

## Test 2

(1) Metazoa is a Kingdom of \_\_\_\_\_.

- (A) many-celled animals (B) many-celled plants (C) unicelled plants (D) unicelled animals  
[A]

(2) Organisms, which swim weakly or drift, belong to \_\_\_\_\_.

- (A) neuston (B) benthos (C) plankton (D) nekton  
[C]

(3) The mesopelagic province occupies the depth range \_\_\_\_\_.

- (A) 0-200m (B) 200-1000m (C) 2000-6000m (D) 200-3000m  
[B]

(4) The neritic zone is \_\_\_\_\_.

- (A) the water that overlies the continental shelf (B) the deep water of the oceans beyond the shelf break (C) the open water that lies seaward of the breaker zone (D) the pelagic province extending downward from the ocean surface to a water depth of ~ 200 m.  
[A]

(5) Benthos includes organisms which \_\_\_\_\_.

- (A) are microscopic in size (B) live on or beneath the bottom (C) drift or swim weakly (D) active swimmers  
[B]

(6) Ecosystems function by the exchange of matter and energy. Consider two statements. (i) within ecosystems, material (matter) is constantly recycled; and (ii) energy is continuously added in and dissipated from ecosystems.

- (A) (i) false & (ii) true (B) (i) & (ii) both true (C) (i) & (ii) both false (D) (i) true & (ii) false  
[B]

(7) The aphotic zone is the area, which receives \_\_\_\_\_.

- (A) no light (B) plenty of iron (C) no nutrients (D) little light (E) small zooplankton  
[A]

(8) The energy transfer between trophic levels in upwelling regions is \_\_\_\_\_.

- (A) about 30% (B) about 12% (C) about 20% (D) about 10%  
[C]

(9) The food web is \_\_\_\_\_.

- (A) biochemical reaction (B) simple, linear, stepwise succession in nutritional relationships (C) combination of trophic levels (D) network of trophic interactions between organisms  
[D]

(10) If the food is abundant, consumers can catch prey with less effort leading to \_\_\_\_\_.

- (A) increase in their body size (B) higher efficiency in transferring energy between trophic levels (C) higher sedimentation rates of particulate organic matter (D) decrease in overall community productivity  
[B]

## Test 3

1). All phototrophs take up CO<sub>2</sub> (i) to produce organic matter (ii) and oxygen (iii)

- A) i and ii only are correct; iii is incorrect  
B) i and iii only are correct; ii is incorrect  
C) i, ii and iii are correct  
D) ii only is correct  
E) None is correct

[C]

2). Which statement is correct?

- A) Respiration can only happen in the presence of oxygen
- B) All heterotrophs are herbivores
- C) Cyanobacteria account for a very small fraction of primary production in the ocean
- D) Heterotrophs require inorganic phosphate for growth
- E) Phytoplankton cells respire a fraction of the organic matter they photosynthesize to sustain their own metabolism

[E]

3). Ecosystems found at hydrothermal vents are supported by

- A) Sunlight
- B) The energy produced during the oxidation of hydrogen sulfide present in the hydrothermal fluid emerging from the seafloor and oxygen in seawater
- C) The heat associated with the hydrothermal fluid from the seafloor
- D) The respiration of organic matter settling down from surface water
- E) The respiration of organic matter brought to the site by deep ocean currents

[B]

4). Which statement is incorrect?

- A) Nitrate and phosphate concentrations are lower in surface water
- B) Photosynthesis is restricted to the euphotic zone of the ocean
- C) Nitrate and phosphate concentrations are higher in Atlantic deep water than in Pacific deep water
- D) The ratio of nitrate to phosphate concentration in seawater is 16:1
- E) Some of the organic matter produced by phytoplankton is respired in the euphotic zone

[C]

5). Gross production by phytoplankton =

- A) Export production
- B) Net production + New production
- C) Regenerated production + New production + phytoplankton respiration
- D) Regenerated production + New production
- E) Net production + Export production

[C]

6). Which statement is incorrect?

- A) ocean productivity is lower at the equator because of thermal stratification of the upper water column
- B) ocean productivity is high in the Arabian Sea during summer because of upwelling resulting from the summer monsoon
- C) ocean productivity is high off the west coast of Africa and America because of upwelling produced by the Trade winds
- D) ocean productivity is highly seasonal at mid latitudes due to seasonal changes in sea surface temperature and stratification
- E) phytoplankton blooms are often associated with melting sea ice at high latitude in summer

[A]

7). It is important to study the cycling of carbon on Earth because (i) CO<sub>2</sub> concentration in the atmosphere is an important factor affecting global climate through greenhouse warming (ii) dissolved CO<sub>2</sub> controls the acidity of seawater (iii) the cycle of carbon control the level of atmospheric nitrogen on long time scales

- A) (i), (ii) and (iii) are true
- B) (i) and (ii) are true; (iii) is false
- C) (i) and (iii) are true; (ii) is false
- D) (i) is true; (ii) and (iii) are false
- E) (ii) and (iii) are true; (i) is false

