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 <u>circle</u>, 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)







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 $_{\rm HF}$ > density $_{\rm CS}$ > density $_{\rm TF}$
- 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

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

17.

IESO 2012 Written TEST ASTRONOMY

Name______ Nationality _______
1. The duration of spring and summer in the southern hemisphere is 178.7 days, whilst the duration of autumn and winter is 186.5 days (the opposite is valid for the northern hemisphere). This apparently strange fact is related to: (1.pt)
(A) The magnetic field of the Sun affects the velocity of the Earth when it approaches the perihelion
(D) The fact the transfer the duration is in the structure of the transfer the structure of the structure of

- (B) The fact that the Earth changes its velocity in accordance to Kepler's Second Law
- (C) The precession of the Earth
- (D) The Earth is in its perihelion in July
- 2. If you were at the North Pole, Polaris would be ... (1.pt)
 - (A) at your zenith
 - (B) at your northern horizon
 - (C) below the horizon
 - (D) It depends on the time of day
- 3. The magnifying power of a (refracting) telescope can be calculated ...(1.pt)
 - (A) using sophisticated computer simulations
 - (B) from the focal lengths of the two lenses
 - (C) from the diameters of the two lens
 - (D) from the price of the telescope
- 4. For similar tidal amplitudes in different geographic locations, the surface of beach covered by the water during each tidal cycle is related to: (1.pt)
 - (A) The absolute value of low tide above mean sea level
 - (B) The slope of the beach
 - (C) The influence of local winds on the tide
 - (D) The influence of the local temperature
- 5. Right ascension is the sky's equivalent to the Earth's ... (1.pt)
 - (A) Latitude
 - (B) Longitude
 - (C) Altitude
 - (D) Meridian
- 6. Azimuth is the ____?(1.pt)
 - (A) angle, measured in degrees, above the nearest horizon
 - (B) horizontal direction (angle) or bearing of an object in the sky
 - (C) point in the sky (on the "celestial sphere") directly overhead
 - (D) great circle on the celestial sphere that passes through your zenith and also through both celestial poles

- 7. If your latitude is 30 , what is the most southerly declination of a star to be circumpolar? (2.pt)
 - (A) + 90
 - (B) + 60
 - (C) +30
 - (D) -30
- 8. The amount of light that a telescope can collect is limited by the telescope's ...(1.pt)
 - (A) chromatic aberration
 - (B) focal point
 - (C) aperture
 - (D) eyepiece
- 9. What is the correct term for the time taken for any object in the Solar System (such as the Moon) to return to the same position relative to the Sun as seen from Earth? (1.pt)
 - (A) year
 - (B) solar time
 - (C) sidereal period
 - (D) synodic period
- 10. The color of a star is mainly due to its ...(1.pt)
 - (A) surface temperature
 - (B) composition
 - (C) distance
 - (D) twinkling
- 11. A superior planet can be seen to retrograde when it is near ...(1.pt)
 - (A) conjunction
 - (B) quadrature
 - (C) opposition
 - (D) the Moon
- 12. When a planet is less than one astronomical unit (AU) from Earth AND shares the same AR as the Sun, that planet must be ...(1.pt)
 - (A) Venus
 - (B) Mercury
 - (C) at superior conjunction
 - (D) at inferior conjunction

13. An inferior planet at its greatest eastern elongation is best seen ...(2.pt)

(A) around midnight

(B) around noon

(C) just after sunset

(D) just before sunrise

14. Two optical telescopes A & B are used to observe the same celestial object. (Assume both have the same transmission rate.)

telescope	А	В
diameter	25 cm	100 cm

To obtain the same number of photons, what would be the exposure of telescope A to have the same amount of photons obtained by telescope B? (2.pt)

