

# **The Written Test**

**The 9<sup>th</sup>**

**International Earth Science Olympiad**

**Pocos de Caldas**

**Brazil**

**September, 2015**

1. The rock unit (Gesteinseinheit) in the picture below consists of rounded grains (besteht aus gerundeten Körnern) ranging in size from sand to small pebbles (in verschiedenen Korngrößen von Sand bis Kies). In which sedimentary environment (Ablagerungsmillieu) did this rock form? (Correct answer = 1 point)



- a. Dune (Düne)
- b. River (Fluß)
- c. Lake (See)
- d. Beach (Strand)

2. The surface wind (Bodenwind) is a result of the balance (Gleichgewicht) between the pressure gradient (Luftdruckgradient) force (Kraft), Coriolis force (Corioliskraft), and frictional force (Reibungskraft). If the surface wind blows from west to east in the Northern Hemisphere (Nordhalbkugel), in which direction (Richtung) would the pressure gradient (Luftdruckgradient) force point? (Correct answer = 1 point)

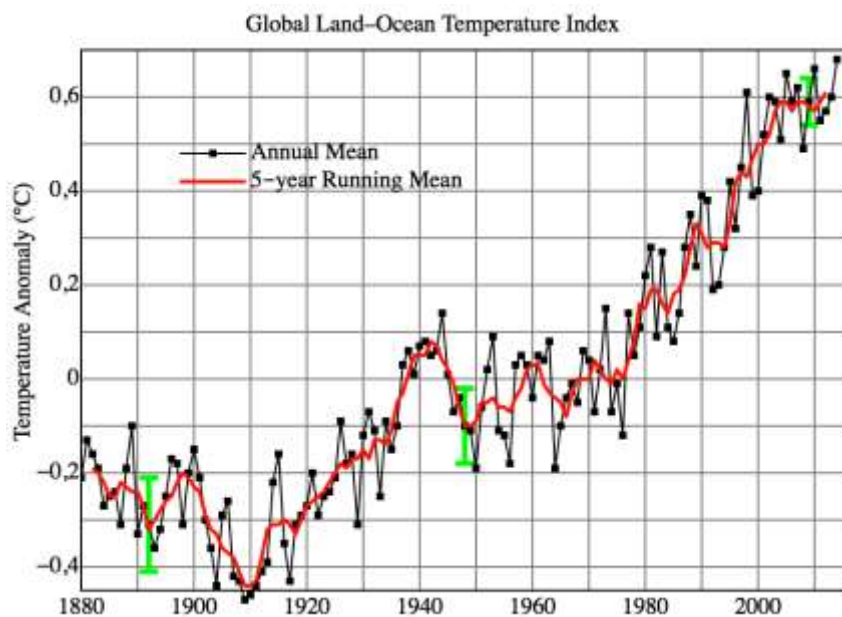
- a) Northeast
- b) Southeast
- c) Southwest
- d) Northwest

3. Choose the correct description (Beschreibung) for the evidence (Beweis) that the Earth's outer core (äußerer Erdkern) is liquid (flüssig). (Correct answer = 1 point)

- a) In some places, the first arriving seismic waves (seismische Wellen) are refracted (gebrochen) waves instead of direct waves.
- b) There is a seismic shadow zone (seismische Schattenzone).
- c) S-waves (S-Wellen) do not reach (erreichen) the opposite side (gegenüberliegende Seite) of an epicenter (Epizentrum).
- d) Weak P-waves (Schwache P-Wellen) are detected (gemessen) in the P-wave shadow zone (P-Wellen Schattenzone).

4. The figure below shows the global mean surface temperature anomaly (weltweit durchschnittliche Oberflächentemperatur Anomalie) and the 5-year running mean (5-Jahresdurchschnitt). The green bars (grünen Balken) show uncertainty estimates (Streuung). The Earth's temperature has remained (ist verblieben) relatively constant for the past 15 years. Which one of the following options would possibly cause this warming slowdown or warming pause?

(Correct answer = 1 point)



- a) Amount of cirrus cloud cover (Bedeckung durch Zirkuswolken) and an increase (Zunahme) in the amount of water vapor (Wasserdampf)
- b) Concentration of tropospheric ozone (Ozon in der Troposphäre) has increased
- c) An increase in the number of sunspots
- d) The frequency (Häufigkeit) of La Nina events has increased.

5. According to the Big Bang theory, approximately how many years ago was the universe at a very high density state (Stadium sehr großer Dichte) and then expanded (Ausdehnung)? (Correct answer = 0.5 point)

- a)  $130 \times 10^6$
- b)  $1.3 \times 10^9$
- c)  $13.8 \times 10^9$
- d)  $138 \times 10^9$

6. Welche der folgenden Aussagen ist richtig und kann ausschließlich hergeleitet werden aus: Der Erforschung seismischer Wellen, die durch die Erde laufen; Strömungslehre von Gesteinsschmelzen; Wissen über den Einfluss von Druck auf Gestein.

(Correct answer = 1 point)

- a) Die Astenosphäre liegt komplett im Erdmantel, ist teilweise geschmolzen und verhält sich dadurch plastisch. Die Lithosphäre gleitet auf ihr.
- b) The theory of plate tectonics states (besagt) that the crust is segmented (zerbrochen) into several pieces (diverse Teile) of a spherical jigsaw puzzle (kugelförmiges Puzzle).
- c) The crust and the outermost mantle comprise (umfassen) the asthenosphere (Asthenosphäre) that behaves plastically (plastisch).
- d) The crust and mantle define a plate (Erdkruste und Erdmantel bilden eine Einheit) that moves relative to one another by floating (schwimmen) on and gliding (gleiten) over the liquid outer core (flüssiger äußerer Erdkern).

7. The figures below (Abbildungen unten) represent two different types of cyclones (zwei verschiedene Zyklontypen).

Which of the statements (Aussagen unten) below is correct?

(Correct answer = 1 point)

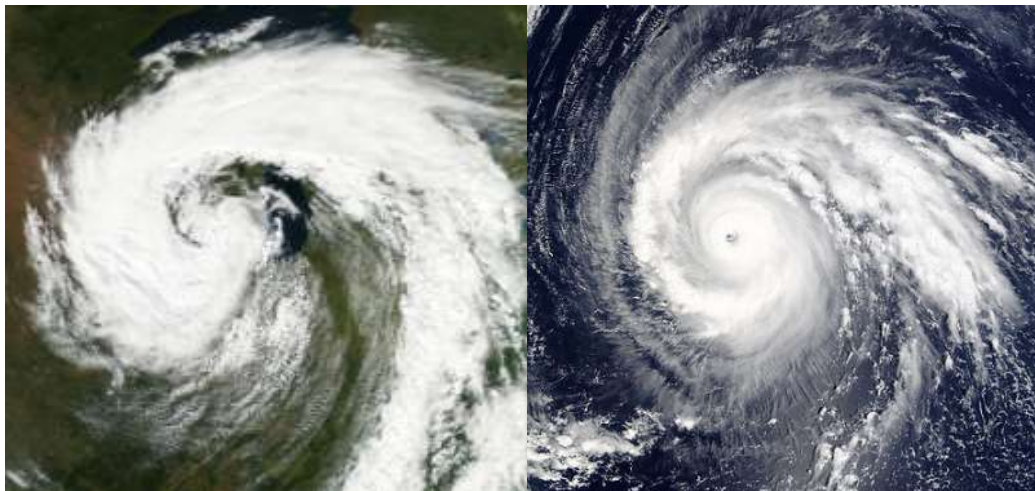


Figure 1

Figure 2

- a) Fig. 1 cyclone forms over cold tropical water. Zyklone bilden sich über tropischem, kaltem Wasser.
- b) Fig. 2 cyclone gains energy from condensation. Zyklone erhalten ihre Energie durch Kondensation.
- c) Fig. 1 cyclone is caused by upper air convergence. Zyklone werden durch Konvergenz in der höheren Luftschicht verursacht.
- d) Fig. 2 cyclone has boundaries separating air masses of different temperatures. Zyklone werden durch Luftmassen unterschiedlicher Temperaturen begrenzt.

