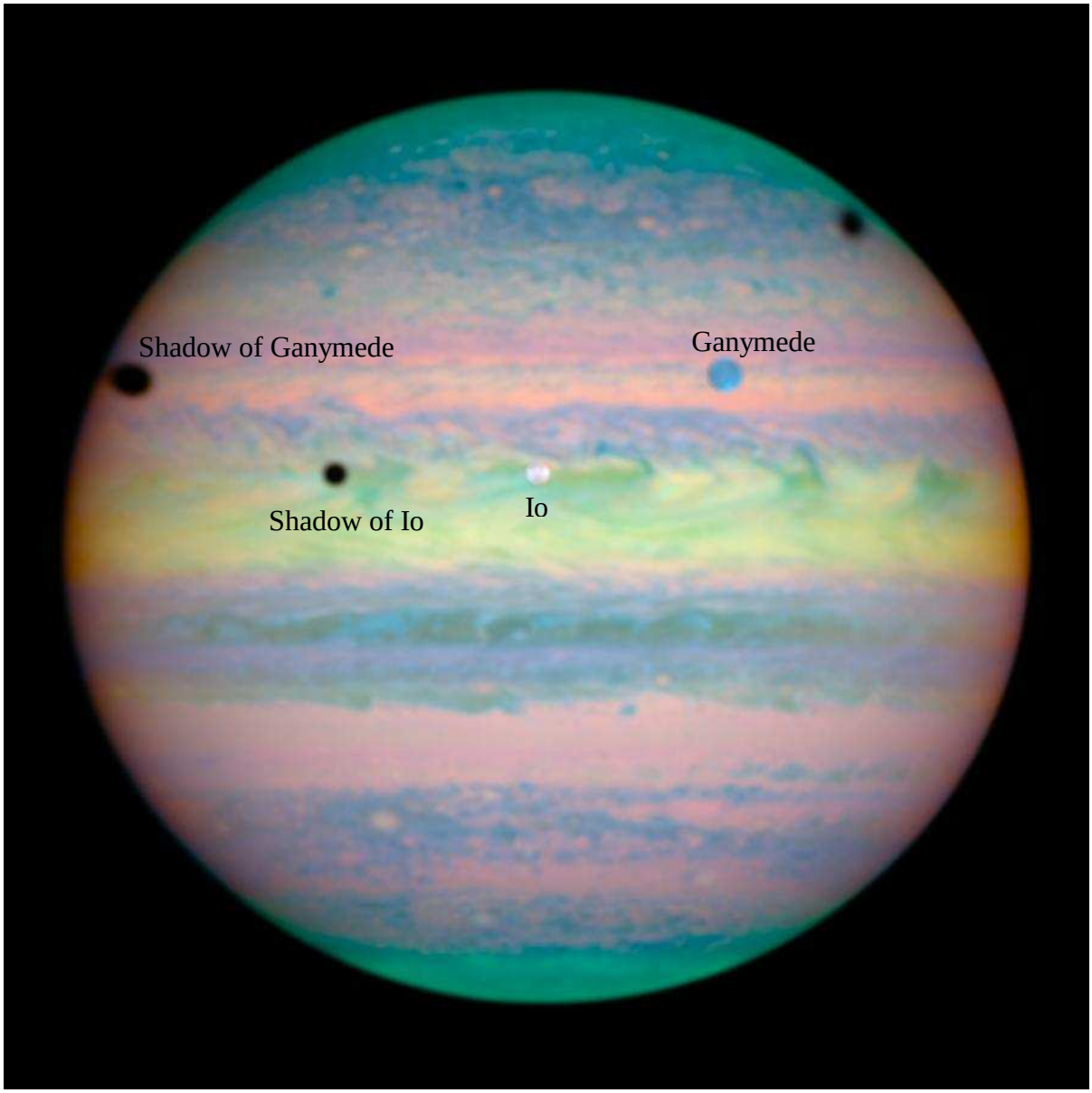
IESO 2012 Written TEST ASTRONOMY

Name_____ Nationality _____

(1) The full moon was photographed using a telescope equipped with a camera whose field of view was too small, so that only part of the moon is visible. Recalling that the angular diameter of the moon is about 30', using rulers and/or compass, estimate the field of view of this camera. **You must write down the whole process on this paper**. (10 pts)

(2) In the image of Jupiter with its moons (taken from Hubble Space Telescope on March 28, 2004), three shadows from the Io, Ganymede, and Callisto are visible, respectively, and two moons are visible in this image, Io in the center and Ganymede at the upper right. However, Callisto is out of the image.