- (A) 4 times
- (B) 8 times
- (C) 16 times
- (D) 32 times
- 15. The star Alpha Centauri is approximately 4.0×10^{13} km away from Earth. If Alpha Centauri moves closer like the Moon (about 4.0×10^5 km away), about how much brighter is Alpha Centauri than before? (2.pt)
 - (A) 10^8 times
 - (B) 10^{12} times
 - (C) 10¹⁶ times
 - (D) 10^{24} times
- 16. If the Sun set below your western horizon about 6 hours ago, and the Moon is barely visible on the eastern horizon. Which phase of the Moon would this be? (2.pt)
 - (A) Full Moon
 - (B) First Quarter
 - (C) New Moon
 - (D) Third Quarter
- 17.If we have our own aircraft and want to fly directly from Albany, Australia (35°1' South, 117°53' East) to Olavarria (36°52'South, 60°5' West), with shortest distance, we will pass through the following region: (2.pt)
 - (A) Antarctic
 - (B) South Africa
 - (C) Hawaii
 - (D) New Zealand

18. Dating impact craters

From time to time, the planets are struck by bodies coming from the space. The impact of these bodies on Mercury's surface results in circular structures known as an impact craters. The superimposing relationships between craters provide a useful tool for relative dating of these structures. Please carefully analyze the photo below. Which of the options below is the correct sequence from oldest to youngest? : (2.pt)



(A) A - B - C
(B) A - C - B
(C) B - A - C
(D) B - C - A

IESO 2012 Written TEST Atmosphere

Name

Nationality _____





4).	The western coast of the southernmost part	In the Andes there are many	Α
	of South America, to the west of the Andes,	volcanoes that produce a lot of	
	is characterized by the presence of a rain	ash that facilitates precipitation.	
	forest. As opposed to the area to the east of	The rainfall mainly resulted	B
	the mountain chain which is a desert (the	from mountain effect –	
	Patagonia). Taking into account that winds	"orographic uplift"	
	in the area blow most of the time from west	Seasonal Monsoonal rainfall	С
	to east, how you could explain this		
	difference in vegetation? (1 pt)	Increased in water flow due to	D
		the melting of glaciers	

5). Choose the correct statement about the atmosphere near the equator (1 pt) :	
(A) Cold and many facuts are the dominant course of minfall	А
(A) Cold and warm fronts are the dominant source of rainfall (B) Diamed variation is not important	В
(B) Diumai variation is not important	
(C) Typhoons often develop in this area	C
(D) The Tropopause temperature is colder than that of midlatitude regions	
(E) The pressure gradient is important for weather analysis	D
	E

00°E 100° 00°U/ 0° 00°	00%E 100% 00%W/ 0% 00%		
		1	А
		2	В
Figure 3a	Figure 3b	3	C
Sundary		2 and 3	D
6). Figures 3a and 3b above illustrates the distribution of annual average atmospheric pressure on the ground in January and July. Select the best response from the following statements to describe			Е
the given weather charts correctly. (1 pt)1. In the northern hemisphere Winter, high pressure develops			F
2. In January, high pressure develops over the land area in the southern hemisphere.			G
3. There is less average variation in atmospheric pressure between winter and summer in the northern hemisphere, compared with the southern hemisphere.			

r			
7).	Match the following	Put the letter of your	
	statements with the right choices (1pt)	choice below	
1.	Which gas has the biggest variation in		
	space and time, and has strong influence		A. CO_2
	on the local weather?		_
	on the focul weather.		B. CO
	****		2. 00
2.	Which gas has the highest concentration		a Ho
	in the Earth's atmosphere?		C. H_2O
3.	Which gas makes the largest contribution		
	to the greenhouse effect?		D. He
	C		
4.	Which gas's anthropogenic concentration		E. N_2
	change is contributing most to climate		
	change?		
	change:		

8). Clouds are classified according to height and form.	High cloud	А
Which response best describes Altocumulus	Middle cloud	В
lenticularis? (1 pt)	Low cloud	С
	Stratiform cloud	D
	Cirriform cloud	E