**8.** Welche der folgenden untenstehenden Aussagen beschreiben die Interaktion zwischen  $\text{CaCO}_3$ ,  $\text{CO}_2$  and  $\text{H}_2\text{O}$ ?

Which of the statements below describe the interaction among  $\text{CaCO}_3$ ,  $\text{CO}_2$  and  $\text{H}_2\text{O}$ ?  
(**EACH** correct answer = 1 point; **EACH** wrong answer = -1 point)

- a) The formation of limestone. Die Bildung von Kalkstein.
- b) The dissolution of limestone. Das Auflösen von Kalkstein.
- c) The interaction between atmosphere and geosphere. Die Interaktion zwischen Atmosphäre und Geosphäre/Lithosphäre).
- d) The interaction among biosphere, hydrosphere and geosphere. Die Interaktion zwischen Biosphäre, Hydrosphäre und Geosphäre/Lithosphäre.

**9.** How many years ago did the solar system form due to the gravitational collapse (Zusammenfallen aufgrund von Gravitationskräften) of a giant interstellar molecular cloud (Wolke)? (Correct answer = 0.5 point)

- a)  $46 \times 10^6$
- b)  $460 \times 10^6$
- c)  $4.6 \times 10^9$
- d)  $46 \times 10^9$

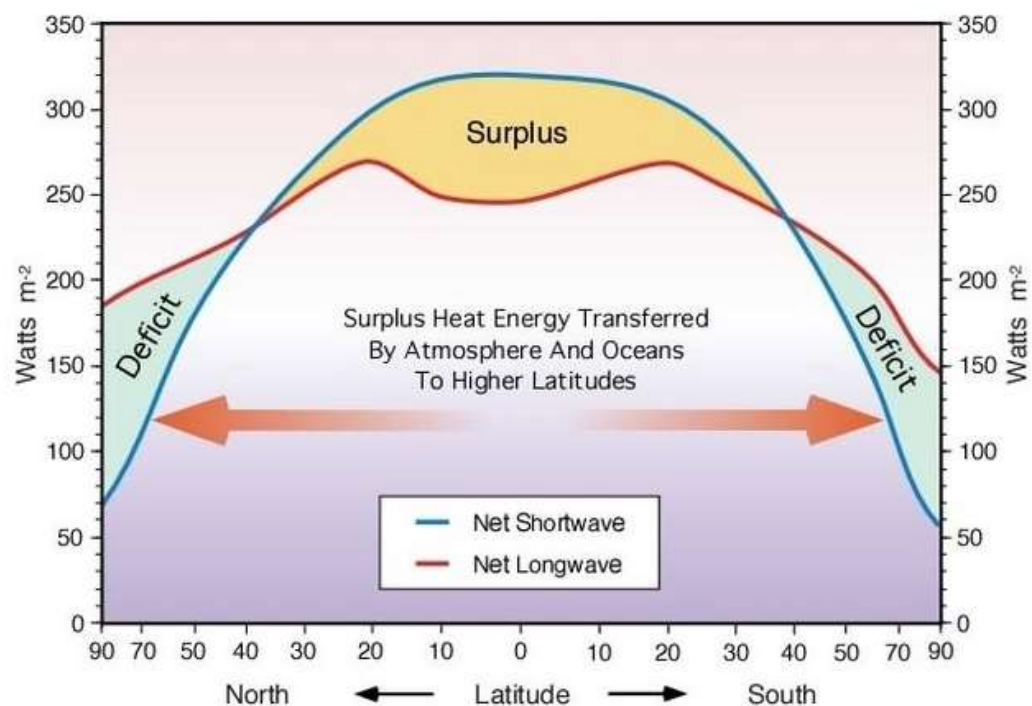
**10.** If a massive formation of stalactites (vermehrtes Auftreten von Stalaktiten) takes place in caves (Höhlen), which of the statements (Aussagen) below describe the outcome (welche Folgen das haben könnte)?

(**EACH** correct answer = 1 point; **EACH** wrong answer = -1 point)

- a) Accelerate the present climate change. Beschleunigung des heutigen Klimawandels.
- b) Slow down the present climate change. Verringerung des heutigen Klimawandels.
- c) Accelerate the precipitation rate of limestone in the ocean. Beschleunigung der Ausfällungsrate von Kalk im Ozean.
- d) Slow down the precipitation rate of limestone in the ocean. Verringerung der Ausfällungsrate von Kalkstein im Ozean.

11. The figure below shows the annual mean (Jahresmittelwert) of solar (shortwave (kurzwellige)) and terrestrial (long-wave (langwellige)) radiation (Strahlung). In the tropics (Tropen), incoming solar radiation (Sonnenstrahlung) exceeds (übertrifft) the outgoing (ausgehende) terrestrial radiation (terrestrische Strahlung) and, hence (als Folge), a surplus of energy exists (Energieüberschuss). The reverse holds (Das Gegenteil gilt) good for the high latitudes (Breiten). Thus, tropical surplus heat (tropische überschüssige Wärme) should be transferred towards the poles (sollte sich in Richtung Pole bewegen, um das Energiebudget im Gleichgewicht zu halten) to balance the energy budget.

Which one of the following statements does **NOT** reduce the latitudinal energy imbalance? Welche der folgenden Aussagen stimmt nicht, wenn das Energiegleichgewicht ausgeglichen werden soll. (Correct answer = 1 point)

