1st IESO Written Test

7-15 (

"Earth for Life,
Universe for future Life"

Thou dawnest beautifully in the horizon of the sky
O living Aton who wast the Beginning of life!

Akhenaton (1386-1358 B.C.)
"Hymn to the Sun"

In nature's infinite book of secrecy
A little I can read.

William Shakespeare (1564-1616)
Antony and Cleopatra, Act I, ii:11

Instructions to candidates:

- Please write your name and nationality in English in the space provided.
- Please write your answers legibly. Illegible answers will not be graded.
- Please keep your answers short and to the key points.
- Please write your answers on the question paper provided in English. There is no separate answer book.
- You may respond to questions either in English, your native language, or a combination of both.
- Read the entire question group carefully before starting to answer. Each question has a point value assigned, for example, [15 pts] & (5 pts).
- For multiple choice type questions, there will be negative point values for incorrect responses; however, each of such questions will have a lowest point value of zero. Wherever a word limit is set, the Jury will take into consideration only that number of words that the students are asked to provide.
- For some questions, you would be asked to provide your answers on charts / diagrams. Please do so carefully.
- If you are found indulging in any form of *malpractice*, your participation would be treated as cancelled.

NAME: NATIONALITY:

I. Granite has light color because it has white or colorless transparent minerals. [15 pts]

1) Name a colorless transparent mineral in granite. (2 pts)

2) Which of the following is/are possible economic values of granite? Circle one or more than one option. (2 pts)

   A. petroleum   B. diamond
   C. fertilizer   D. cement
   E. construction materials

3) When granite is metamorphosed, which rock is produced? (2 pts)

4) Give three physical/chemical factors of metamorphism. (6 pts)

5) Which of the following is/are associated with the formation of granite. Circle one or more than one option. (3 pts)

A. faulting

B. volcanic eruption

C. intrusion of magma

D. relatively deep in the crust

E. slow cooling of magma

II. The following diagram shows the variations in the length of day during the Phanerozoic based on data gathered from corals, stromatolites, bivalves and other invertebrates. The dashed line shows the gradual decrease in the number of days in a year with time; this corresponds to 2 milliseconds per century. [15 pts]

Geological time (million years before present)
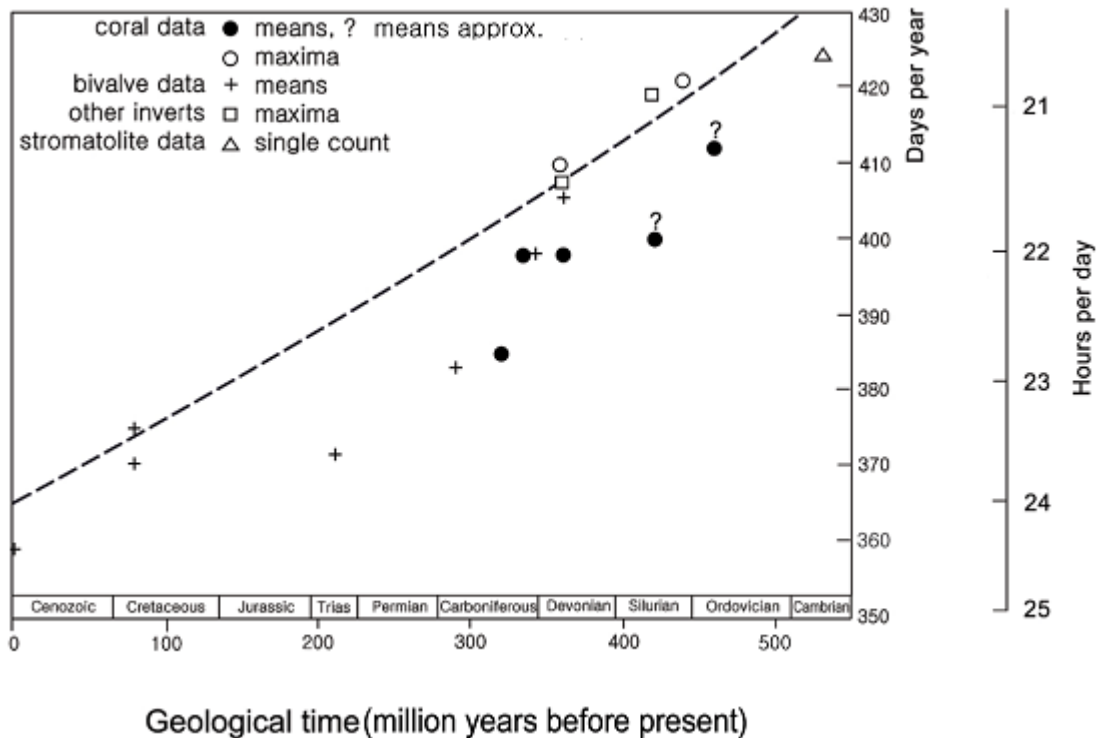
1) Suppose the earth's orbit remains constant, what was the length of a day 65 million years ago and 300 million years ago based on the above graph? Calculate in terms of the number of hours per day. Answer to nearest th of hour, i.e. 00.0 (The length of a day is presently 24 hours). (8 pts)

2) What is the driving force that causes a decrease in the number of days per year during this time? (3 pts)

3) How many years from now will a day be 25 hours long? Show your calculations. (4 pts)

