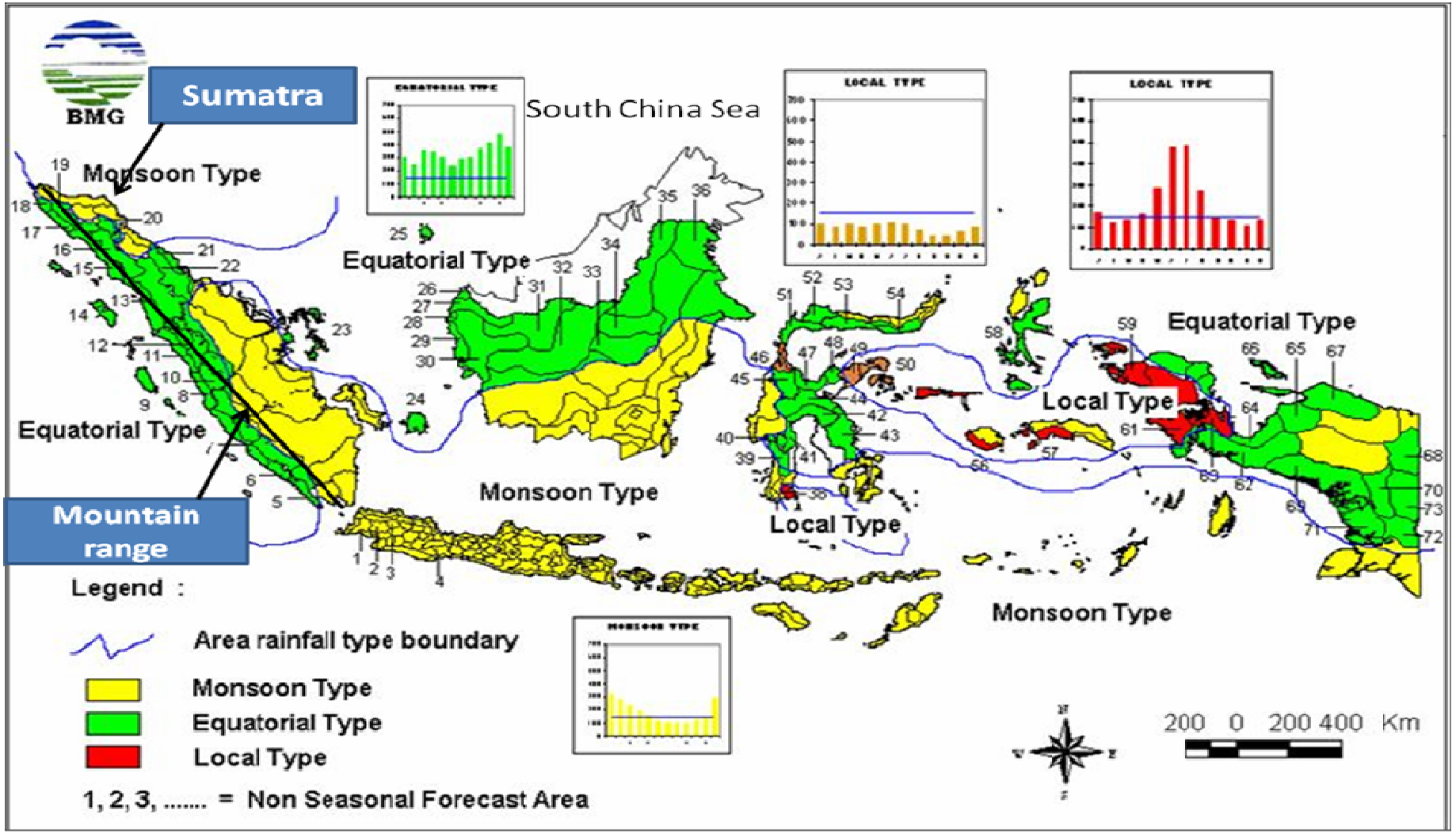


Figure 8. Indonesian Annual Rainfall Type Map

10. Greenhouse gases are transparent to visual radiation and not transparent to infrared radiation. Sequence the gases according to their radiative forcings, starting from the largest impact. (6 points)
    (a) CO_2, CH_4, H_2O, NO_2
    (b) H_2O, CH_4, CO_2, NO_2
    (c) H_2O, CO_2, CH_4, NO_2
    (d) CO_2, H_2O, NO_2, CH_4
    (e) None is true.