[B]

8). The largest carbon reservoir on Earth is found

- A) in the atmosphere
- B) in the ocean
- C) in marine sediments
- D) as organic carbon in sedimentary rocks
- E) as limestone in sedimentary rocks

[E]

9). If we were to burn all the fossil fuel available in the Earth's crust, which of the following WOULD NOT be happening? We would

- A) increase the concentration of CO<sub>2</sub> in the atmosphere
- B) increase the acidity of the ocean
- C) increase global warming
- D) severely decrease the level of oxygen in the atmosphere
- E) decrease the level of oxygen, but by a very small fraction which would be barely measurable

[D]

10). Which of the following statement is FALSE

- A) Methane is a very potent greenhouse gas
- B) carbon is found in marine sediments as organic carbon and carbonate minerals
- C) fossil fuel consists of inorganic carbon
- D) some plankton species produce shells made of CaCO<sub>3</sub>
- E) there is much more inorganic carbon dissolved in seawater than carbon dioxide gas in the atmosphere

[C]

11). Which of the following carbon reservoir is NOT involved in the organic carbon cycle?

- A) CH<sub>4</sub>
- B) atmospheric CO<sub>2</sub>
- C) biomass
- D) limestone
- E) soils and sediments

[D]

12). On seasonal timescale, atmospheric CO<sub>2</sub> ..

- A) is at steady state
- B) decreases from May to September in the northern hemisphere
- C) decreases from May to September in the southern hemisphere
- D) increases substantially during winter near the poles but changes little at the equator
- E) does not change throughout the year

[B]

13). Which of the following statement is FALSE?

- A) Atmospheric CO<sub>2</sub> increases as a result of fossil fuel burning and deforestation
- B) Atmospheric CO<sub>2</sub> fluctuates seasonally as a result of exchange of carbon with land biomass
- C) It is the balance between CO<sub>2</sub> uptake during photosynthesis by land plants and CO<sub>2</sub> release by land heterotrophs that produces seasonal variations in atmospheric CO<sub>2</sub>
- D) Seasonal variations in atmospheric CO<sub>2</sub> are smaller in the southern hemisphere
- E) Atmospheric CO<sub>2</sub> fluctuates seasonally as a result of CO<sub>2</sub> uptake during photosynthesis by marine phytoplankton and CO<sub>2</sub> release by marine heterotrophs

[E]

14). Considering that the atmosphere contains 760 Gtons of carbon as CO<sub>2</sub> and the annual uptake of CO<sub>2</sub> by photosynthesis is 60 Gtons, and assuming that atmospheric CO<sub>2</sub> is at steady-state, which of the following statement is CORRECT?

- A) the rate of CO<sub>2</sub> release to the atmosphere by respiration is 60 Gtons/year and the residence time of CO<sub>2</sub> in the atmosphere is 760/60 years
- B) the rate of CO<sub>2</sub> release to the atmosphere by respiration is 60 Gtons/year and the residence time of CO<sub>2</sub> in the atmosphere is 60/760 years
- C) the rate of CO<sub>2</sub> release to the atmosphere by respiration is 760 Gtons/year and the residence time of CO<sub>2</sub> in the atmosphere is 60/760 years
- D) the rate of CO<sub>2</sub> release to the atmosphere by respiration is 760 Gtons/year and the residence time of CO<sub>2</sub> in the atmosphere is 760/60 years
- E) the rate of CO<sub>2</sub> release to the atmosphere by respiration is 700 Gtons/year and the residence time of CO<sub>2</sub> in the atmosphere is 760/60 years

[A]

15). The CO<sub>2</sub> fertilization effect is a negative feedback loop which helps mitigating the rise in anthropogenic CO<sub>2</sub> in the atmosphere because..

- A) higher temperature increases the rate of decomposition of organic matter in soils
- B) higher atmospheric CO<sub>2</sub> increases the acidity of the ocean
- C) higher atmospheric CO<sub>2</sub> decreases the photosynthetic rate of land plants
- D) higher atmospheric CO<sub>2</sub> increases the photosynthetic rate of land plants
- E) higher atmospheric CO<sub>2</sub> fertilizes the ocean and increase CO<sub>2</sub> uptake by marine plankton

[D]

16). On timescales of millions of years or longer, atmospheric CO<sub>2</sub> is controlled by..

- A) the balance between uptake of CO<sub>2</sub> from the atmosphere into the ocean and addition of CO<sub>2</sub> to the atmosphere by volcanism
- B) the balance between uptake of CO<sub>2</sub> from the atmosphere during weathering and addition of CO<sub>2</sub> to the atmosphere by volcanism
- C) the balance between release of CO<sub>2</sub> from the atmosphere during photosynthesis and CO<sub>2</sub> uptake by respiration
- D) the balance between carbon burial in sediment and metamorphism at mid ocean ridges
- E) the balance between uptake of CO<sub>2</sub> from the atmosphere during weathering and CO<sub>2</sub> release by respiration

[B]

17). A negative feedback loop stabilizes atmospheric CO<sub>2</sub> on timescales of millions of years or longer because..