III. Answer the following questions based on the Hawaiian islands map. Numbers printed near the names of islands / seamounts represent ages of rocks (in million years before present). [10 pts]
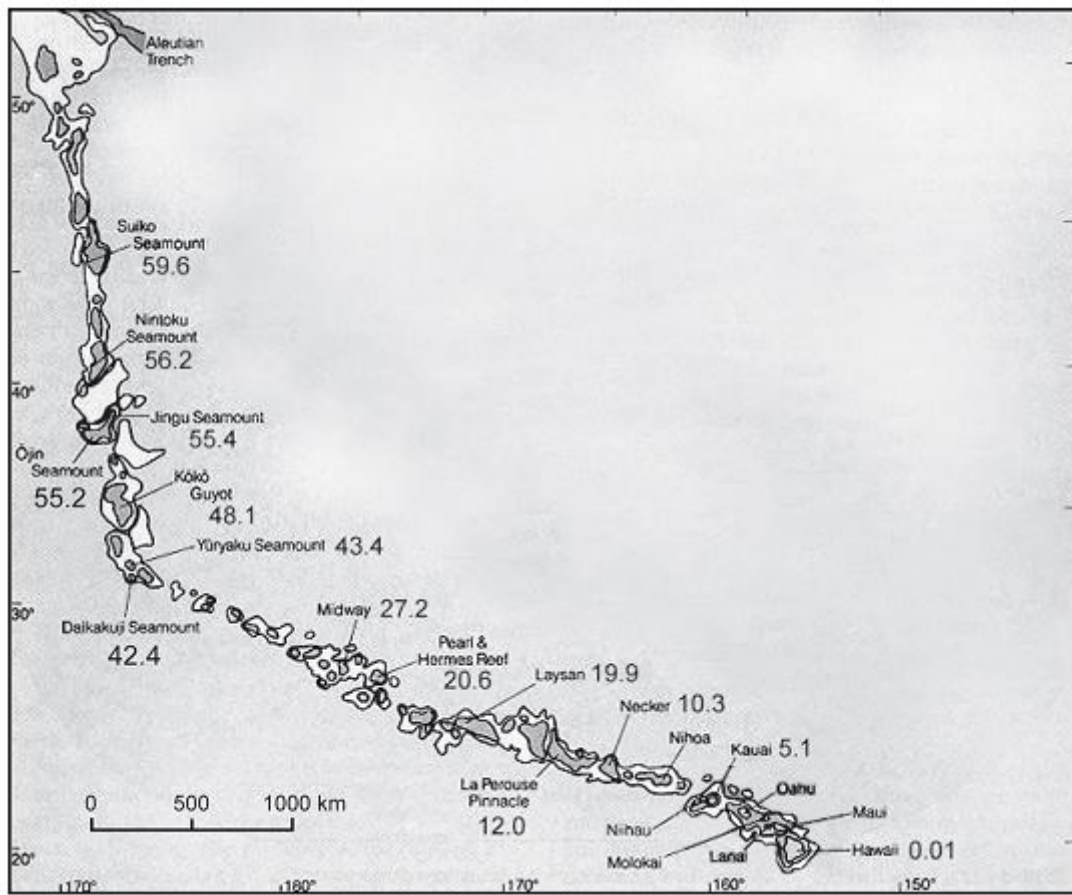
Figure. Hawaiian Islands - Emperor Seamount chain.

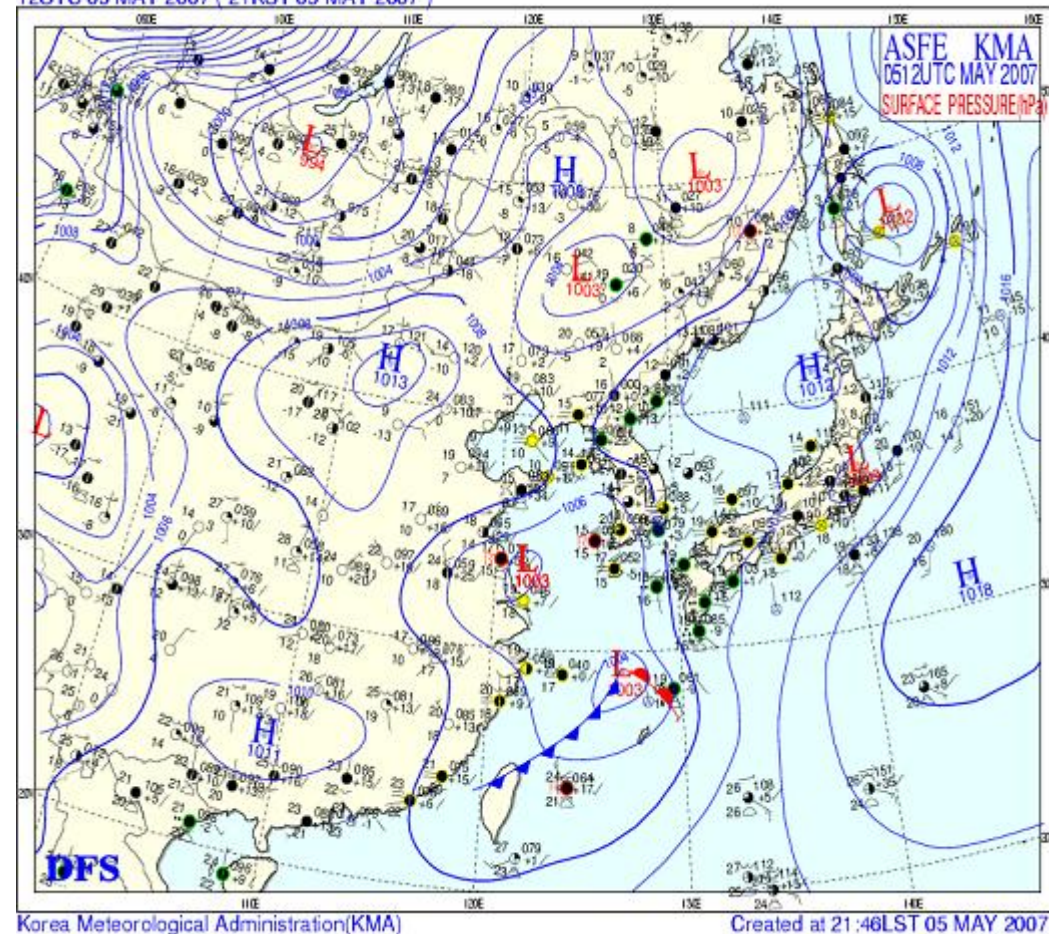1) How did this chain of islands form? Circle one option. (1 pt)

      A. subduction zone   B. mid-ocean ridge   C. hot spot
      D. meteorite impact   E. transform fault

2) What is the average speed (cm/yr) of plate movement? Show your calculations. (5 pts)

3) With two arrows, draw the direction of plate movement during the last 60 million years on the map. (4 pts)

IV. Following is a surface weather map on 5 May 2007. Answer the following questions based on the map. [15 pts]

12UTC 05 MAY 2007 (21KST 05 MAY 2007)

ASFE KMA
0512UTC MAY 2007
SURFACE PRESSURE(hPa)

DFS

Korea Meteorological Administration(KMA)   Created at 21:46LST 05 MAY 2007

1) With shaded pattern, mark two areas where precipitation(rainfall or snowfall) is expected. (8 pts)

2) Circle all correct statement(s) from the following items. (7 pts)

    A. Wind above the 1 km elevation generally blows in the directions parallel to the pressure contour lines.
    B. It rains as a warm front is approaching.
    C. Behind the cold and warm fronts, the northwest and southeast winds will blow, respectively.
    D. The fronts are expected to move toward the north.
    E. The speed of the front is nearly the same as the wind speed just behind the cold front.