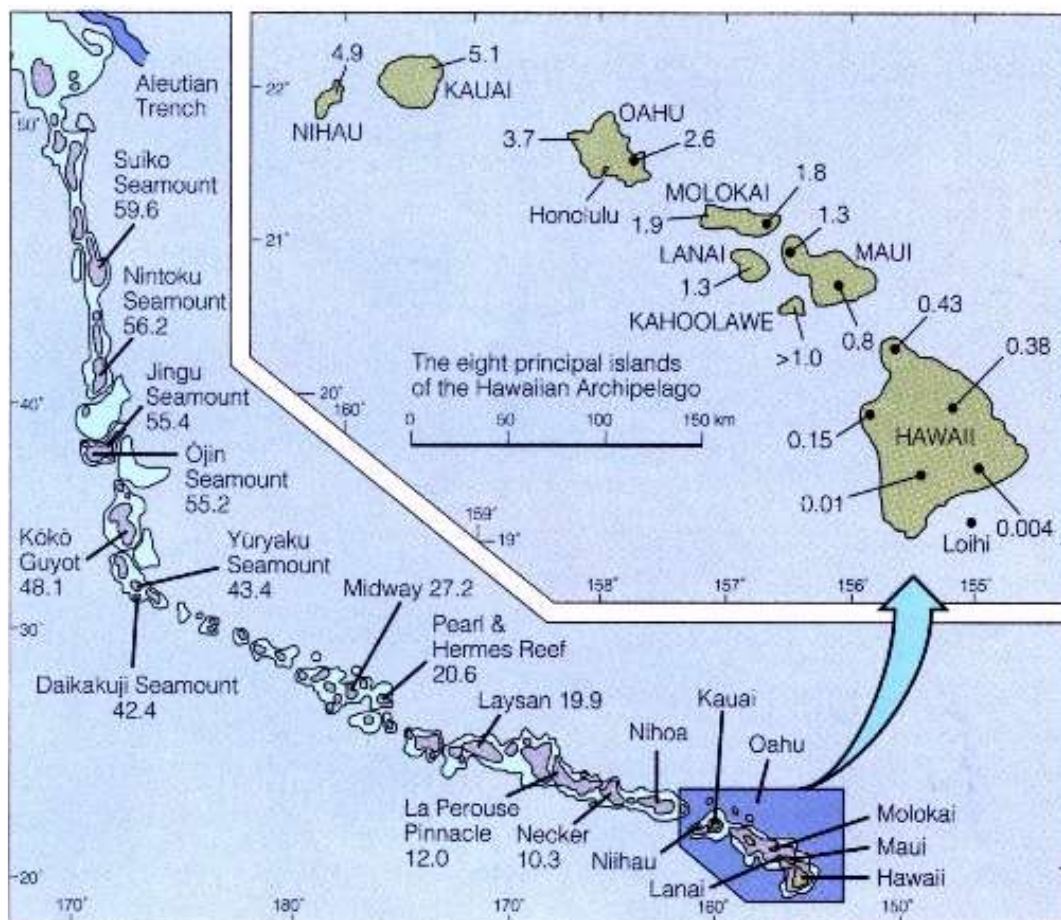


- Hurricanes (typhoons) move poleward (in Richtung der Pole).
- Cold currents flow towards the equator (in Richtung Äquator).
- Atmospheric circulation in the mid-latitudes (in mittleren Breiten).
- Cyclones develop in mid-latitudes (in mittleren Breiten).

12. For a given gas (für Gase gilt generell), a decrease (Abnahme) in temperature increases (steigert) its solubility (Löslichkeit) in water. How will global warming (Globale Erwärmung) influence (beeinflussen) the carbonate rocks (Karbonatsteine) on Earth? Choose the correct statement (Aussage) below. (Correct answer = 1 point)

- a) It will only increase (steigern) the dissolution (Auflösen) of limestone (Kalkstein).
- b) It will increase (steigern) the dissolution (Auflösen) of all the carbonate rocks (Karbonate).
- c) It will have no effect (keinen Effekt) on the dissolution (Auflösen) or formation (Bildung) of carbonate rocks.
- d) It will increase the formation of carbonate rocks (Karbonate).

13. The figure (die Abbildung) below shows the distribution (Verbreitung) of the Hawaiian and Emperor chains (Inselkette) with the geological age (geologisches Alter) of volcanic rocks (Vulkangesteinen) (unit (Einheit):  $10^6$  years). What is the velocity (Geschwindigkeit) of the Pacific plate movement (Plattenbewegung) at present (heute) on the basis of this distribution? Choose the correct statement (Aussage) from the list below (untenstehende Liste) (Correct answer = 1 point):



- a) 6 cm/year
- b) 60 cm/year
- c) 3 cm/year
- d) 30 cm/year

**14.** Which of the statements below (untenstehende Aussagen) describe the outcome (beschreiben das Ergebnis) of the increase (Zunahme) of CO<sub>2</sub> in the atmosphere? (**EACH** correct answer = 1 point; **EACH** wrong answer = -1 point))

- a) A decrease (Abnahme) in the formation (Bildung) of CaCO<sub>3</sub> in the oceans.
- b) The formation (Bildung) of CaCO<sub>3</sub> in the oceans.
- c) Acidification (Versauerung) of the oceans.
- d) An increase (Zunahme) in the growth (Wachstum) of coral reefs (Korallenriffe).

**15 –16.**The following paragraph (Absatz) concerning sunspots contains numbered blanks (nummerierte Lehrstellen). Please match (ordne zu) the numbered blanks with the correct letters from the word bank (Wortliste) provided below (siehe Tabelle). (Correct answer = 0.5 point)

A sunspot is a relatively colder part on the sun's surface. The number of sunspots typically changes with a periodicity (periodisch alle) of **(15)** years; solar activity is **(16)** when there are many sunspots.

**Word bank:** (a) 11 (b) 110 (c) 1100 (d) low (e) high (f) constant

Blank number in the paragraph	The matching letter from the word bank
15	
16	

**17.** How many times bigger is the diameter (Durchmesser) of the Sun compared (im Vergleich zu) to that of the Earth? (Correct answer = 0.5 point):

- a) About 100 times
- b) About 1,000 times
- c) About 10,000 times
- d) About 100,000 times

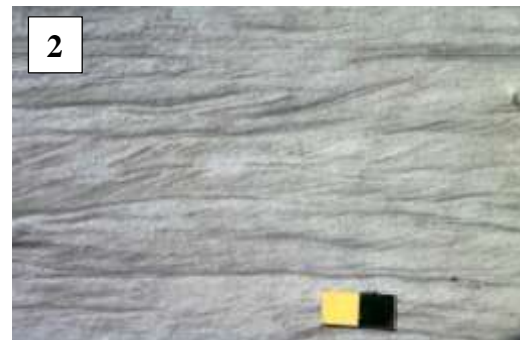
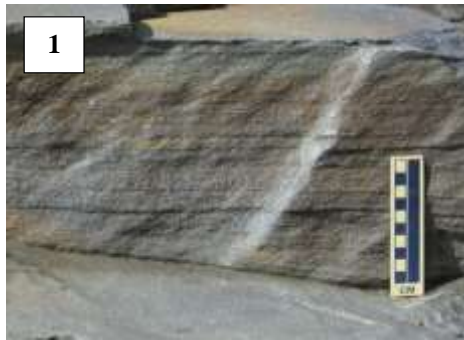


**18.** Both the figures below show medium-grained sandstone (mittelgroß gekörnter Sandstein).

Figure (1) shows horizontal lamination (Schichtung) and Figure (2) shows ripple cross-lamination (Rippelkreuzschichtung).

Choose the correct answer that explains (erklärt) these sedimentary structures (die Struktur des Ablagerungsgesteins)?