11. When you attempt to predict the weather for the next 25 minutes by assuming that conditions in general will not change during that time, you would employ (3 points)
    (a) persistence forecasting
    (b) statistical forecasting.
    (c) historical forecasting.
    (d) numerical forecasting.
    (e) synoptic forecasting.

12. Look at figure 9.

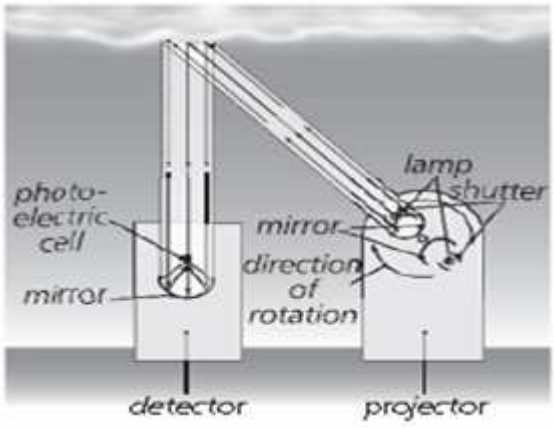


Figure 9. Ceilometer for essay question 40

It is a ceilometer, the device to measure the elevation of cloud ceiling. It consists of a projector and detector. The projector has two lamps that each emit a focused beam through a shutter. The focusing mirrors and lamps rotate, so the beams are transmitted as pulses, shining at an angle onto the base of the cloud. The detector responds electronically to a series of pulses at the predetermined frequency. The height of the cloud base is calculated trigonometrically from angles of the transmitted and reflected beams and the known distance between the projector and the detector. A ceilometer can measure cloud bases up to 3000 m during the day and up to about 6000 m at night.

If the distance *b* between the projector and the detector of a ceilometer is fixed at 20 m and the angle α between the transmitted beam and the reflected beam onto a cloud is 0.5 deg, calculate the distance *d* to the base of the cloud.

(12 points)

21. Gravitational acceleration, *g*, at the surface of the earth can be formulated as $g = G\frac{M}{r^2}$ where G = 6.673 x 10^{-11} N.m^2/kg^2, M = 5.98 x 10^{24} kg and r = the distance from the Earth's surface to its centre. If the gravity, *g*, at the mean sea level (R = 6371 km) is 9.83 m/s^2 and the gravity value depends on elevation, *h*, gravity value decreases with increasing elevation as per the formula _____ . (Note: 1 cm/s^2 = 1 gal). Write the calculation procedure. (2 points)

22. The mathematical formula for seismic refraction in 2-layer systems shows that the travel time of seismic waves, *t*, is dependant on its propagation distance, *x*.

$$t = \frac{2h_1 (V_2^2 - V_1^2)^{1/2}}{V_2 V_1} + \frac{x}{V_2}$$

where t is the travel time of seismic waves (second)

h_1 is the thickness of 1st layer

x is the distance of seismic wave propagation

V_1 is the seismic velocity in 1st layer

V_2 is the seismic velocity in 2nd layer

The seismic velocity of layers, V_1 and V_2, and the thickness of layer, *h*, are constant. The seismic refraction data are given in Table 1. Determine the seismic velocity of the 1st and 2nd layers, V_1 and V_2, respectively (2 points)

Table 1. Seismic Refraction Data

x (m)	*t* (ms)
2	4
4	10
6	12
8	19
10	24
12	27
14	30
16	31
18	32
20	34
22	36
24	39

- Write the calculation procedure. (2 points)
- Calculate h_1 (1 point)

23. Tthe number of earthquake events (N) and their magnitude (M) are related as follows:

$$\log N = a - b\,M$$

The graph associated with the above equation is shown in Figure 1 for such an earthquake which occurred at Padang, West Sumatra. The parameter a is a constant representing the number of earthquakes which have magnitude higher than 1 on the Richter scale. Similarly, b is a value that represents the ratio of the number of small to big eartquakes. If the value of b is 1, determine the ratio of the number of earthquakes (with magnitude 5) to the number of earthquakes (with magnitude 7) on the Richter scale (2 points).