V. The following schematic figure illustrates the process of precipitation when unsaturated air passes over the mountain. The altitude of location A is 500m, the air temperature at A is 26.2℃, and the level of condensation of the upward moving air is 1200m above sea level. The adiabatic lapse rates of the dry and moist air are 10 ℃/km and 6.5 ℃/km, respectively. Assume that the air flow, above B in lee (down-wind) side, does not go below 500m. Thick arrows indicate the air flow. [15 pts]

2000m

A

s

500m

B
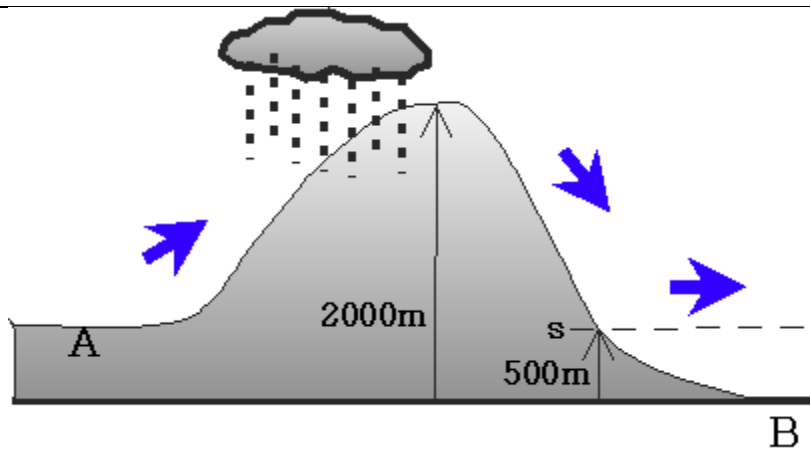
Before the air flow passes over the mountain, the environmental air temperature at each elevation is shown by the green line below.
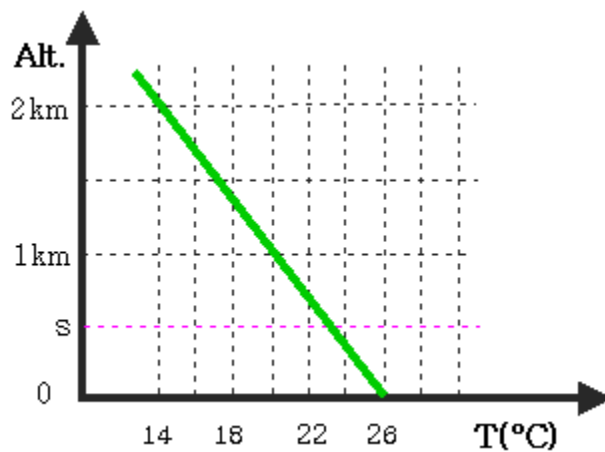

1) Using the information above, what will be the temperature of air when it reaches 1.2 km altitude? Show your calculations. (5 pts)

2) What will the temperature be when the air reaches the top of the mountain at 2 km altitude? Show your calculations. (5 pts)

3) Draw the line showing temperature variation with altitude, as the air descends the lee-side (down-wind side). (5 pts)
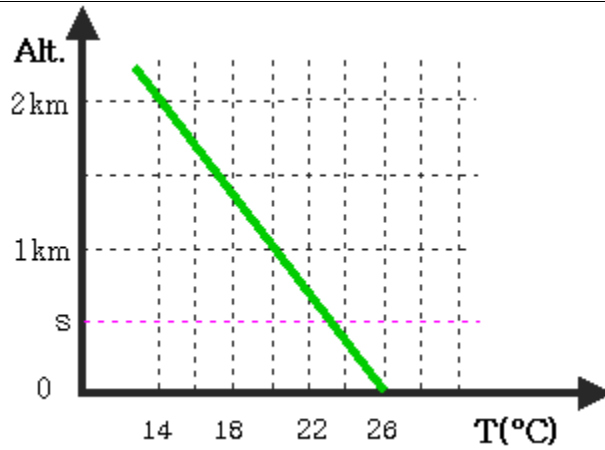
VI. On a clear day and night, a person in the northern hemisphere wants to observe celestial objects in the southern sky. Answer the questions using the figure and the data below. [10 pts]
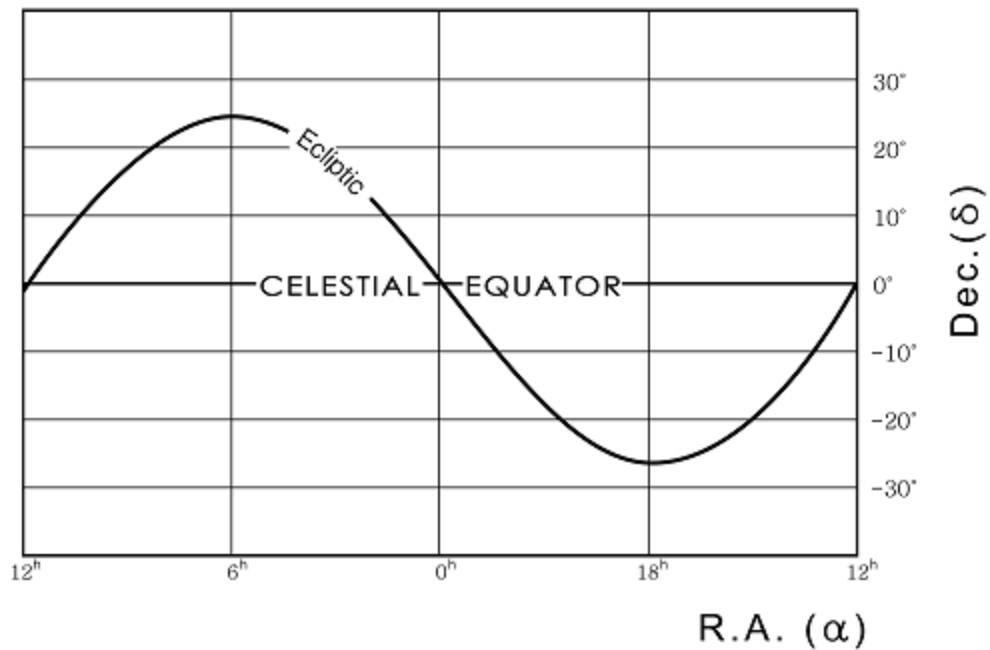
1. Canopus: Right Ascension (R.A.) $\alpha = 06^h\ 24^m$,
         Declination (Dec.) $\delta = -52.7°$(2000.0)
2. Vernal Equinox: March 21st.
   Autumn Equinox: September 23rd.
3. The Sun's meridian transit occurs at 12 noon.