10). According to Figure 4, The thickest layer is (1 pt)	101-110 hPa	А
	501-510 hPa	В
	701-710 hPa	С
	1001-1010 hPa	D

11). Choose the correct answer (1 pt)		
	r1	
	1 and 2 are true	А
1. Wind above the 1 km elevation generally blows		
parallel to the pressure contour lines.	2 and 4 are true	В
2. It always rains when a warm front is approaching.	1 and 3 are true	С
3. Behind the cold front a northwest wind will blow. A	1 and 4 are true	D
southeast winds will blow behind a warm front.	1 and 5 are true	Е
4. The fronts are expected to move towards the north.		
5. The speed of the cold front is nearly the same as the	3 and 5 are true	F
wind speed just behind front.	4 and 5 are true	G
	3 and 4 are true	Н

12). The center of mass of the Earth's atmosphere is (1pt):

- A) a little less than halfway between the Earth's surface and the outer boundary of the atmosphere.
- B) near the surface of the Earth.
- C) near the outer boundary of the atmosphere.
- D) near the center of Earth.
- E) none of the above.

13). Look at the picture of the clouds in Figure 5 below

Which statement is correct ? (1pt) The clouds are:

- (A) associated with a vertical wind shear
- (B) formed due to a passage of a jet plane (jet contrail)
- (C) thunderstorm clouds
- (D) a precursor of an earthquake
- (E) cloud street

Figure 5

Calculation Problems

r		
14).		The vapor pressure of water decreases as the
Temperature	Vapor Pressure	temperature decreases. If the amount of water
(⁰ C)	$(X 10^{3} Pa)$	vapor in the air is kept constant as the air is
10,0	1,23	cooled, then the temperature would reach the
12,0	1,40	dew point, at which the partial pressure and
14,0	1,60	vapor pressure coincide and the vapor is
16,0	1,81	saturated.
18,0	2,06	If the air is cooled further, vapor condenses
20,0	2,34	to liquid until the partial pressure again equals
22,0	2,65	the vapor pressure at that temperature.
24,0	2,99	In the meteorological laboratory with the
26,0	3,36	room temperature 26.0 °C, a meteorologist
28,0	3.78	cools a metal can by gradually adding cold
30,0	4,24	water. When the can temperature reaches
,	,	16.0°C, water droplets form on the can's
	1	outside surface.

What is the relative humidity of the 26.0°C air in the room? (show all your calculations) (3 pts)

Answer.

Relative humidity = $\frac{partial \ pressure \ of \ water \ vapor \ at \ temperature \ T}{saturated \ vapor \ pressure \ of \ water \ at \ temperature \ T} \times 100 \ \%$

The experiment shows that the dew point is 16.0° C, so the partial pressure of water vapor at 26.0° C is equal to the vapor pressure at 16.0° C, which is 1.81×10^{3} Pa.

Thus the relative humidity = $\frac{1.81 \times 10^3 Pa}{3.36 \times 10^3 Pa} \times 100\% = 0.539 \times 100\% = 53.9\%$

15). In a static atmosphere, the pressure change with height is governed by the hydrostatic equation $\Delta p = \rho g \Delta z$.

In this equation: g is the gravitational acceleration in m/s² (g = 9.81 m/s²) ρ is the air density in kg/m³ Δp is pressure difference in Pa (pascal) Δz is the thickness of different height When the mean air density between 1000 hPa to 500 hPa layer is 0.910 kg/m³, calculate the height of 500 hPa level with the assumption that mean sea level pressure is 1000 hPa