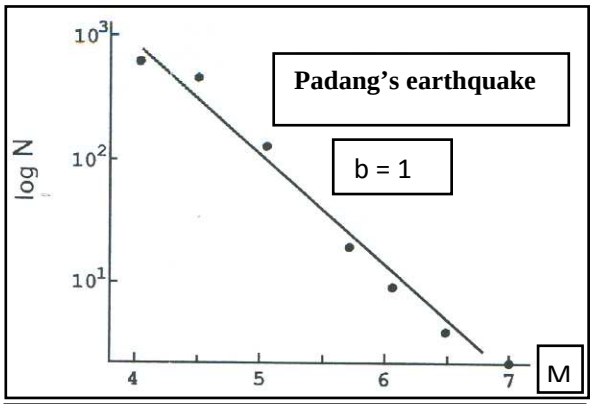


Figure 1. The graph of number (N) of earthquakes versus its magnitude (M) of Padang's event.

24. An earthquake was recorded at four seismic stations in Central Java, Indonesia. Figure 2 shows the locations of the seismic stations: AE2 (7.7 S; 109.5 E), AG2 (7.6 S; 110.0 E), BH2 (7.5 S; 110.4 E), and AK4 (8.2 S; 110.9 E). Figure 3 displays the seismograms recorded at the seismic stations. If the average longitudinal (P) wave velocity, V_p, is 6.4 km/s and the average transversal (S) wave velocity, V_s, is 3.7 km/s, determine the epicenter of the earthquake. Write the calculation procedure and draw your graphical solution in Figure 2. (1 degree = 111 km). (5 points)

Figure 2. Location of the seismic stations AE2, AG2, BH2, and AK4 which recorded the earthquake.