1) Mark the Sun's location on March 21st in the above figure. (2 pts)

2) What is the observer's latitude if he/she saw Canopus in 3° highest altitude above the horizon during the whole year, at the time of meridian transit. Show your calculations. (4 pts)

3) If someone wants to observe Canopus at the time of its meridian transit at 9 pm, which is the best day, i.e., month and day? Show your calculations. (4 pts)

VII. Figure 1 shows the four positions of the Earth orbiting around the Sun, whereas Fig. 2 displays the path of the Sun projected on the celestial hemisphere. [10 pts]
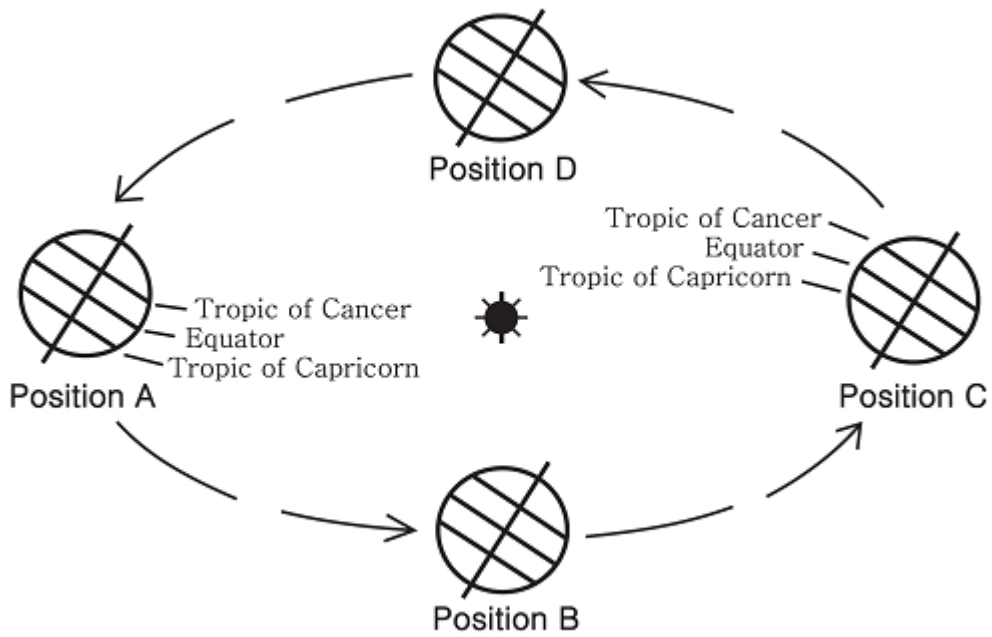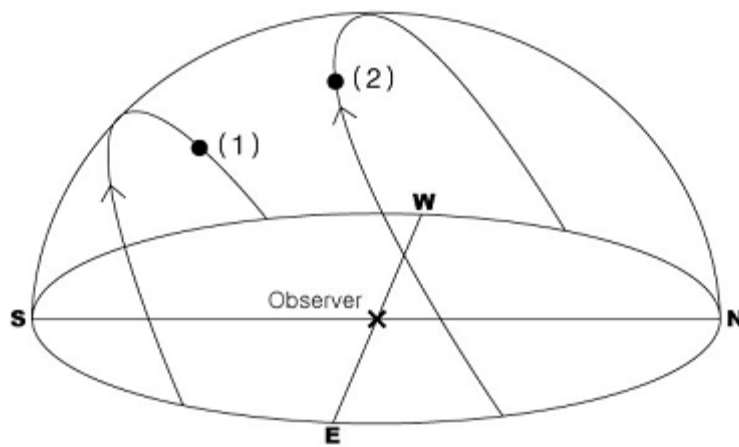
Fig. 1. The Earth around the Sun

Fig. 2. The path of the Sun projected on the celestial hemisphere.

1) Briefly describe the changes of the Sun's altitude at noon observed by a person at 40° north latitude when the Earth is at positions A, B, C, and D. (4 pts)

2) Identify and circle below the position of the Earth from Fig. 1 when the sun follows path (1) from Fig. 2. (2 pts)

Path (1):   position A,   position B,   position C,   position D

3) Identify and circle below the position of the Earth from Fig. 1 when the sun follows path (2) from Fig. 2. (2 pts)

Path (2):   position A,   position B,   position C,   position D

4) Which position in Fig. 1 would receive the minimum insolation at 50°N latitude? Circle one option below. Briefly describe how this would affect the local ecosystem productivity. Note: Insolation is the solar energy received per m^2 of flat ground. (2 pts)

Position A,   position B,   position C,   position D

VIII. We are interested in the effect of global warming on changes in sea surface temperature (SST). Given below is a map of the world oceans (deeper blue colour indicating deeper waters and lighter blue, shallower waters). Four stations are marked as A, B, C, and D. [10 pts]
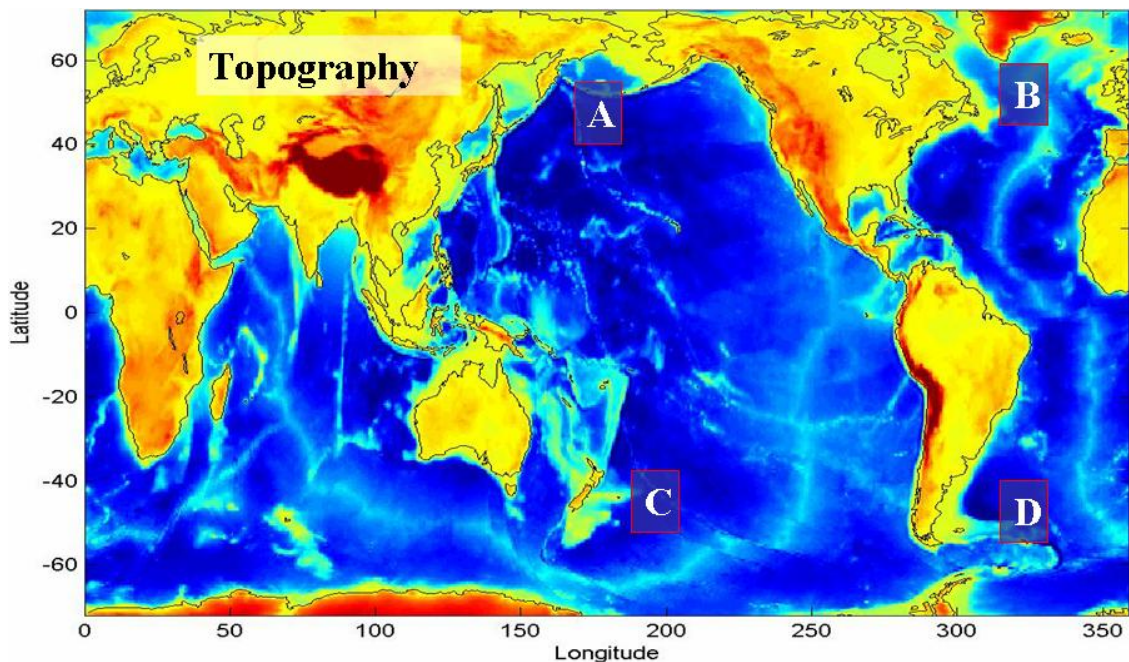
1) Figures (a) and (b) below show time-series of SST at two locations in the ocean. Calculate the rate of SST change (in °C/year) for figures (a) and (b). (2 pts)
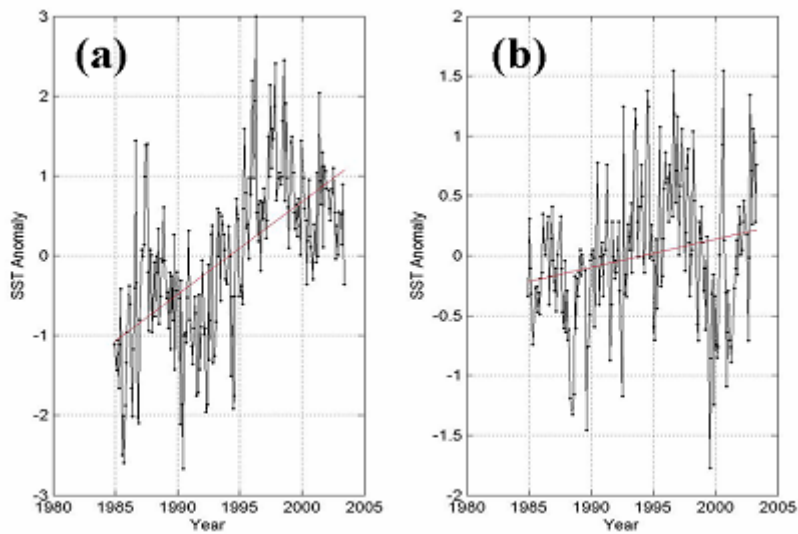
Ans: (a):   (b):