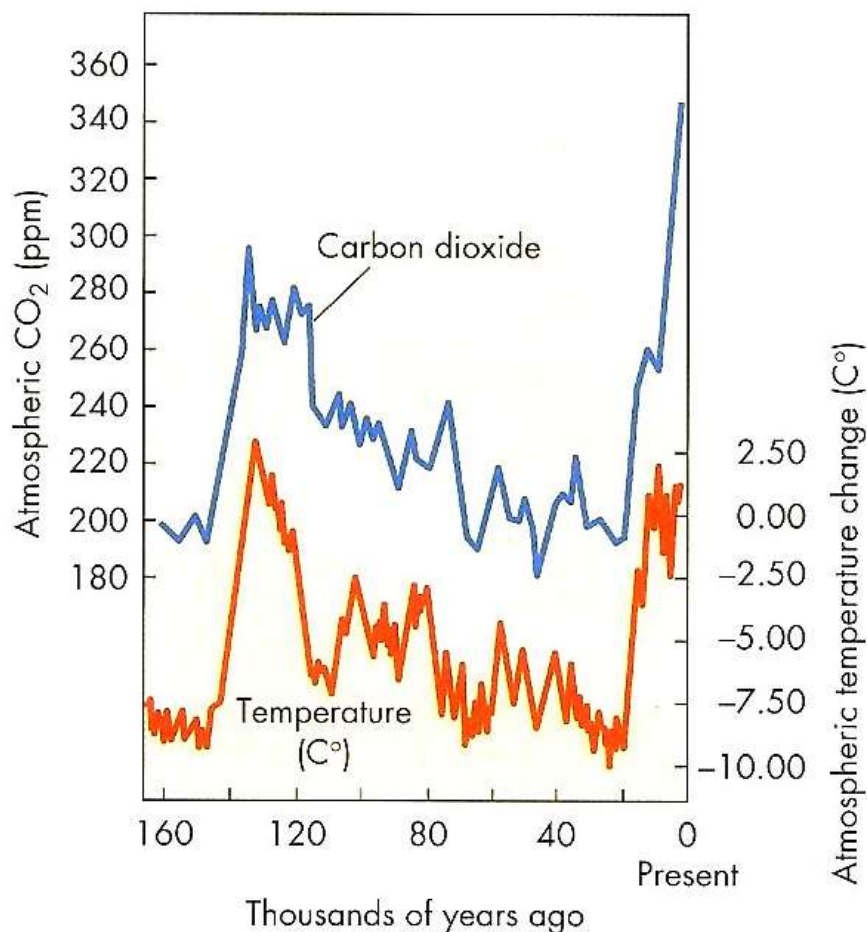
(Correct answer = 1 point).



- a) The water depth to form sedimentary structure (2) is deeper than that to form sedimentary structure (1).
- b) Sedimentary structure (2) is formed in a delta.
- c) Sedimentary structure (1) is formed by the settling (sinkende) of grains (Körner) in water.
- d) Sedimentary structure (1) requires (benötigt für die Entstehung) water flow (Fließgeschwindigkeiten) of a higher velocity (höhere Geschwindigkeit) when compared (im Vergleich zu) to that (zu denen) needed (benötigt) for sedimentary structure (2).

19. The following figure shows the inferred changes (Rückschluss/Folgerung) in the concentration of atmospheric carbon dioxide and temperature during the past 160,000 years.

Choose the correct answers to explain the geologic processes related to this figure. (EACH correct answer = 1 point; EACH wrong answer = -1 point)

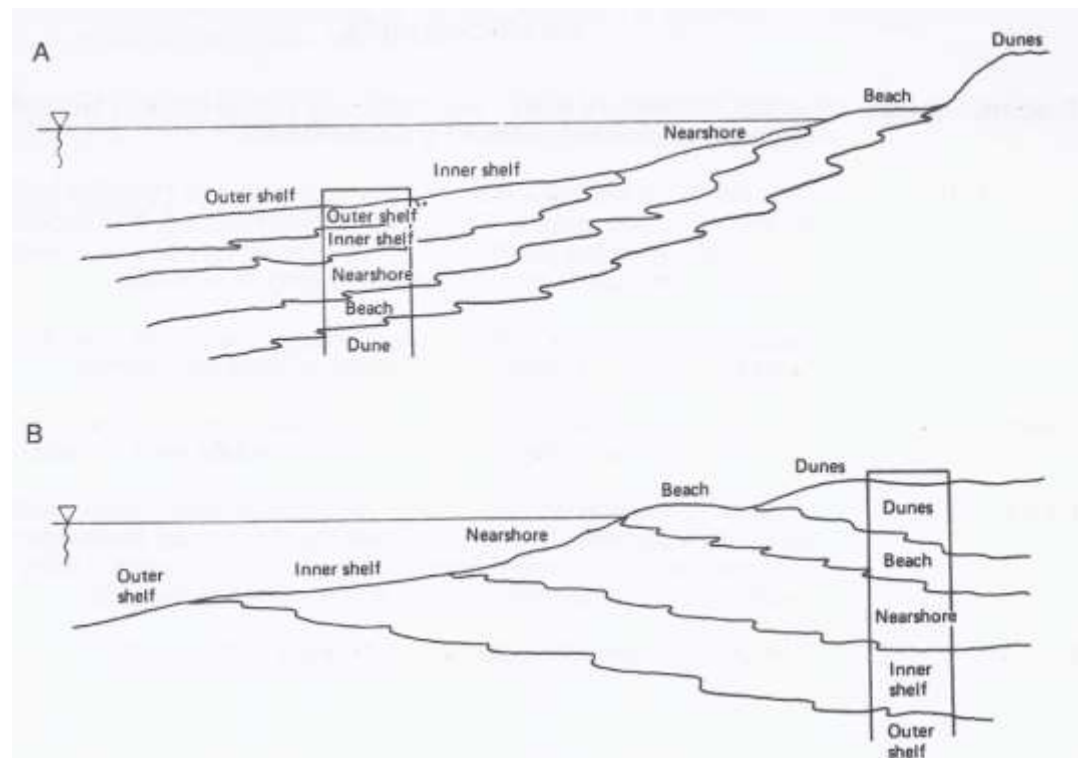


- The high concentration of atmospheric CO<sub>2</sub> at present is mainly caused by (verursacht durch) global warming.
- Ocean acidification (Ozeanversauerung) is expected and already recorded (dokumentiert/gemessen) at present due to (als Folge von) an increase (Zunahme) of atmospheric CO<sub>2</sub>.
- Development of glaciers in polar regions is expected (Gletscher entstehen vorraussichtlich in Polregionen) when the atmospheric CO<sub>2</sub> concentration is below (niedriger als) 220 ppm.
- Dissolution of limestone (Lösung von Kalkstein) exposed (freigelegt) on continents is thought to have occurred more effectively 20,000 years ago than 120,000 years ago.

20. Diagrams A and B show the development pattern (Entwicklungsform/-muster) of sequences in a coast-to-continental shelf setting (Setting eines Küste-zu-Kontinent Festlandssockels).

Choose the correct answer to explain the balance between the rate of sea level rise (Meeresspiegelanstieg) and the rate (Anteil) of sediment supply (Sedimentzufuhr) to the sea to form the sequences in (A) and (B).