(show your calculations). (3 pts) Answer: $1 \text{ hPa} = 100 \text{ Pa} = 100 \text{ kg/m/s}^2$

$$\Delta p = 1000 \text{ hPa} - 500 \text{ hPa} = 500 \text{ hPa} = 50000 \text{ Pa}$$

$$\Delta p = \rho g \Delta z \Rightarrow \Delta z = \Delta p / (\rho g)$$

$$= 50000 \text{ Pa} / (0.910 \text{ kg/m}^3 \text{ x } 9.81 \text{ m/s}^2)$$

$$= 50000 \text{ Pa} / (8.9271 \text{ kg/m}^2/\text{ s}^2)$$

$$= 5600.9 \text{ m}$$

Thus the hight of 500 hPa level is ≈ 5601 m

IESO 2012 Written TEST Hydrosphere

Name_____ Nationality _____



2). Methane hydrates, also called <i>fire ice</i> , trap	Decreasing the global	А
methane molecules, and are found in enormous	warming	
quantities in the near subsurface of marine	Increasing the global	В
sediments in many places. If the warming of	warming	
water melts the <i>fire ice</i> , and liberates the	It will not affect the global	С
methane molecules into the ocean water and	warming	
eventually into the atmosphere, what will the	Increasing only the local	D
effect on the global weather be: (2 pts)	warming	

3). Tide is the most periodic phenomena in the sea but the tidal range varies every day. Choose the	Lunar tide is generated by the difference of forces between the gravitational attraction force of the Moon and the centrifugal force by the Earth's rotation.	А
two <u>INCORRECT</u>	Tide generating forces (TGF) by the Sun is about	В
answers describing the	46% of TGF by the Moon.	
tidal phenomena (2 pts).	Tidal range is greater in the new and full moon	С
	phases than in quarter moon phases.	
	Spring and neap tides are produced by the	D
	superposition of diurnal and semi-diurnal tides.	
	High and low tides occur once or twice a day	E
	depending on the geographical locations on the	
	Earth.	

4). Figure 2 below indicates the general pattern of ocean currents in the Pacific Ocean.



- 4.1) From Figure 2, what wind is responsible for the current at location A? (2pts)
 - (A) Polar Westerly Wind
 - (B) Southeasterly Trade Wind
 - (C) Westerly Wind
 - (D) Northeasterly Trade Wind

4.2) From Figure 2, what is the name of current at location B? (2pts)

- (A) South Equatorial Current
- (B) Equatorial Counter Current
- (C) North Equatorial Current
- (D) North Pacific Current
- 4.3) Currents at locations A, B, C all belong to the geostrophic current. What are the two major opposing forces that create the geostrophic currents? (2 pts)
 - (A) Wind stress
 - (B) Coriolis force
 - (C) Pressure gradient force
 - (D) Bottom friction

answer.



2 millimeters per year D of erosion in depth per year for 2004. Choose the correct 0.2 millimeter per year E

IESO 2012 Written TEST Geosphere

Name_____ Nationality _____

Write down your answer in the separate answer sheet. Choose ONLY one answer for every question. All questions carry the same points

1. The existence of an inner solid core is supported by seismic signals Earlier А crossing the core that have arrival _____ than (as) expected for a В Later given seismic station. Same time С

2. Which of the following statements is most	They may have active and inactive	А
correct for transform faults?	segments	
	They change from normal to reverse	В
	along strike	
	They are related to mid ocean ridges	С
	A and C are correct	D

3. Isostatic models explain the presence of thick	The average rock density in the	А
roots under most mountain chains. These roots	mountain chain	
depend on	The height of the mountain chain	В
	Neither A or B	С
	Both A and B.	D

4. Polygonal patterns are found in several geological structures.	a,b	А
Choose all polygonal patterns.	b,d	В
a) Columnar jointing in igneous rocks	a.b.c	С
b) Mud cracks	abcd	D
c) Polygonal soils	u,0,0,u	
d) Recrystallization of some minerals during metamorphism		

5. Each mineral has a typical	Hematite, red; Azurite: blue; Malachite: green; Kaolin:	Α
colour of its powder (streak).	white; Goethite: ochre (orange); Magnetite: black.	
Choose the correct	Hematite, red; Azurite: blue; Malachite: green; Kaolin:	В
combination of mineral name	ochre (orange); Goethite: white; Magnetite: black.	
and the colour of its powder.	Hematite: black; Azurite: blue; Malachite: green; Kaolin:	С
	white; Goethite: red; Magnetite: ochre (orange).	
	Hematite, red; Azurite: blue; Malachite: green; Kaolin:	D
	ochre (orange); Goethite: black; Magnetite: white.	