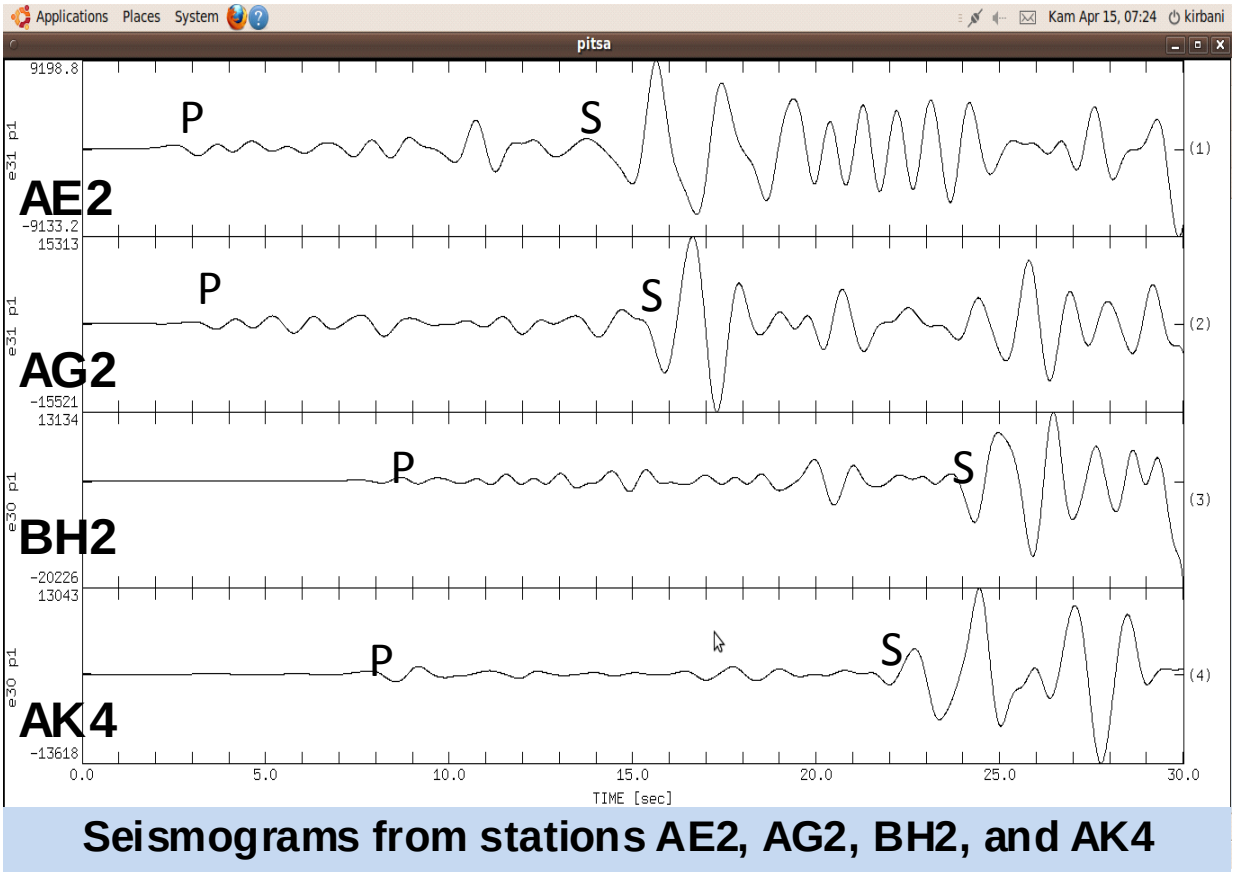


Figure 3. Seismograms of the earthquake recorded at seismic stations AE2, AG2, BH2, and AK4.

GEOLOGY

1. The law of superposition explains that (1 point)
    a. The lower stratum is older than the upper stratum.
    b. The lower stratum is younger than the upper stratum.
    c. If there is a disturbance, the lower stratum is older than the upper stratum.
    d. If there is no disturbance, the lower stratum is older than the upper stratum.
    e. The stratum is characterized by fossil content.

2. If we stand along a strike-slip fault, and if the left hand side block has moved towards us, (1 point)
    we call this a_____
    a. Dextral strike-slip fault
    b. Sinistral strike-slip fault
    c. Normal fault
    d. Thrust fault
    e. Oblique fault.

3. The last mineral to form in the Bowen's Reaction Series is _____. (1 point)
    a. Olivine
    b. Quartz
    c. Orthoclase
    d. Biotite
    e. Pyroxene.

4. Which fossil is usually found in Permo-Carboniferous rocks? (2 points)
    a. Homo erectus
    b. Mastodont
    c. Eohippus
    d. Nummulites
    e. Fusulina

5. The Mohorovicic discontinuity is characterized by _____. (2 points)
    a. A change in seismic wave velocity
    b. High temperature
    c. Elevated gravity
    d. Rayleigh wave attenuation
    e. High pressure

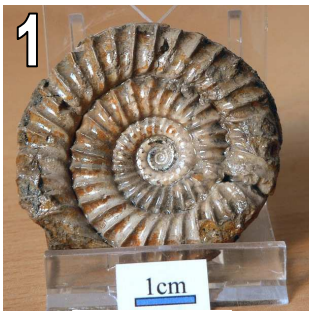
6. _____ is an ore mineral of aluminum. (2 points)
    a. Bauxite
    b. Garnierite
    c. Pyrite
    d. Chalcocite
    e. Chalcopyrite

7. When did Pangea the supercontinent break up into Gondwana and Lauratia continents? (2 points)

a. Silurian period
b. Cambrian period
c. Triassic period
d. Oligocene epoch
e. Eocene epoch

8. Which of the following is a character of river valley in its early stage? (2 points)
a. Alluvial fans
b. U-shaped cross section
c. V-shaped cross section
d. Flood plain
e. Meander

9.