(Choose the correct answer = 1 point)

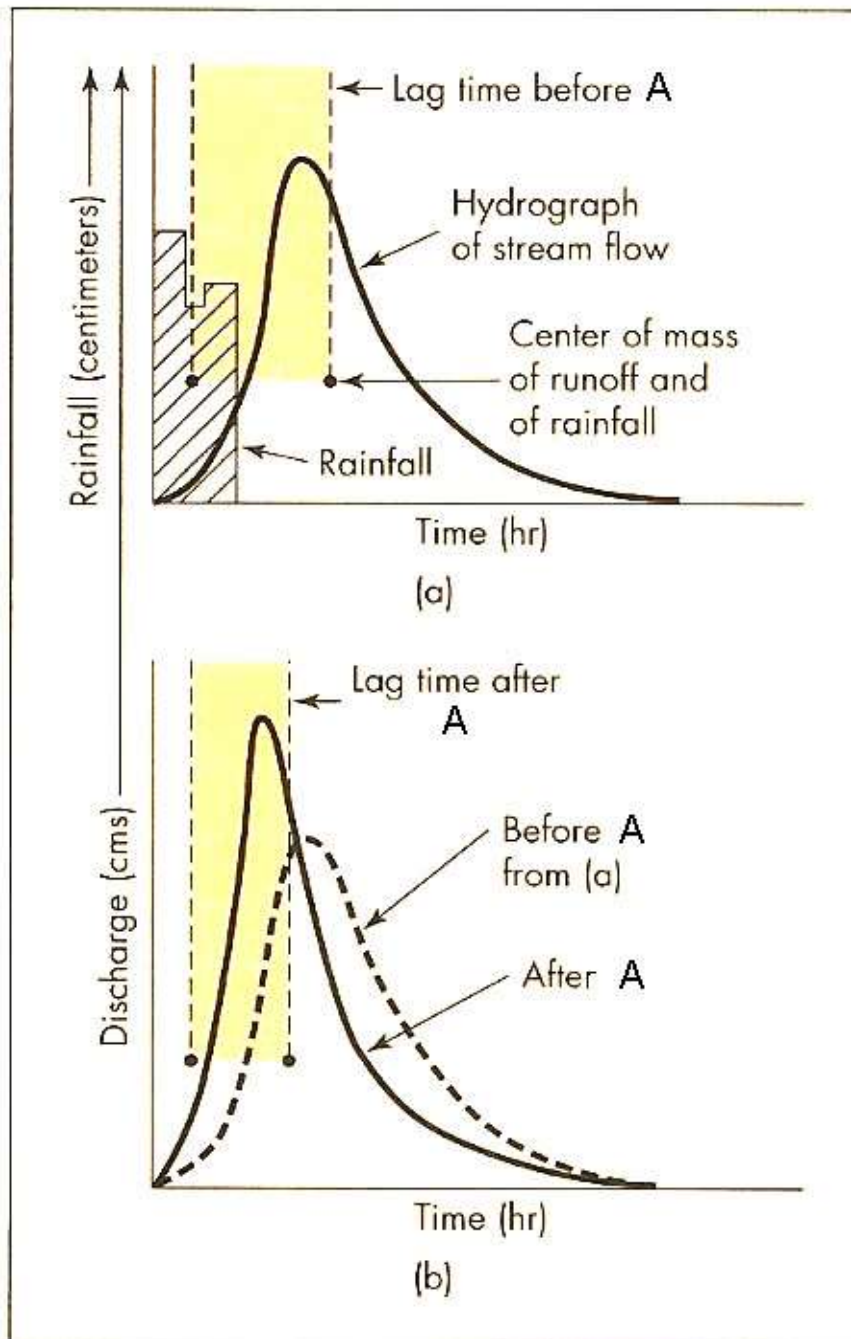


- a) In section A: rate of sea level rise = rate of sediment supply  
In section B: rate of sea level rise < rate of sediment supply
- b) In section A: rate of sea level rise > rate of sediment supply  
In section B: rate of sea level rise = rate of sediment supply
- c) In section A: rate of sea level rise > rate of sediment supply  
In section B: rate of sea level rise < rate of sediment supply
- d) In section A: rate of sea level rise < rate of sediment supply  
In section B: rate of sea level rise > rate of sediment supply

21. The Sun produces nuclear fusion (Kernfusion) by converting (durch Umwandlung von ) \_\_\_\_\_. (Correct answer = 0.5 point)

- a) Helium to Hydrogen,
- b) Hydrogen to Lithium,
- c) Helium to Carbon,
- d) Hydrogen to Helium

22. A hydrograph (Hydrograph) shows the rate of flow/discharge (Flußrate) versus time past a specific point in a river. The unit cms (cm/s) is cubic meters per second. Figure (a) is a hydrograph showing the typical lag (Verzögerung) between the time when most of the rainfall occurs and the time when the stream floods. "A" in the hydrographs below represent a factor which influences lag time. In Figure (b) there is a decrease (Rückgang) in lag time with the same amount of rainfall as in figure (a). What is the correct reason for this decrease? (Correct answer = 1 point).



Runoff=Abfluss  
Rainfall=Niederschlag

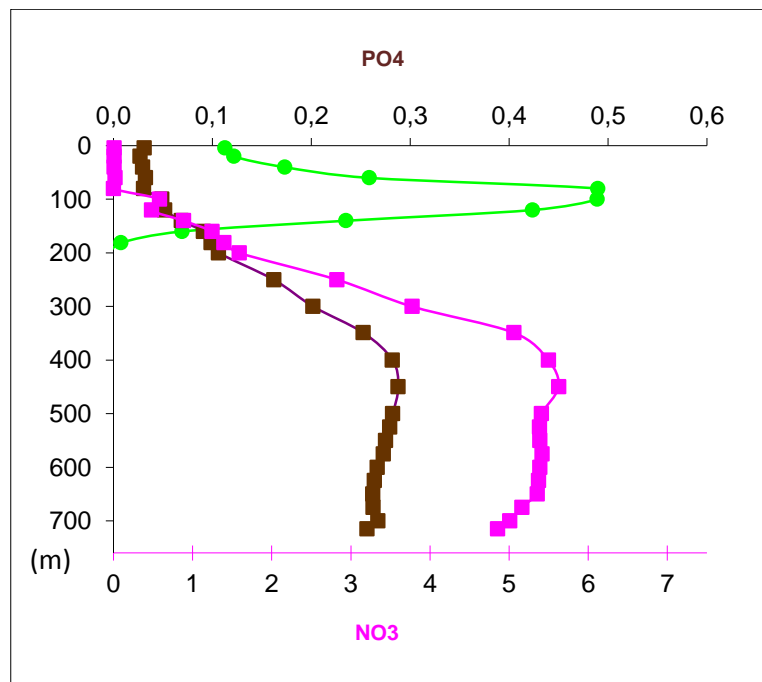
- a) Construction of upstream (flussaufwärts) retention ponds (Auffangwanne)
- b) Storm
- c) Urbanization (Städtebildung)
- d) Restoration of catchment forestation (Aufforstung des Umlandes)

23. Which of the statements below correctly describes the outcome (Resultat) of the formation of limestone (Kalkstein) and chalk (Kreide)? (Correct answer = 1 point)

- a) An increase in the amount of CO<sub>2</sub> in the hydrosphere and in the atmosphere.
- b) An increase in the amount of CO<sub>2</sub> in the atmosphere only.
- c) A decrease in the amount of CO<sub>2</sub> in the atmosphere and in the hydrosphere.
- d) A decrease in the amount of CO<sub>2</sub> in the hydrosphere only.

24. The green line in the graph below presents the chlorophyll content (water depth-wise) in the Gulf of Aqaba (latitude 29°) (29° Breitengrad). Which of the items below is related to the high amount of chlorophyll at shallow depth (~ 100 m)?