6. Stromatolites	Related to the first stages of plate tectonic development on the Earth	Α
are:	Related to the activity of cyanobacteria (blue-green algae)	В
	Fossil marine plants indicative of warm and clear shallow waters	С
	developing during interglacial periods	
	Related to the activity of bacteria	D

7. Gravitational acceleration is recorded at points A and B of the same elevation. Assuming a homogeneous subsurface structure and similar density, which point (A or B) will show a larger gravitational acceleration?



8. Which of contac Notice th northern evidence	type of fault cou to between northe that the dip of the to the southern b that it is not a str	Id have dis rn and sout layers chan lock and th rike slip fau	splaced the thern block ages from t at you hav alt.	traces Left-lateral strike-slip fault ss? he e	A
	C 60° –	В	А	Normal fault	C
	Vertical fault	B 30° —	A	A rotational or oblique slip fa	ault D

9. M, Z and P are sedimentary beds that have been affected by a reverse fault. Will the boundaries between the sedimentary beds be closer or farther apart in the northern block.	Closer to each other	A
NC AB		
ZP	Further away	В
	No change	C
₽	Move to the left	D

10. A "doodle" that celebrated the 374 th anniversary of Steno appeared on January 11 of this year. Steno did a great job trying to find out how many natural processes worked. He is considered the father of Geology because he established several principles that worked as knystenes for the further dayalonments of the geological	The law of Faunal Succession, no exception	A
knowledge. The Google logo makes reference to the most famous of his principles	Law of Superposition, no exception	В
that refers to the order of layers in a normal sedimentary sequence. Can you name the principle and whether or not exceptions to the principle could exist.	Principle of Superposition, there are exceptions	С
Reference: www.google.com/Nicolas-Steno-374th-birthday	The law of Faunal Succession, there are exceptions	D

11. Crinoids are a group of:	algae	А
	bivalves	В
	corals	С
	echinoderms	D

12. A granite pluton intrudes a sedimentary succession	marble and quartzite	А
composed of limestone and sandstone. Which kind of	schist and marble	В
metamorphic rocks will be formed?	schist and gneiss	С
	quartzite and gneiss	D

13. Which of the following pairs of minerals cannot be	olivine – pyroxene	Α
found in the same rock type?	olivine -quartz	В
	biotite – quartz	С
	plagioclase – pyroxene	D

14. Which of the following phenomena are precursors of an	a,b,d	Α
impending (forthcoming) volcanic eruption?		
a) Floods		
b) Anomalous seismicity	b,d,g	В
c) Heavy rains		
d) Increase of temperature and chemical changes in fumarolic	b	C
gases	-11	D
e) Strong winds	all	D
g) Ground uplift		

15. What is this geological phenomenon called that has occurred in a karst region?	volcanic chimney	А
	meteor impact crater	В
	rockfalls	С
	sinkhole	D

16. What kind of a fault caused the displacement of this	Dextral (right lateral) strike-slip	А
fence?	fault	
110 1111 (the second	Sinistral (left lateral) strike-slip fault	В
HAT		
	oblique slip fault	С
and the second s		
	thrust fault	D
all the second second second second		
and the second		

17. Choose the sedimentary feature which DOES NOT	1	А
increase with distance from the source area of sediments.	2	В
1. grain size	3	С
2. roundness	2 and 3	D
3. quartz to feldspar ratio		

18. The precipitation of which of the following minerals is	halite;	Α
regulated by the concentration of CO_2 in the solution?	gypsum;	В
	apatite;	С
	calcite;	D

19. In which of the following	Deep ocean trench	A
geological contexts is it more probable to find oil reservoirs?	Abyssal plains	В
to find on reservoirs.	Mid - oceanic ridges	С
	Passive continental margin	D