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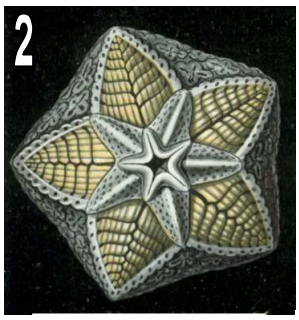

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www.bewareofdarwinistfalsehoods.com

The figure above shows several invertebrate fossils. The names of the fossils are: (2 points)
a. 1=Ammonite 2= Blastoidea 3=Trilobite
b. 1= Blastoidea 2= Ammonite 3= Trilobite
c. 1= Trilobite 2= Ammonite 3=Blastoidea
d. 1=Trilobite 2= Blastoidea 3= Ammonite
e. 1= Blastoidea 2= Trilobite 3= Ammonite

10. Which of the following is not the landslide? (2 points)
a. Rockfall
b. Debris fall
c. Subsidence
d. Sliding
e. Mudflow

11. In stratigraphy, the grouping of sedimentary rocks based on their fossil content is called _____. (2 points)
a. Lithostratigraphy
b. Chronostratigraphy
c. Geochronology
d. Biostratigraphy
e. Sequence stratigraphy

12. The unconformity between the older igneous/metamorphic rocks and (1 point)

the younger sedimentary rock is called _____.

a. Angular unconformity
b. Nonconformity
c. Paraconformity
d. Hiatus
e. Disconformity

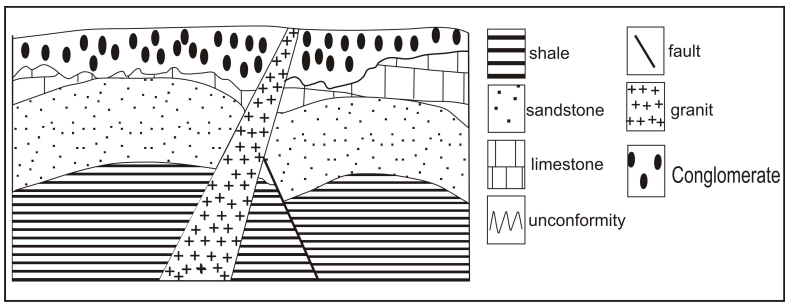
13 . The Himalayan mountain started rising since the _____. (1 point)

a. Pleistocene
b. Miocene
c. Jurassic
d. Eocene
e. Pliocene

14. Conglomerate is a sedimentary rock that consists of _____. (1 point)

a. Round grains of size more than 2 mm
b. Round grains of size less than 2 mm
c. Angular grains less than 2 mm
d. Angular grains more than 2 mm
e. Round or angular grains cemented by SiO_2 or $CaCO_3$.

15. Based on the geologic cross-section given below, (3 points)
the chronology of the geologic events is:



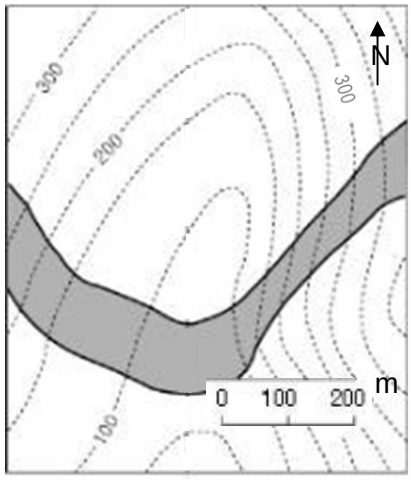
a. Conglomerate - Shale – sandstone – limestone – unconformity – fault – granite
b. Granite – fault – unconformity – limestone – sandstone – shale – conglomerate
c. Shale – granite – sandstone – unconformity – fault – limestone – conglomerate
d. Shale – sandstone – fault – limestone – unconformity – conglomerate – granite
e. Shale – fault – sandstone – limestone – unconformity – conglomerate – granite

16. Limestone consists of calcium carbonate minerals. The most abundant calcium carbonate mineral is _____. (2 points)

17. Two major minerals in granite are _____ and _____. (2 points)

18. If we have a fault where the hanging wall has relatively moved down compared to the foot wall, (1 point)
we call this fault a _____.
    a. Dextral strike-slip fault
    b. Sinistral strike-slip fault
    c. Normal fault
    d. Thrust fault
    e. Oblique fault

19. According to the V rule, the stratum (in darker grey color) in the figure below strikes in _____ direction and dips in the _____ direction. (2 points)



20. If you make a geologic section along the true dip in the figure given above, the cross section should run in _____ direction and the thickness of the stratum is _____ m. (2 points)

PRACTICAL TEST FOR IESO 2010

DLINGO AREA, BANTUL REGENCY, YOGYAKARTA, INDONESIA

Wednesday, September 22, 2010

INSTRUCTIONS:

1. Please write your name and nationality in English on the cover pages
2. The total time allocated for this practical test is about 45 minutes for every student.
3. Please write your answer legibly. Illegible answers will be counted as incorrect.
4. Please write your answers only on this practical test sheet. Please encircle the most appropriate answer.
5. Read the entire question carefully before answering.
6. Please handover the competed practical test sheet to member of the organizing committee at the location.