(Correct answer = 1 point)



- a) The concentration of CO<sub>2</sub> in the atmosphere
- b) The sun light and water
- c) The salinity (Salzgehalt) of the water
- d) The amount of nitrate and phosphate

25. Which of the options below do **NOT** reflect the interrelationships (Wechselbeziehung) between the Earth systems and the formation of limestone and chalk? (**EACH** correct answer = 1 point; **EACH** wrong answer = -1 point)

- a) Geosphere (Geosphäre), atmosphere (Atmosphäre), hydrosphere (Hydrosphäre) and biosphere (Biosphäre).
- b) Only the geosphere, atmosphere and hydrosphere.
- c) Only the biosphere, hydrosphere and geosphere.
- d) Only the biosphere, atmosphere and geosphere.

**26.** What is the average surface temperature (durchschnittliche Oberflächentemperatur) of the Sun? (Correct answer = 0.5 point)

- a) 3750°C
- b) 4750°C
- c) 5750°C
- d) 6750°C
- e) 7750°C

**27 – 40.** The following paragraph (concerning (betreffend) our solar system) contains (enthält) numbered blanks (numerierte Leerstellen). Please match (zuordnen) the numbered blanks with the correct letters (Buchstaben) from the word bank (Begriffsauswahl) provided below. (Each correct answer = 0.5 point):

The four inner planets - Mercury, Venus, Earth and Mars - are called (27), which are made up of (28) and (29). The four outer planets are (30). Jupiter and Saturn, are (31), and are mainly composed (bestehen aus) of (32) and (33). Uranus and Neptune are (34), and are mainly composed of (35), (36) and (37). Smaller objects also exist in the Solar System, mostly between (38) and (39), which is called (40).

**Word bank:**

<b>a)</b> Rock	<b>m)</b> Ice giants
<b>b)</b> Ice giant (Eisriese)	<b>n)</b> Scattered disc (Streuscheibe)
<b>c)</b> Methane (Methan)	<b>o)</b> Water
<b>d)</b> Mars	<b>p)</b> Venus
<b>e)</b> Neptune	<b>r)</b> Saturn
<b>f)</b> Kuiper belt (Kuipergürtel)	<b>s)</b> Ammonia (Ammoniak)
<b>g)</b> Metal	<b>t)</b> Earth
<b>h)</b> Hydrogen	<b>u)</b> Uranus
<b>i)</b> Helium	<b>v)</b> Gas giants (Gasriesen)
<b>j)</b> Giant planets (Riesenplanet)	<b>w)</b> Asteroid belt (Asteroidengürtel)
<b>k)</b> Mercury	<b>x)</b> Rocky planets (Felsplaneten)
<b>l)</b> Jupiter	<b>y)</b> Planetesimals (Planetesimale)

<b>Blank number in the paragraph</b>	<b>The matching letter from the word bank</b>
27	
28	
29	
30	
31	
32	
33	
34	
35	
36	
37	
38	
39	
40	

**41.** Which of the options below (untenstehende Auswahl) is the correct order of the size of carbon reservoirs (Kohlenstoffreservoir) on Earth? (Correct answer = 1 point).

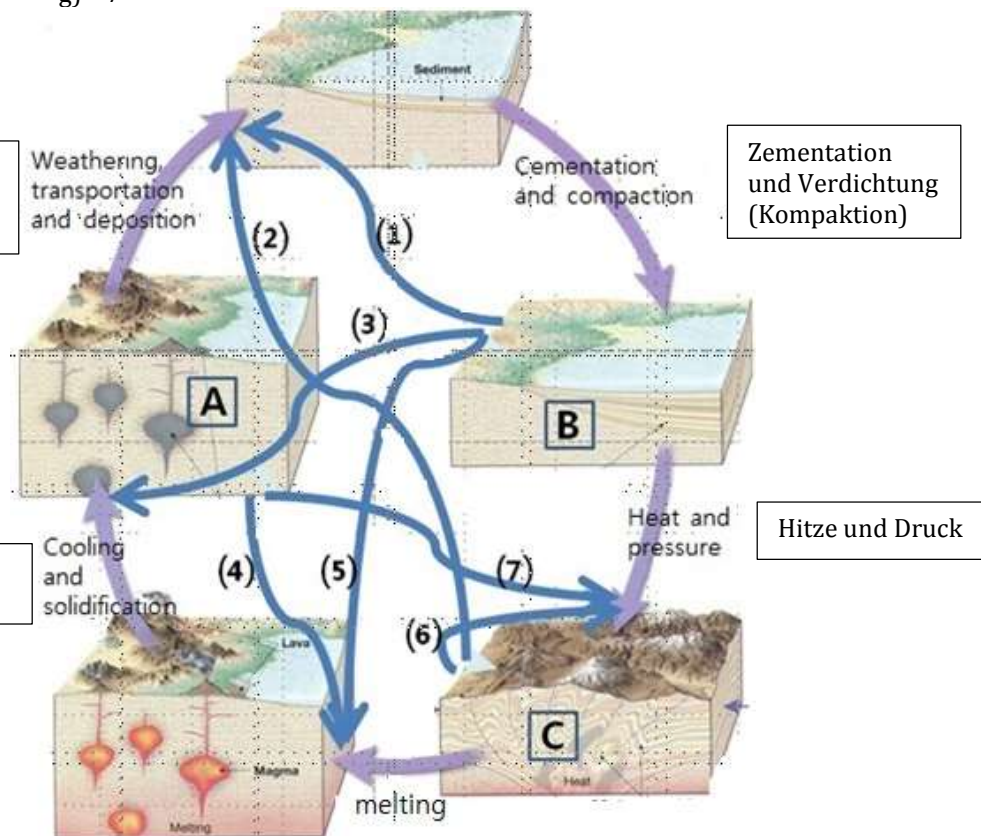
- a) Atmosphere (the largest).  
Biosphere  
Hydrosphere  
Geosphere (the smallest) Geosphere = Lithosphäre
- b) Atmosphere (the largest).  
Biosphere  
Geosphere  
Hydrosphere (the smallest)
- c) Biosphere (the largest).  
Atmosphere  
Geosphere  
Hydrosphere (the smallest)
- d) Geosphere (the largest).  
Atmosphere  
Biosphere  
Hydrosphere (the smallest)
- e) Geosphere (the largest).  
Hydrosphere  
Biosphere  
Atmosphere (the smallest)

**42.** Which of the following statements is true about the conditions under which carbonate sedimentation (Carbonatsedimentation) occurs (stattfinden) in oceans? (Correct answer = 1 point).

- a) The formation (Bildung) of carbonate sediments is promoted (begünstigt) through respiration (Atmung) of living organisms.
- b) Carbonate sedimentation is relatively high in oceans with conditions for rapid photosynthesis (schnelle Photosynthese).
- c) Oceanic carbonate sediments are primarily derived (stammen hauptsächlich von) from the erosion (Erosion) of limestone deposits (Kalksteinablagerungen) in continents.
- d) Carbonate sedimentation is relatively high in warmer oceans.