20. Comparing two materials with	flows easier	А
different viscosities, the one with the	is harder to deform	В
	is easier to deform	С
	is less sticky	D

21. Which of the following provide tectonic activity?	evidence	of	plate	the rotation of Earth	А
				the presence of mid-ocean ridge	В
				the presence of impact crater	С
				the presence of erosion	D

22. The photo below displays cross-bedding.	top	А
Where is the youngest strata shown on this vertical outcrop?	bottom	В
omerop.	top right	C
	bottom left	D
and the second		
THE AND A		

23. There are three rocks A, B, and C. Two of them are basalt and limestone.	A is limestone	А
If the formation temperature T of the	B is schist	В
three rocks are $T_A > T_B > T_C$, which statement is correct?	B is evaporite	С
	C is basalt	D

24. Which of the geological features can not be determined in this geological section for its relative age sequence? There is no	А
overturning of beds.	В
B	С
The state of the s	D
	E
	F

25. Choose ALL sedimentary structures useful in paleocurrent analysis.	1,2	А
1. graded bedding, 2. cross bedding, 3. desiccation cracks, 4. ripple marks	1,3	В
	3,4	С
	2,4	D

This is a schematic diagram showing rock cycle in lithosphere. Rocks at the Earth's surface change due to various geological processes.



A great earthquake M 9.0 occurred off the Pacific of Tohoku in Japan on March 11, 2011. The epicenter of the earthquake is shown in the figure. The red line is plate boundary.



Convergent-reverse	С
Convergent-normal	D

the second dependence of the second	The following diagram shows a sedimentary sequence	e obtai	ned
	from a lake. Answer the questions.		
	28. Explain the formation of light and dark layers in	a,b	А
	terms of water circulation.		D
Contraction of the second s	a) The light layer was deposited during the	a,c	в
time of good water circulation and organic matter was pxidized			a
		b,d	С
	b) The dark layer was deposited during the	c,d	D
	time of good water circulation and organic matter		
and the second	was oxidized		
5 cm	c) The dark layer was deposited during the		
	time of poor water circulation and organic matter		
Appendix and the second second	was not oxidized.		
\mathbf{V}	d) The light layer was deposited during the		
	time of poor water circulation and organic matter		
	was not oxidized.		
30. Which layer(s) do you think	Light layer		А
show coarse grains? (1.pts) Dark layer			В
	Both		С
	Dom		C
	Neither		D

Figure shows the classification of sandstones by Pettijohn	30. Show the	Quartz	А
(1975).	names of rocks A	arenite-	
Mudrocks	and B in the	mudrock	
В	figure.	Mudrock-	В
A		greywacke	
Quartz wacke 75		Arenite-	С
Quartz arenite Quartz		wacke	
Subarkose 25 5 Felden lithic neithin		Greywacke-	D
Sublitharenite greywacke greywacke		quartz arenite	
Lithic arkose			
Arkosic arenite			
Feldspar 50			
0 Port			
fragments			

31. Earth's bulk density is 5500 kg/m^3 . It is estimated that Earth's	2500 km	A
uncompressed density (the density Earth would have if gravity	14200 km	В
were "turned off" and pressure inside the Earth were zero) is 4000	3050 km	С
kg/m ³ . Using the actual mass of Earth (6.0×10^{24} kg), what would its radius have to be to give a bulk density of 4000 kg/m ³ ?	7100 km	D
(Assume this Earth is a perfect sphere.)		

32. How can studies of ice cores help scientists to understand and	The record of frequencies-amplitudes of cyclic climate changes can serve to predict major cycles;	А
predict future climate changes?	The physical record can be correlated with changes in atmospheric gases and aerosols;	В

The physical record can be correlated to changes in mean	С
ocean and atmospheric temperatures,	
The physical record can be correlated to changes in ocean	D
salinity, glacial intervals, etc.	
All of the above answers	E