(2-1) Callisto is out of the image. On the image above, draw an arrow pointing to where Callisto would be located. (1 pt)

(2-2) The diameter of Io is 3646 km, and the diameter of Ganymede is 5262 km. What is the scale (km/mm) of this image. (2 pts)

(2-3). Find the direction of light from Sun to Jupiter

Refer to the image and drawing on the page below. The image, taken from the Hubble Space Telescope is shown on the upper-left side, and the circle on upper-right side is a view from the northern sky of Jupiter, with the circle line representing the equator of Jupiter. The diameter of Jupiter is 143000 km.

(i) Plot a circle, C, inside the equator circle of Jupiter, showing the latitude of the shadow of Io. (2 pts)

(ii) Plot the position of the shadow of Io on circle C. (2 pts)

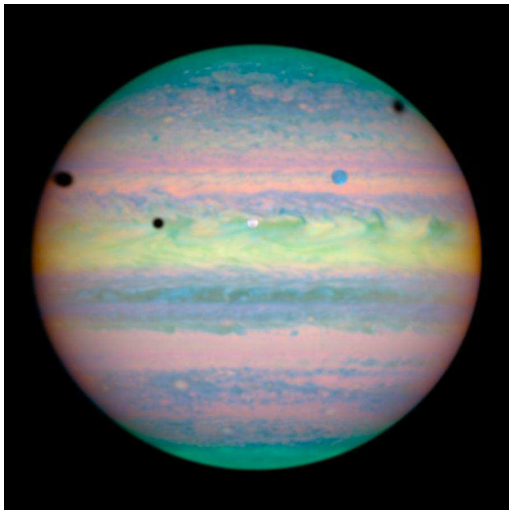
(iii) Draw the line through Io to the Earth. (1 pt)

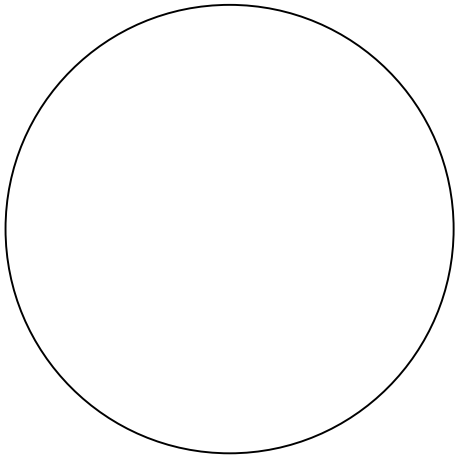
(iv) The rays of light from the Sun to Jupiter and its moons are almost parallel. The radius of the orbit of Io is about 422000 km. Draw a circle outside the equator circle representing the orbit of Io. (1 pt)

(v) Mark a point representing the location of Io. (1 pt)

(vi) Draw a line from the shadow of Io to the direction of Sun. (1 pt)

(vii) Calculate the distance between Io and its shadow in km? (2 pts)





To Earth

IESO 2012 Practical TEST Atmosphere

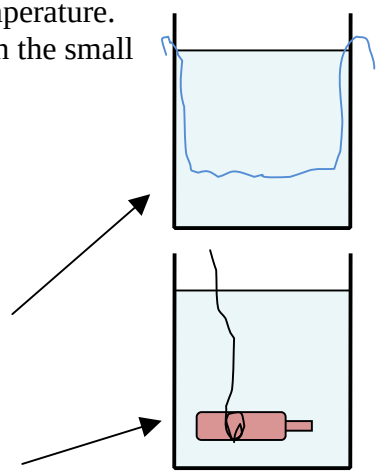
Name_____ Nationality _____

Please give your answer just in this question sheet and give your plot in the Emagram (Skew-T log-P) for question number 3.

1) Modelling an inversion

Material

- salted water (300g of salt per litre) at 5°C
- hot fresh water at 50°C
- tall beaker
- plastic film (useful for pouring hot water gently on top of cold salted water without mixing it ; you get rid of the film gently after that)
- colour Tepid fresh water filled in small bottle at room temperature.
- a metal wire attached to the flask : useful for pushing down the small bottle at the bottom of the beaker.