43. Which of the pathways (Pfad) (1-7 in the diagram below) cannot occur (auftreten) in nature? (Correct answer = 1 point)

- a) 1
- b) 2
- c) 3
- d) 4
- e) 5
- f) 6
- g) 7



44. While walking in a mountain range (Gebirgszug), you find a fossil reef (fossils Riff) in a limestone layer (Kalksteinablagern). What might you conclude based on this field observation? (Was kannst aufgrund dieser Beobachtung schließen) (Correct answer = 1 point)

- a) It is most likely (höchstwahrscheinlich) that this area was an ancient deep ocean floor (vorzeitlicher tiefer Ozeanboden)
- b) It is most likely that this area was a continental shelf located in an area with rather warm water.
- c) It is most likely that this area was a continental shelf located in a rather cold area.
- d) It is most likely that this area was a former continental slope (Kontinentalhang) beneath which detrital sediments (Verwitterungsschutt) have been accumulating (angesammelt).



**45 - 47.** In the photograph below, the darker units (dunkleren Bereiche) are metamorphic rocks (metamorphes Gestein) with some igneous intrusions (mit einigen vulkanischen Aufwölbungen) and the lighter unit consists of (hellerer Bereich besteht aus) limestone, dolomite, chalk and chert (Flint/Feuerstein).

Question numbers 45, 46 and 47 are related to this photograph.



**45.** Which of the structures below is most likely the reason (am ehesten der Grund für) for this appearance (Auftreten) of the rocks units (Gesteinseinheiten)? (Correct answer = 1 point)

- a) Syncline ( nach unten gewölbte Falte)
- b) Anticline (nach oben gewölbte Falte)
- c) Horst
- d) Graben

**46.** What are the geologic processes that took place in the area? Choose the correct answers. (**EACH** correct answer = 1 point, **EACH** wrong answer = -1 point)

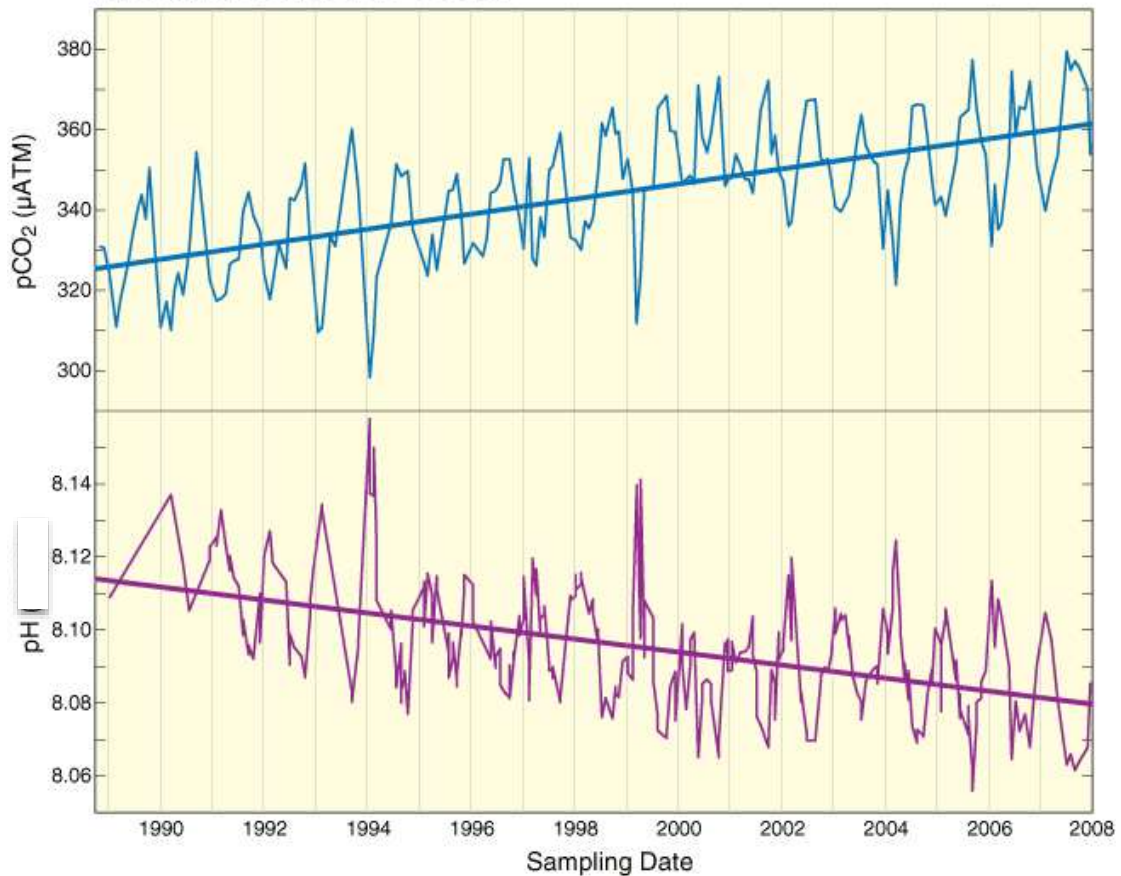
- a) Sedimentation
- b) Metamorphism
- c) Volcanic eruptions
- d) Magmatic intrusions (Magmatische Eindringen/Verlagerungen)
- e) Erosion
- f) Chemical weathering (chemische Verwitterung)
- g) Lithification (Versteinerung)
- h) Melting (Schmelzen)
- i) Burial (Verschüttung)
- j) Uplift (Hebung)

47. Which of the sequences given below (unten stehende Abfolge/Reihenfolge) best describes the order of the geological processes that took place (stattfinden) in the area? (Correct answer = 1 point)

- a) Metamorphism, erosion, magmatic intrusions (Verlagerung), sedimentation, erosion.
- b) Metamorphism, magmatic intrusions, erosion, sedimentation, erosion.
- c) Metamorphism, sedimentation, magmatic intrusions, erosion.
- d) Metamorphism, magmatic intrusions, volcanic eruptions (Vulkanausbrüche), sedimentation, erosion.

48. The graph below depicts (darstellen) the changes of atmospheric CO<sub>2</sub> concentration and the pH (pH Wert) of the Pacific Ocean water. The measurements were made in Hawaii from 1990 to 2008. Based on the graph, mark the correct statements in the list below. (EACH correct answer = 1 point; EACH wrong answer = -1 point)

**The Station ALOHA Curve**



- When the pH increases, CO<sub>2</sub> is released from the ocean to the atmosphere.
- Global warming causes an increase in atmospheric CO<sub>2</sub> concentration and the ocean water becomes more acidic (sauer).
- When atmospheric CO<sub>2</sub> concentration increases, CO<sub>2</sub> gets into the ocean and the ocean water becomes more acidic.
- If only the atmospheric CO<sub>2</sub> concentration was increasing and the oceanic pH was constant, global warming would be more rapid.
- If only atmospheric CO<sub>2</sub> concentration was increasing and the oceanic pH was constant, global warming would be slower.
- An increase in oceanic CO<sub>2</sub> concentration can affect (beeinflussen) coral reef (Korallenriffe).
- The annual variation (jährliche Schwankung) of the atmospheric CO<sub>2</sub> concentration is a result of biological activity.
- The common explanation (übliche Erklärung) for the increase of atmospheric CO<sub>2</sub> concentration is human activity, mostly fossil fuel burning (Verbrennung fossiler Brennstoffe) and forest fires.
- The atmospheric CO<sub>2</sub> data shown (vorliegende Daten) represent only the changes in the Pacific Ocean.