PRACTICAL TEST FOR IESO 2010

DLINGO AREA, BANTUL REGENCY, YOGYAKARTA, INDONESIA
Wednesday, September 22, 2010

PROBLEM SETS

Location 1 (*4 minutes*): 8 points

1. Using the hand lens provided to you observe the igneous rock within the marked area and identify two main minerals in the rock.
   a. Plagioclase and pyroxene
   b. Plagioclase and biotite
   c. Quartz and pyroxene
   d. Quartz and hornblende
   e. Hornblende and pyroxene

2. Observe the petrological characteristics and identify the igneous rock
   a. Andesite
   b. Rhyolite
   c. Granite
   d. Diorite
   e. Gabbro

3. By observing the whole part of the outcrop in this area identify the igneous rock body
   a. A fragment in conglomerate
   b. An exotic block in meta-breccia
   c. A part of groundmass of the igneous rock
   d. An inclusion in the volcanic rock
   e. A fragment in volcanic breccia

Location 2 (*5 minutes*): 10 points

4. Please observe the rock components at this Location. Identify at least two types of included rock fragments:
   a. Basalt and dolomite
   b. Andesite and tuff
   c. Andesite and limestone
   d. Basalt and quartzite
   e. Basalt and shale

5. Please carefully observe by naked-eye and/or using the hand lens identify the rock fragment (*shown by arrow*).
   a. Quartzite
   b. Tuff
   c. Coral
   d. White marl
   e. Phyllite

6. By observing the entire outcrop identify the rock type
   a. Volcanic breccia
   b. Brecciated andesite
   c. Conglomerate
   d. Fault breccia
   e. Fanglomerate

Location 3 (*6 minutes*): 12 points

7. Identify the geological structure at this Location by careful observation.
   a. Normal fault
   b. Dextral strike-slip fault
   c. Sheared joint
   d. Thrust fault
   e. Oblique fault

8. By using your compass, please measure the direction of dip of the plane of the geological structure identified in Question 7.
   a. Northeast
   b. Southwest
   c. Southeast
   d. Northwest
   e. West

9. The strike/dip angle of the bedding plane is about (*<u>Note</u>: acceptable error is ±5º*)
   a. N 15º E/45º
   b. N 50º W/45º
   c. N 75º E/15º
   d. N 60º W/45º
   e. N 45º E/15º

Location 4 (*3 minutes*): 6 points

10. Sedimentary structures identified in the rock marked by *arrows* ‘A’, ‘B’, and ‘C’.
    a. A = Scouring B = ripple mark C = lenticular bedding
    b. A = Cast B = lamination C = Cross bedding
    c. A = Convolute bedding B = lamination C = flame structure
    d. A = Flame structure B = lenticular bedding C = burrow
    e. A = Ripple mark B = lenticular bedding C = convolute bedding

Location 5 (*3 minutes*): 6 points

11. Please observe the sedimentary structure present in the marked area and its vicinity, and identify it.
    a. Ripple mark
    b. Cross bedding
    c. Flame structure
    d. Convolute bedding
    e. Slump structure

Location 6 (4 *minutes*): 8 points

12. The rock at this Location is predominantly composed of the following rock fragments
    a. Andesite and dacite
    b. Dacite and granite
    c. Basalt and syenite
    d. Diorite and gabbro
    e. Rhyolite and basalt

13. Please identify the rock type at this Location.
    a. Intrusive breccia
    b. Fault breccia
    c. Volcanic breccia
    d. Agglomerate
    e. Brecciated igneous rock

Location 7 (*3 minutes*): 6 points

14. Three types of rock fragment identified in the rock at this location are
    a. Marl, tuff and lignite
    b. Tuff, claystone and charcoal
    c. Limestone, tuff and coal
    d. Tuff, lapilli and lignite
    e. Tuff, chalk and charcoal