2) The oceanographer has lost the location data for figures (a) and (b)! Your job is to determine which data set (Figure (a) or (b)) goes with which location (A or B in the ocean map). Please give two reasons for your choice. (5 pts)

Ans: Figure (a) corresponds to location _____. (Choose location A or B). (3 pts)

Reasons (2 pts):

3) The rates of SST change at locations C and D are about +0.0011 ^{o}C/year and +0.0066 ^{o}C/year respectively. These rates are much lower than those at locations A and B in the northern hemisphere. Discuss the possible causes of the distinctly different rates between the northern and southern hemispheres. (3 pts)

PRACTICAL TEST
QUESTIONS

October 10, 2007
Inter-Burgo Hotel, Daegu Metropolitan City, Korea

Name: _____   Nation: _____

Geology

A map provided in a separate sheet is a simplified geologic map showing geologic boundaries, strike and dip. Topographic contours are shown as dotted lines with elevations in meters.

The letters in parentheses represent different rock types:

(P) Precambrian gneiss,
(Q) Cambrian conglomerate,
(R) Cambrian sandstone,
(S) Ordovician limestone,
(T) Jurassic sandstone, and
(U) Cretaceous granite.

Please note that pebbles of rock type (P) are found at the base of rock type (Q).
Answer the following questions:
1) Draw a geologic cross-section along the line A-A'. The horizontal and vertical scales are the same. (40 points).

2) Please match the rock types given as letter in parentheses in the geologic map with the rock specimens provided. (30 points)

Rock type of the geologic map	Rock type of specimens
(P)	
(Q)	
(R)	
(S)	
(U)	

3) What do we call the boundary between the rock type (P) and (Q)?(10 points)
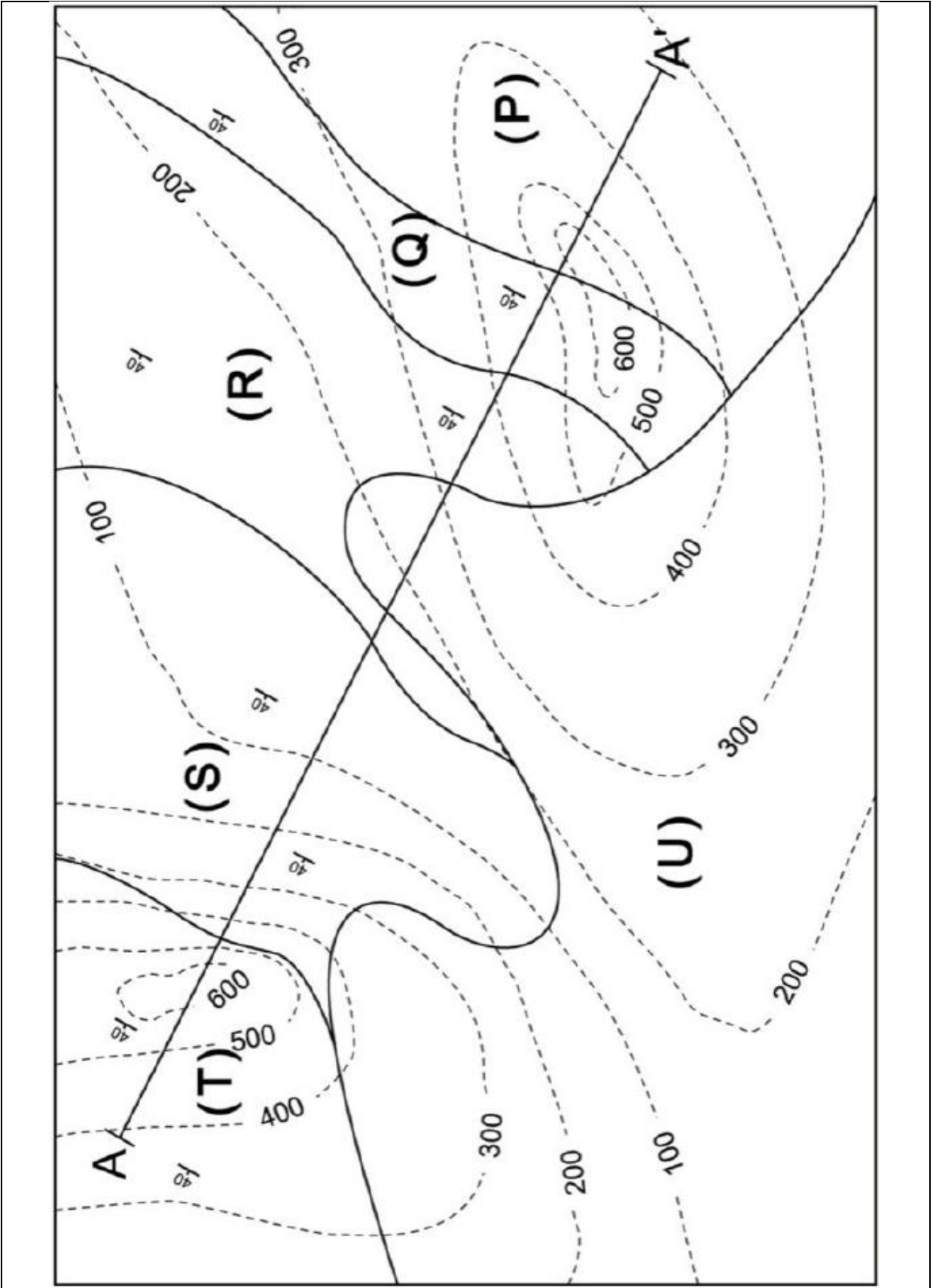