**49.** What is the dated age (datiertes Alter) of the rocks in which the first evidence (erste Beweis) of life forms appeared (aufgetreten ist)? (Correct answer = 0.5 point):

- a) Approximately  $380 \times 10^6$  years ago.
- b) Approximately  $550 \times 10^6$  years ago.
- c) Approximately  $3.8 \times 10^9$  years ago.
- d) Approximately  $4.6 \times 10^9$  years ago.

**50.** Which of the statements below correctly describe the change in the CO<sub>2</sub> concentration in the primitive atmosphere of the Archaean Earth (Urerde)?

(**EACH** correct answer = 1 point; **EACH** wrong answer = -1 point):

- a) Increased (erhöht) following the appearance (Auftreten) of life on earth.
- b) Decreased (senkt) following the appearance of photosynthetic organisms.
- c) Decreased following the formation of calcium carbonate by living organisms.
- d) Increased following the formation of calcium carbonate by living organisms.
- e) Decreased following the weathering (Verwitterung) of igneous minerals (vulkanisches Gestein).
- f) Increased following the weathering of igneous minerals.

**51 - 52.** The following paragraph concerning the Sun contains numbered blanks. Please match the numbered blanks with the correct letters from the word bank provided below. (Correct answer = 0.5 point)

The Sun ejects charged particles, referred to as (bezeichnet als) (**51**), with the speed of several (**52**) of km/s

**Word bank:**

- a) Corona
- b) Solar wind
- c) Solar flare
- d) Tens
- e) Hundreds
- f) Thousands
- g) Ten thousands

Blank number in the paragraph	The matching letter from the word bank
51	
52	

**53 – 56.**The following paragraph concerning fossil fuels (bezugnehmend auf fossile Brennstoffe) contains numbered blanks. Please match the numbered blanks with the correct letters from the word bank provided below. (Correct answer = 0.5 point)

Fossils of (**53**), which derive energy through (welche ihre Energie beziehen aus (**54**), existed in the ocean and produced (**55**). This created (**56**) in the Archaean oceans (Urozean).

**Word bank:**

- a) Cyanobacteria
- b) Burgess Shale (Burgess Schiefer)
- c) Oxygen
- d) Brachiopoda
- e) Zooplankton
- f) Nickel ore (Nickelerz)
- g) Photosynthesis
- h) Trilobites
- i) Uranium ore (Uranerz)
- j) Stromatolites
- k) Nitrogen
- l) Banded Iron Formation (gebänderte Eisenformation)
- m) Crinoids (Crinoiden/Stielglieder)

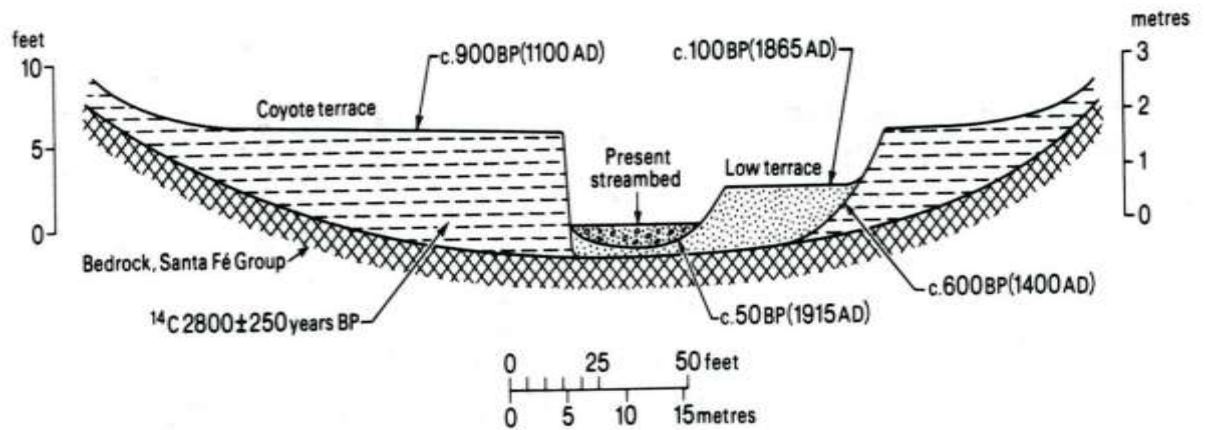
Blank number in the paragraph	The matching letter from the word bank
53	
54	
55	
56	

**57.** Which of the statements below correctly describe the tendency of weathering of feldspars (Verwitterung von Feldspat)? (**EACH** correct answer = 1 point; **EACH** wrong answer = -1 point)

- a) Decreases the amount (senkt den Wert) of CO<sub>2</sub> in the atmosphere.
- b) Increases the amount (erhöht den Wert) of CO<sub>2</sub> in the atmosphere.
- c) Enhances (fördert/hebt) the acidification (Versauerung) of the oceans.
- d) Limits (begrenzt) the acidification of the oceans.
- e) Increases the formation of calcium carbonate.
- f) Decreases the formation of calcium carbonate.

**58 – 59.** The cross section (Querschnitt) below represents terraces in a desert (Terrassen in einer Wüste). The terraces were dated and their ages are presented in the figure.

Question numbers 58 and 59 are related to this diagram.



**58.** What is the rate of deposition (Ablagerungsrate) in the older terrace? (Correct answer = 1 point)

- a) One meter in 1000 years.
- b) One meter in 100 years.
- c) One meter in 300 years.
- d) Three meters in 1000 years.

**59.** What can be the reasons for the incision (Einschnitt) of the valley? Choose the correct answers. (EACH correct answer = 1 point; EACH wrong answer = -1 point)

- a) Change in the base level (Grundniveau)
- b) Climate became drier. (trockener)
- c) Climate became wet. (feucht)
- d) Changes in the drainage basin (Entwässerungsgebiet/Wasserscheide) over time.

**60 – 67.** The following paragraph concerning the Earth's early evolution (über die Frühzeit der Evolution der Erde) contains numbered blanks. Please match (zuordnen) the numbered blanks with the correct letters from the word bank provided below. (Correct answer = 0.5 point)

The Earth formed (**60**) years ago by accretion (Zusammenziehung) from the solar nebula. The early Earth was (**61**) from the surface (Oberfläche) to the core (Kern) and heavy (**62**) sunk (gesunken), leading to the formation (führt zum Aufbau) of the (**63**). The surface was covered (bedeckt) with a (**64**) and volcanic outgassing (vulkanische Ausgasung) created the primordial atmosphere (Uratmosphäre) with (**65**) oxygen. Then Earth cooled and formed a crust (Kruste), with the ocean at the surface. This is the beginning of the (**66**) age, which occupies (einnimmt) the (**67**) span of time in the Earth's history.

**Word bank:**

a) hydrogen	l) iron
b) oxygen	m) mantle
c) reductive (reduzierend)	n) core
d) nitrogen (Stickstoff)	o) magma ocean
e) water	p) set of plates (Anzahl an Platten)
f) $460 \times 10^6$	q) plenty of
g) $4.6 \times 10^9$	r) no
h) $46 \times 10^9$	s) smallest
i) solid	t) largest
j) molten (geschmolzen)	u) Cambrian (Kambrium)
k) silicon (Silizium)	v) Precambrian (Präkambrium)

Blank number in the paragraph	The matching letter from the word bank
60	
61	
62	
63	
64	
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66	
67	