I) Pour cold, salted water in the beaker up to mid-height

II) Cover the water with the plastic sheet

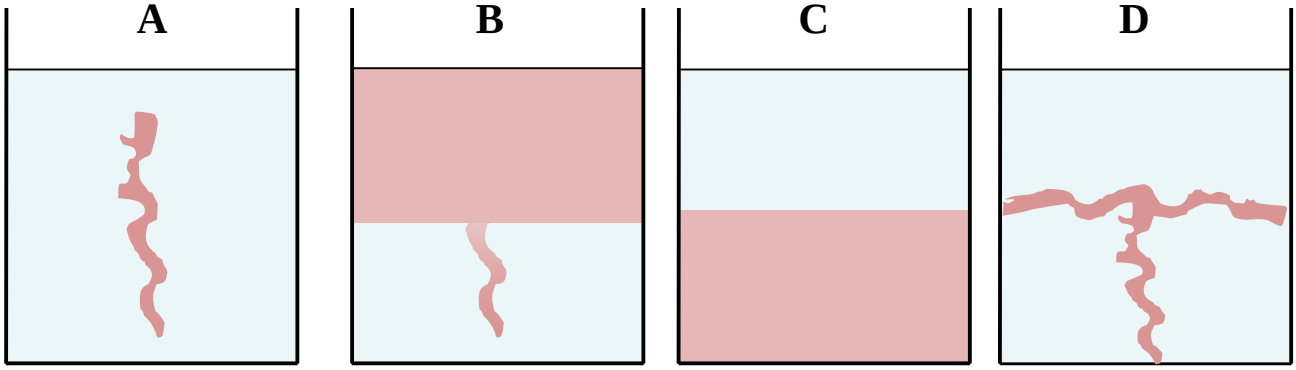
III) Pour gently hot fresh water on the top of the filmed layer of salted water, in order to avoid mixing the two water masses.

IV) Pull gently the film, avoiding turbulence.

V) Put the small bottle filled with colored tepid water at the bottom of the beaker (using the wire) ; incline the opening of the bottle so as to let the colored water go out gently.

Questions

1.1) Indicate which drawing best describes what you observe in your beaker (5 points)
Ans. ( )



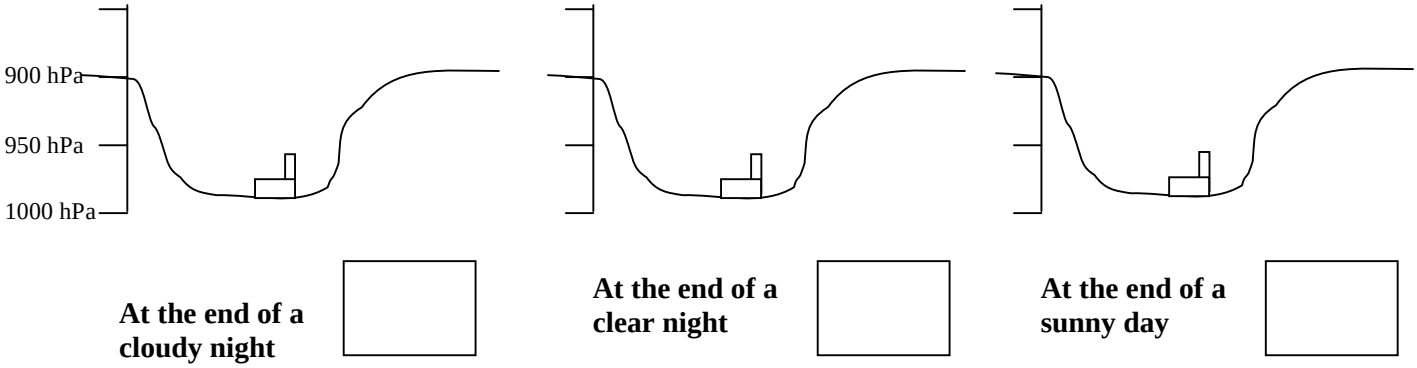
1.2) Please indicate the relative densities of the 3 water masses
(HF : hot and fresh, CS : cold and salted, TF : Colour Tepid fresh) : (2 points)
Ans. ( )