4) What do we call the geologic process that results in the formation of rock type (U) in the geologic map? (10 points)
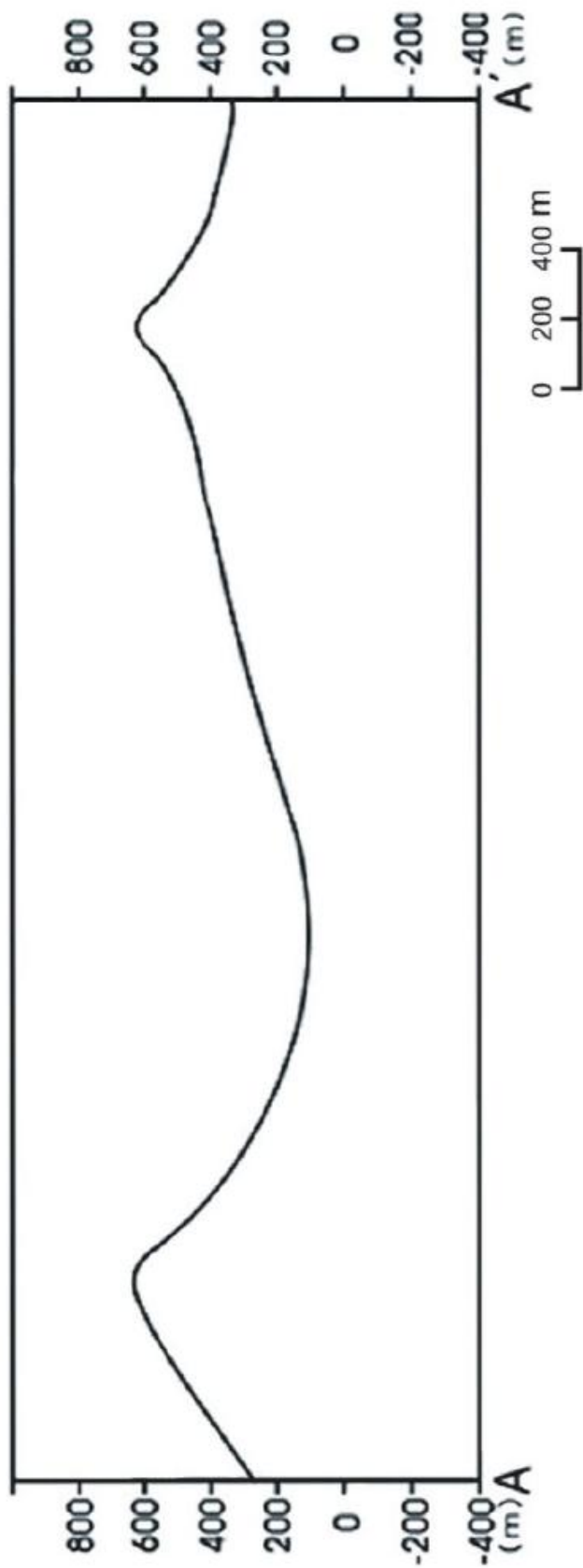

5) Using a polarizing microscope, identify thin sections A and B from the following choices. (10 points)

   Gneiss
   Basalt
   Limestone
   Sandstone

Thin section A:

Thin section B:

Atmospheric Science

Observed meteorological fields of pressure (hPa), wind, and temperature (°K) are presented below. On the pressure map contour lines for 1020hPa and 1016hPa are drawn. [total 100 points]

1) Draw contour lines for 1004hPa, 1008hPa and 1012hPa on the pressure map, and put the symbols H and L on the centers of high and low pressure regions, respectively.[50 points]
2) Draw cold and warm fronts on the wind field map, taking the wind vectors into consideration. [35 points]
3) Which region is expected to have the largest temperature increase ? Choose one among A, B, C, D, and E in the temperature map. [15 points]