Location 8 (*6 minutes*): 12 points

15. Two main rock fragment types observed in the rock at this Location include
    a. Tuff and lignite
    b. Tuff and charcoal
    c. Chalk and coal
    d. Tuff and peat
    e. Limestone and charcoal

16. Please observe the marked area on the outcrop and identify the rock type.
    a. Agglomerate
    b. Volcanic siltstone
    c. Tuff-enriched siltstone
    d. Coarse-grained sandstone
    e. Pumice breccia

17. On the basis of the orientation measurement of rock fragments, the paleocurrent direction in the formation of this sedimentary rock was
    a. Westward
    b. Northward
    c. Southeastward
    d. Southwestward
    e. Northeastward

ASTRONOMY

Students can use the table provided in the last page for solving the problems if necessary.

A. Multiple Choice

1. Suppose you see a new planet in the night sky. Based on observations, you find that the planet is close to the Sun, with maximum elongation of 30 degrees. Given that the maximum elongations of Venus and Mercury are 46 and 23 degrees respectively, you can conclude that :

a. the orbit of the planet is closer to the Sun than that of Mercury

b. the orbit of the planet is located between those of Mercury and Venus

c. the orbit of the planet is located between those of Venus and Earth

d. the position of the planet can not be determined from the given data

e. all the answers above are incorrect

[1 point]

2. For an astronaut who is standing on the surface of the Moon facing the Earth, which one of the following statements is correct?

a. The Earth will always appear as a full disk

b. The length of one day and one night is equal to the synodic period of the Moon seen by an observer on the Earth

c. The length of the day is half of the sidereal period of the Moon orbiting the Earth

d. The duration between Earth rise and Earth set is the same as the duration between New Moon and Full Moon on the Earth

e. The surface of the Earth facing the Moon is always the same so that only one side of the Earth is visible from the Moon

[1.5 points]

3. How would the length of the solar day change if the direction of the Earth's rotation is suddenly reversed while maintaining the direction of revolution?

a. It would be 4 minutes longer than before
b. It would be 4 minutes shorter than before
c. It would be 8 minutes longer than before
d. It would be 8 minutes shorter than before
e. It would not change, but remains the same as before
[1.5 points]

4. According to stellar evolution theory, the Sun will evolve into the red giant stage in a few billion years. How would the average temperature on the surface of the Earth change compared to the present temperature, in the time when the Sun becomes a red giant with a radius of 1.12×10^7 km and its temperature drops to 2900 K ? Assume that the current radius of the Sun is 7×10^5 km, its surface temperature is 5800 K and neglect the possible change of the albedo of the Earth.

a. Becomes four times the present temperature

b. Becomes twice the present temperature

c. Becomes half the present temperature

d. Becomes a quarter of the present temperature

e. No change

[2 points]

5. The parallax of a star measured on the Earth is 0.05 arc-seconds. Determine its parallax if we measure it from Jupiter (heliocentric distance of Jupiter is 5.2 AU).

a. 1.00 arc- seconds
b. 0.52 arc- seconds
c. 0.33 arc- seconds
d. 0.26 arc- seconds
e. 0.15 arc- seconds
[1.5 points]

6. If the mass of the Sun increases by two times its present value, and the planets remain in their present orbits, then the Earth's period of revolution will be about:

a. 423 days

b. 365 days

c. 321 days

d. 258 days

e. 147 days

[1.5 points]

7. If the perihelion of comet Halley is 8.9×10^{10} meters and its period is 76 years, then the eccentricity of Halley is:

a. 0.567

b. 0.667

c. 0.767

d. 0.867

e. 0.967

[1.5 points]

8. A particular spectral line of a star is observed at 4999 Å. According to laboratory experiments, this spectral line should appear at 5000 Å. What is the velocity of this star relative to the observer?

a. 60 km/s approaching the observer
b. 60 km/s receding the observer
c. 75 km/s approaching the observer
d. 75 km/s receding the observer
e. The star does not move relative to the observer

[1.5 points]

B. Essay

1. Some time ago, there was a rumour that the planet Mars as seen from the Earth would appear as big as the Moon (about 0.5°). The following data are given. The semi-major axis and eccentricity of the Earth are a_E = 1 AU and e_E = 0.017 respectively and those of Mars are a_M = 1.5 AU, e_M = 0.093, and the radius of Mars is R = 3393.4 km. Determine the maximum angular diamater of Mars and justify the rumour (answer with a RIGHT or WRONG).