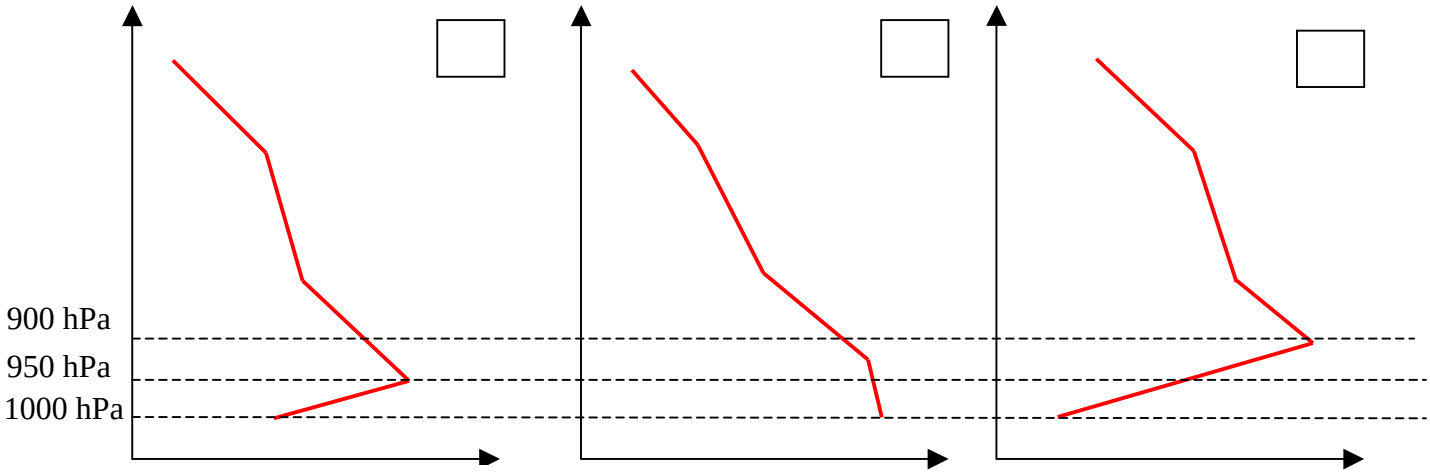
A) density $_{CS}$ > density $_{HF}$ > density $_{TF}$
B) density $_{HF}$ > density $_{CS}$ > density $_{TF}$
C) density $_{TF}$ > density $_{CS}$ > density $_{HF}$
D) density $_{CS}$ > density $_{TF}$ > density $_{HF}$

2) Inversion in a valley

Inversion can be a problem when there is pollution. Let's consider a valley with a polluting factory in winter.