Guidance for drawing contour lines on pressure map: The observed meteorological pressure values are given on the grid points which have constant spatial interval both in longitude and latitude. You therefore need to linearly interpolate the grid point values to draw a contour line of specific value.
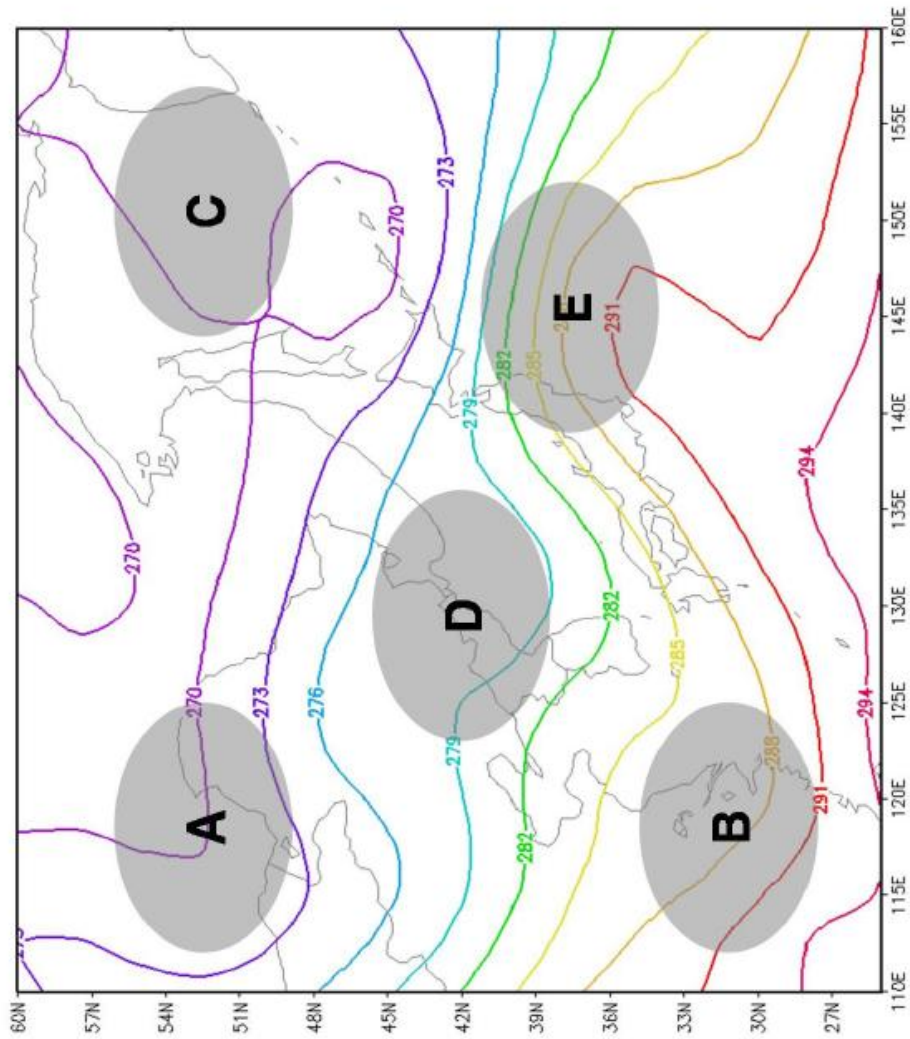
Pressure Map
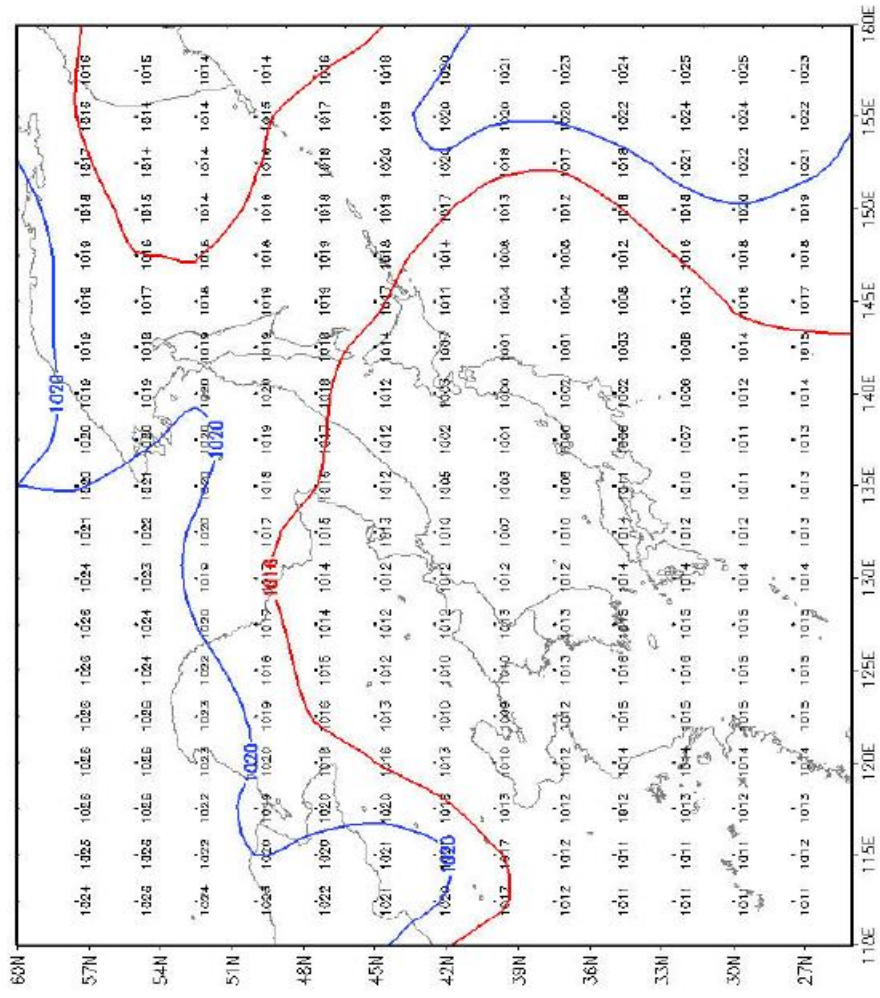
Wind Field
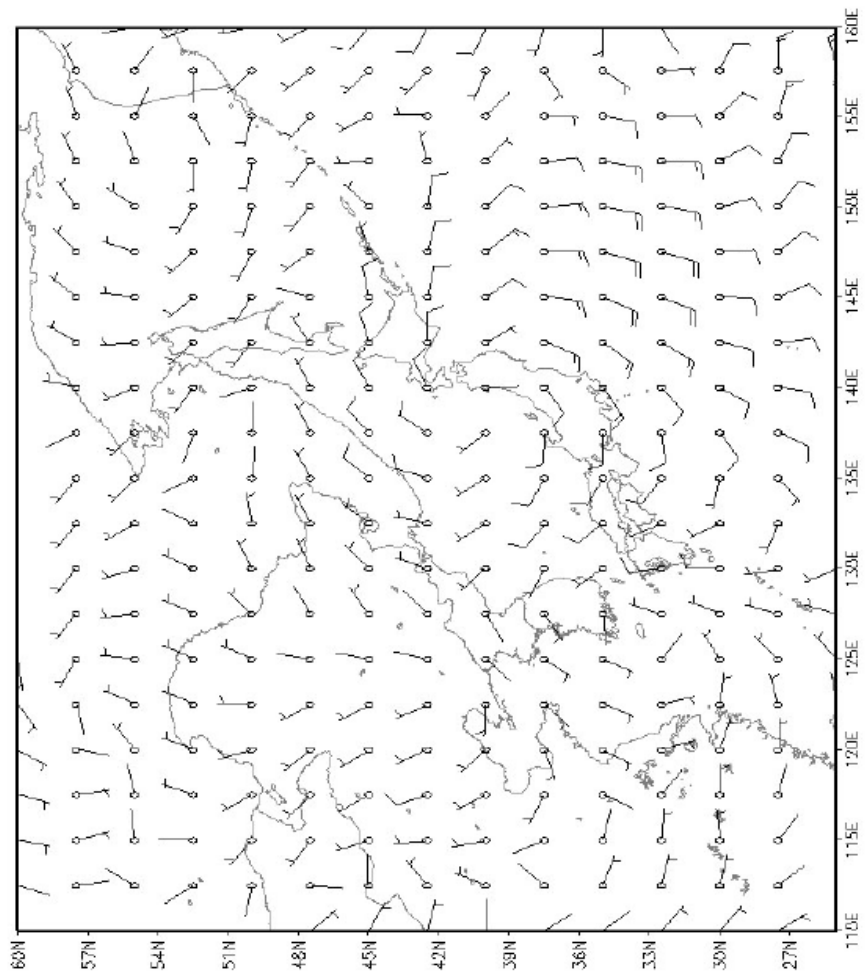
Temperature