To answer these you have to

a. Draw a sketch of the situation.
b. Show the formula(s) that will be used.
c. Show the calculations and the final results.

[5 points]

2. On January 15, 2010, there was an annular eclipse, where at maximum 97% of Solar disk was covered by the Moon. At that time the Earth was very close to its perihelion. The following data are given. The semi major axis of the Earth's orbit is 1.5×10^8 km, the solar radius is 7×10^5 km, eccentricity 0.017 and the radius of the Moon is 1.738×10^3 km. What is the distance of the Moon from the Earth ?

(Show the formula(e), calculations and the final results)

[3 points]

Table of constants and units

Constants	Symbols	Values
Solar luminosity	$L_\odot$	3.86×10^{26} Js^{-1} = 3.86×10^{26} watt
Solar constant	$F_\odot$	1.368×10^{3} Jm^{-2}
Universal gravitational constant	G	6.67×10^{-11} Nm^2kg^{-2}
Earth's gravitational acceleration	g	9.8 ms^{-2}
Earth mass	$M_\oplus$	5.98×10^{24}kg
Lunar mass	$M_\leftmoon$	7.34×10^{22}kg
Solar mass	$M_\odot$	1.99×10^{30}kg
Stefan-Boltzmann constant	σ	5.68×10^{-8} $Js^{-1}m^{-2}K^{-4}$
Astronomical Unit	AU	1.496×10^{11} m
Moon-Earth average distance	D	3.84×10^{8} m
Earth radius	$R_\oplus$	6.37×10^{6} m
Solar radius	$R_\odot$	6.96×10^{8} m
Sidereal year	τ	365.256 days = 3.16×10^{7} s
Solar effective temperature	$T_\odot$	5880° K
Light year	Ly	9.5×10^{15} m
Parsec	pc	3.26 Ly
Speed of light	c	3×10^{8} m/s

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Astronomy Practical Test
Yogyakarta, 19-28 September 2010

Plan A; Good weather
Time: 15 minutes

Problem:

Night observation using telescope with eye piece (coordinates of the location: South 07° 55'.0144, East 110° 34'.344). Find and look carefully Jupiter (RA: 23h 56m 32s; Dec: -$02^0$06'59") and Galilean satellites

a. Please select a suitable (provided) eye-piece for viewing all Galilean satellites in one field of view
   (20 points)
b. Draw the positions of Jupiter satellites with the proper orientation on the provided answer sheet. How many satellites of Jupiter are seen?
   (60 points)
c. Give marking the N-S and E-W directions on your answer sheet
   (20 points)

Plan B: Bad weather
Time: 10 menit

Problem:

1. Mark by names or numbers (1, 2 and 3) on the printed sky map, the positions of the bright stars as listed below (15 minutes)

1. Antares (Alpha Scorpii)
   (RA: 16h 29m 24.461s; Dec: -26^0 25' 55.209")
2. Vega (Alpha Lyra)
   (RA: 18h 36m 56.336s; Dec: +38^0 47' 01.290")
3. Arcturus (Alpha Bootis)
   (RA: 14h 15m 39.672s; Dec: +19^0 10' 56.67")

(total point for three stars 40)

2. Draw the ecliptic line in the map and identify the position of Mars
   (10 for ecliptic and 10 for Mars)
3. Calculate the hour angle of Jupiter (RA: 23h 56m 32s; Dec: -02^{0}06’59”) in the sky at 8.00 PM local time. (coordinates of the location : South 07° 55’.0144, East 110° 34’.344)
   (20)(5 minutes)
4. Point the telescope to the direction of Jupiter (RA: 23h 56m 32s; Dec: -02^{0}06’59”) and show to the jury (coordinates of the location : South 07° 55’.0144, East 110° 34’.344)
   (20)