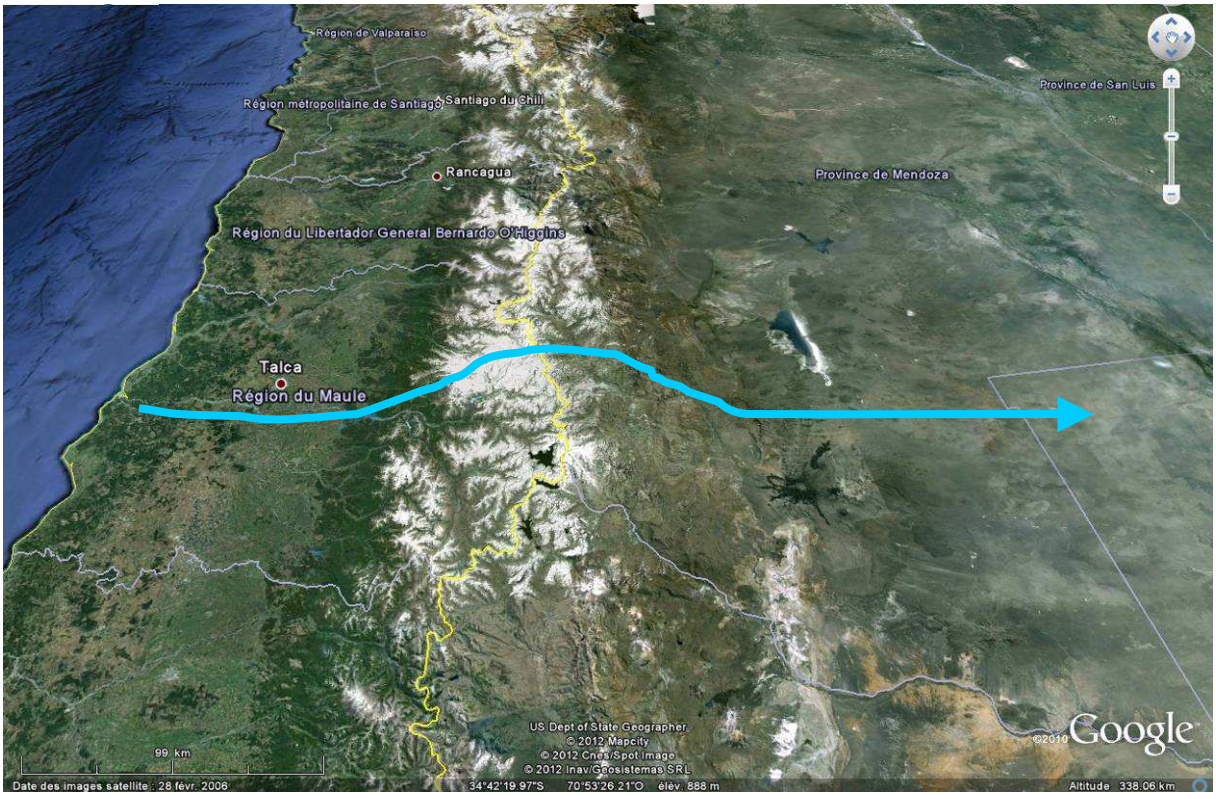
2.1) Associate each time of the day /weather condition below with one of the vertical profiles of temperature A, B, and C in the small box (3 points)





2.2) Draw the limit of the polluted layer on the valley profile above (if any) (2 points)

3) Zonda (Foehn) wind



An emagram (Skew T Log-P-diagram in the US) is a thermodynamic diagram which allows to predict how the state of a parcel of air changes when the parcel moves up or down. You may kindly note that in those diagrams, isotherms (solid brown lines) are skewed towards the right at 45°, so you must read temperature obliquely! Pressure/altitude is on the vertical axis.

We are going to apply it to the study of a famous Argentinian wind, blowing from the Andes : Zonda wind.

Let’s consider a parcel of humid air arriving from the Pacific Ocean in Chile. At the altitude of 200 meters, air pressure is 1000 hPa. The temperature of this parcel of air is then 15°C (A point) and its mixing ratio (water content) is 6 g of water per kg of air.

3.1) Plot this point (A point) on the emagram. Plot the dew point (D_A) at this altitude and indicate the dew point temperature. (1 point)

Ans.

West winds push this parcel of air up the Chilean slopes of the Andes. We will consider that this move is adiabatic: the parcel of air does not exchange heat with the surrounding air and cools just because its pressure decrease.
At some point, the air parcel will reach saturation and rain will start(B point).

3.2) Plot the point B up to which the rain starts (saturation) on the emagram and draw the path between A and B. (1 point)

Now saturated air continue to move up the slope, until the summit of an Andean mountain pass, at 2500 m (750 hPa).(C point)

3.3) Plot the point C giving the state of the parcel of air at 750 hPa, and draw the path between B and C. (2 points)

Now the parcel will go down the argentinian slope of the Andes, until it arrives at the altitude of 200 m (1000 hPa).(D point)

3.4) Plot the point D giving the state of the parcel of air at 1000 hPa, and draw the path between C and D. Indicate the temperature and mixing ratio of the air in D.(2 points)