Astronomy

Figure 1 shows a typical reflector, and Figure 2, a refractor. Tables 1 and 2 are basic specifications of two small telescopes and a CCD camera, which are commonly used in astronomical observations.
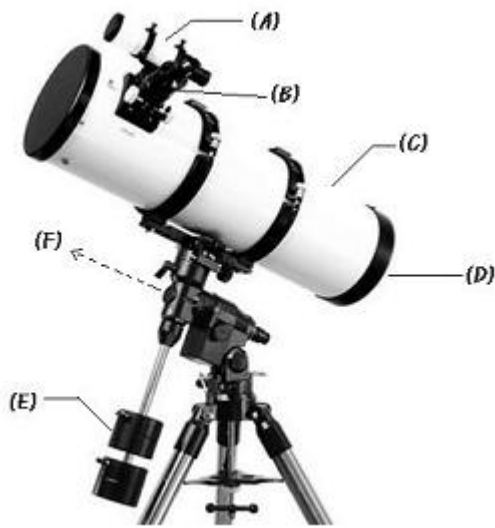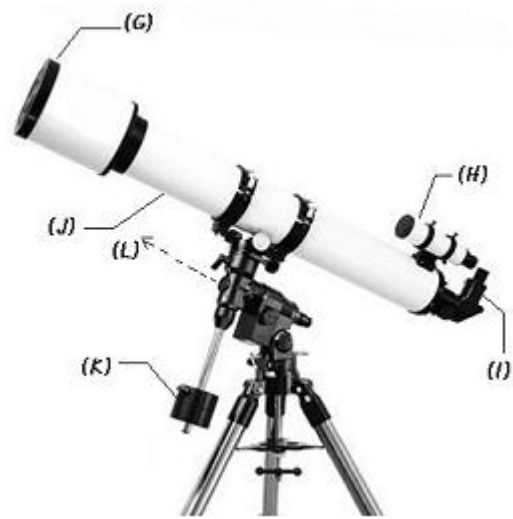
| Figure 1. Reflector | Figure 2. Refractor |

Table 1. Basic specifications of the reflector (Figure 1) and the refractor (Figure 2).

Specifications	Reflecting Telescope	Refracting Telescope
Optical System	Newtonian	Achromatic Multi-coated lens
Aperture	200 mm	125 mm
Focal Length	900 mm	1200 mm
Mount	German Equatorial	German Equatorial

Table 2. Specifications of the CCD camera.

Array (pixels)	1024×1024
Pixel size (μm)	24
Digital resolution	16-bit
Dark current	1e/pixel/sec at -20℃
Dynamic range	86 db

Referring to the tables and figures above, answer the following questions.

1) Fill in each blank with the most appropriate letter from (A) to (L), which indicates each part of the telescopes (24 points).

	Reflector	**Refractor**
Finder Scope		
Balance Weight		
Optical Tube		
Eye piece		
Objective Lens/Mirror		
Polar Axis		

2) Calculate the focal ratios (f-ratios or f-numbers) of the two telescopes. Show your calculations.   (26 points).

3) What is the ratio of the light-gathering power of the two telescopes? Show your calculations. (20 points)

4) What is the ratio of the theoretical resolving power of the two telescopes? Show your calculations. (10 points).

5) If you take an image of the Moon at the primary focus of the reflector, calculate the diameter of the Moon's image. Do the same calculation for the refractor. (Note: Assume that the angular diameter of the Moon is 0.5°.) (20 points).
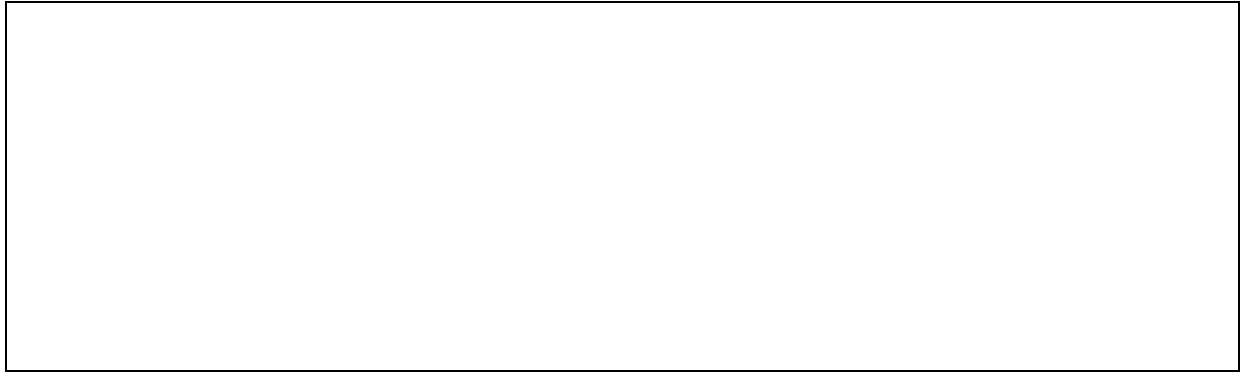
□ **Written Test Results example**

Student No.	I A	I B	II A	II B	III A	III B
1	10	10	9	8	10	10
2	11	11	4	4	1	1
3	13	13	15	15	8	8
4	15	15	13	13	8	8
5	9	9	0	0	3	3
6	12	12	15	15	8	8
7	9	9	9	8	4	4
8	15	15	15	15	10	10
9	7	7	0	0	2	2
10	14	14	10	9	8	8
11	14	14	12	12	6	6
12	11	11	0	0	4	4
13	9	9	8	8	8	8
14	15	15	15	15	10	10
15	9	9	9	9	10	10
16	7	7	0	0	2	2
17	10	10	8	8	5	5
18	15	15	15	15	10	10
19	11	11	0	0	1	1
20	8	8	8	8	3	3
21	15	15	15	15	8	8
22	12	12	12	12	8	8
23	13	13	15	15	10	10
24	13	13	15	15	5	5

Student No.	IV A	IV B	V A	V B	VI A	VI B

1	3.5	3.5	10	10	6	6
2	0	0	0	0	2	2
3	11.5	11.5	15	15	9.5	9.5
4	8	8	0	0	7	7
5	0	0	5	5	0	0
6	11.5	11.5	15	15	9.5	9.5
7	3.5	3.5	2.5	2.5	2	2
8	11.5	11.5	15	15	6	6
9	4	4	0	0	0	0
10	8	8	7.5	7.5	0	0
11	8	8	15	15	6.5	6.5
12	11.5	11.5	0	0	0	0
13	8	8	0	0	0	0
14	11.5	11.5	15	15	10	10
15	8	8	0	0	0	0
16	7	7	0	0	0	0
17	0	0	0	0	2	2
18	11.5	11.5	15	15	10	10
19	0	0	0	0	0	0
20	8	8	0	0	2	2
21	11.5	11.5	10	10	10	10
22	8	8	5	5	0	0
23	11.5	11.5	15	15	10	10
24	8	8	15	15	2	2