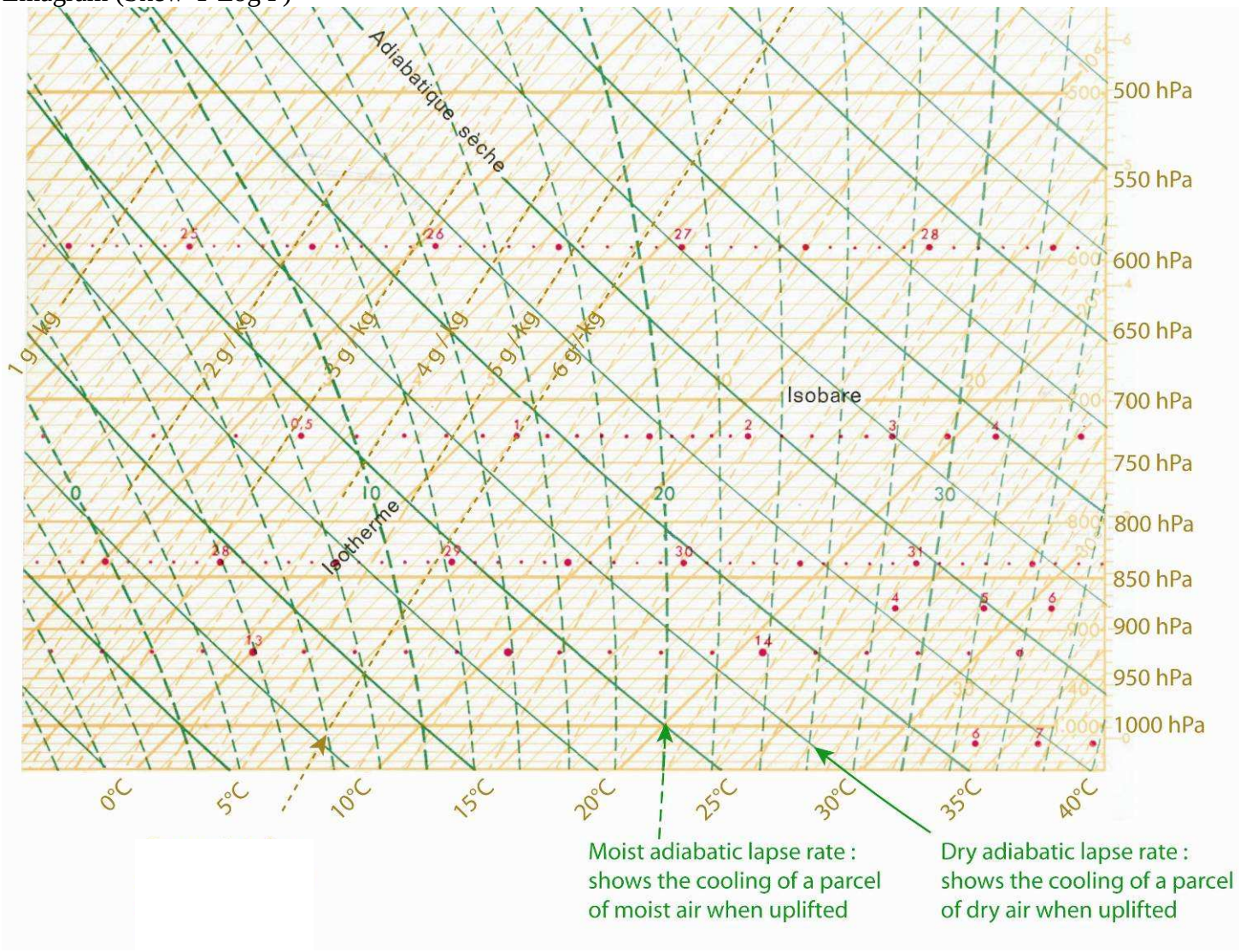
Ans.

3.5) Choose how to describe the perception of the Zonda wind in Argentina (1 point)

(A) warm and humid
(B) cold and humid
(C) warm and dry
(D) cold and dry.

Ans.

Emagram (Skew-T Log P)



IESO 2012 practical TEST Geosphere

Name_____ Nationality

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1. Draw a geologic cross section along A-B in the box to the right. If a bore hole is drilled from point C, at what depth will you encounter the shale-limestone boundary? (16.pts)

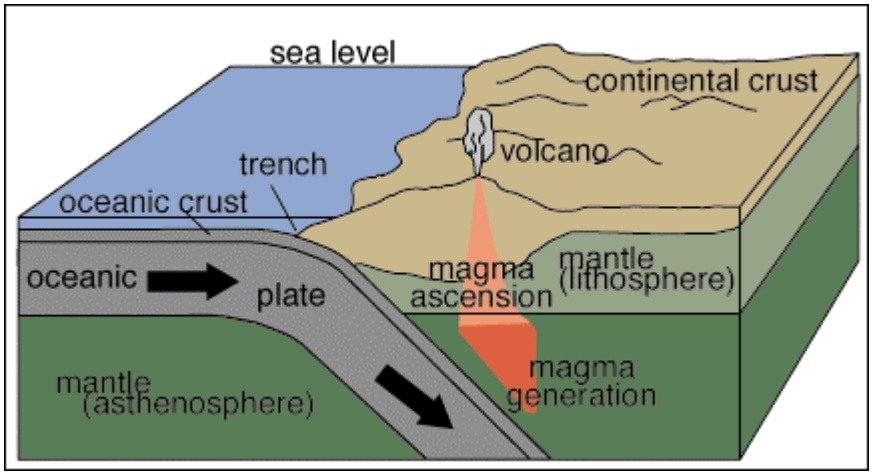
Answer

2. Name the rocks in trays A, B and C and show where (X, Y and Z in the diagram) they occur in terms of plate tectonics (12 pts).

A- Granite

B- Obsidian

C- Pumice.



http://www.platetectonics.com/book/page_12.asp

3. Name the sedimentary rock in tray D. What is the environmental significance of its colour? (6 pts)

A: Shale/ black shale; Anoxic/reducing environment

4. Name the rock in tray E (among the choice of answers provided), and identify the fossil present in it.(6 pts)

a. mudstone- b. limestone c. sandstone d. dolomite; Plant fossil

5. Name the rock in tray F.(5pts)

A: schist/ amphibolite schist

For question numbers 6-8: Name the minerals and mention their diagnostic property (one property per mineral is enough).

6. Quartz; hardness, lustre, no cleavage, fractures (5 pts)

7. Muscovite (mica); cleavage, sheety, flaky, hardness (5 pts)

8. Talc; hardness (4 pts)

9. Please measure the strike and dip of a plane assigned. (10 pts)

10. Please measure the strike and dip of a plane assigned.(10 pts)

11. Name the rock used at the flag mast. Name the two primary mineral constituents in it.(6 pts)

Pink granite/ granite; quartz and feldspar

12. Name the rock used for the step in the hall. What rock was it originally? (6 pts)

Marble; limestone

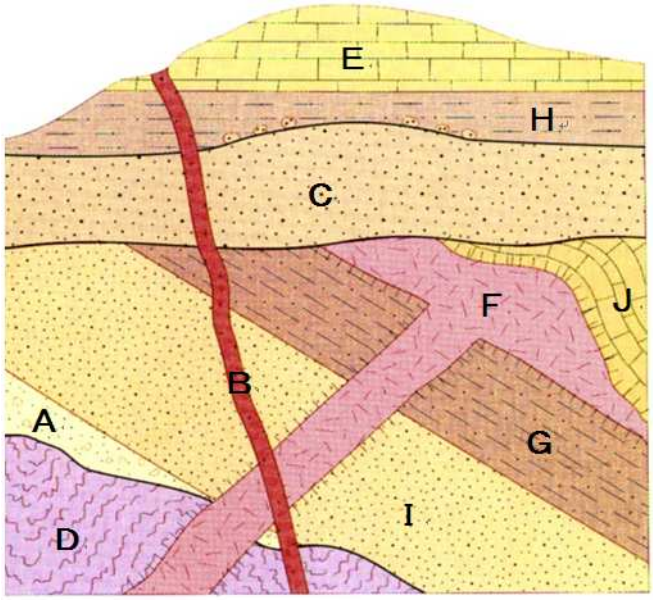
13. What would you call the long feature in the rock? Name the dominant mineral constituent in this feature. (6 pts)

Vein; feldspar

14. Identify the structure you see in the encircled area. (3 pts)

Fault/ microfault.

15. Choose the correct chronological sequence of events represented in the map.



a) A-B-C-E-F-G-I-J-D-H

b) D-A-I-G-F-J-C-H-E-B

c) I-J-D_B-C-A_E-G-F-H

d) B-E-F-G-I-A- H-C-J -D

16. Match the following:

a) Inclined beds	i) straight line outcrop intersecting topographic contours
b) horizontal beds	ii) straight line outcrop parallel to topographic contours
c) vertical beds	iii) outcrop intersecting topographic contours
	iv) outcrop parallel to topographic contours

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