- A) higher atmospheric CO<sub>2</sub> increases the rate of decomposition of organic matter in sedimentary rocks
- B) higher atmospheric CO<sub>2</sub> decreases the acidity of the ocean
- C) higher atmospheric CO<sub>2</sub> decreases the photosynthetic rate of land plants
- D) higher atmospheric CO<sub>2</sub> decreases weathering rates of silicate minerals
- E) higher atmospheric CO<sub>2</sub> increases weathering rates of silicate minerals

[E]

18). Which of the following statement is FALSE

- A) Atmospheric CO<sub>2</sub> dissolving in rain water produces carbonic acid (H<sub>2</sub>CO<sub>3</sub>)
- B) Carbonic acid in rain water reacts with continental crust minerals to produce calcium ions (Ca<sup>2+</sup>), carbonate ions (CO<sub>3</sub><sup>=</sup>) and dissolved silica (SiO<sub>2</sub>), which are discharged by rivers and groundwater to the ocean
- C) Calcium ions (Ca<sup>2+</sup>), carbonate ions (CO<sub>3</sub><sup>=</sup>) and dissolved silica (SiO<sub>2</sub>) are taken up by marine plankton to produce shells of calcium carbonate (CaCO<sub>3</sub>) and biogenic silica (SiO<sub>2</sub>) which accumulate on the seafloor
- D) The shells of calcium carbonate which accumulate on the seafloor are slowly transported to subduction zones by seafloor spreading and the carbon in the shells is permanently sequestered into the mantle
- E) During carbonate metamorphism, biogenic silica and calcium carbonate shells react together to reconstitute silicate minerals and CO<sub>2</sub>, which is returned to the atmosphere by volcanism

[D]

19). Increasing the rate of seafloor spreading..

- A) increases atmospheric CO<sub>2</sub> only because of greater CO<sub>2</sub> addition to the atmosphere by volcanism
- B) decreases atmospheric CO<sub>2</sub> because of lower CO<sub>2</sub> addition to the atmosphere by volcanism
- C) increases atmospheric CO<sub>2</sub> because of greater CO<sub>2</sub> addition to the atmosphere by volcanism AND lower rate of weathering due to continental flooding and formation of shallow seas
- D) increases atmospheric CO<sub>2</sub> only because of lower rate of weathering resulting from continental flooding and formation of shallow seas
- E) decreases atmospheric CO<sub>2</sub> because of lower CO<sub>2</sub> addition to the atmosphere by volcanism AND higher rate of weathering because of formation of mountain ranges

[C]

20). Lower rates of seafloor spreading..

- A) decrease the volume of ocean basins and displace seawater over the continental shelf
- B) increase the volume of ocean basins and lowers sea level
- C) do not affect the volume of ocean basins
- D) increase the volume seawater and increases sea level
- E) decrease the volume seawater and decreases sea level

[B]

21). Orogeny or mountain building..

- A) contributes to increasing atmospheric CO<sub>2</sub> by increasing volcanism
- B) contributes to decreasing atmospheric CO<sub>2</sub> by increasing weathering and atmospheric CO<sub>2</sub> uptake rates
- C) does not affect atmospheric CO<sub>2</sub>
- D) contributes to increasing atmospheric CO<sub>2</sub> by reducing land biomass
- E) contributes to decreasing atmospheric CO<sub>2</sub> by trapping it in glacier ice

[B]

22). The long-term evolution of the oxygen content of the atmosphere is controlled by

- A) the balance between the formation of O<sub>2</sub> during photosynthesis and utilization of O<sub>2</sub> during respiration
- B) the balance between the formation of O<sub>2</sub> during photosynthesis and utilization of O<sub>2</sub> for the oxidation of organic carbon during the weathering of sedimentary rocks
- C) the burial of calcium carbonate in marine sediments
- D) the balance between uptake of O<sub>2</sub> from the atmosphere during weathering and O<sub>2</sub> release by volcanism
- E) None of the above

[B]

23). (i) We can measure changes in atmospheric CO<sub>2</sub> during the last 650,000 years by analyzing air bubbles trapped in the ice covering Antarctica --- (ii) Atmospheric CO<sub>2</sub> is lower during ice ages and higher during warm interglacial periods --- (iii) Atmospheric CH<sub>4</sub> content is higher during ice ages --- (iv) Recorded changes in atmospheric CO<sub>2</sub>, CH<sub>4</sub> and temperature in Antarctic ice support the notion that the atmospheric concentration of these greenhouse gases significantly affect global climate

- A) (i), (ii), (iii) and (iv) are true
- B) (i), (ii), (iii) and (iv) are false
- C) (i) and (iii) are true; (ii) and (iv) are false
- D) (i), (ii), and (iii) are true and (iv) is false
- E) (i), (ii), and (iv) are true and (iii) is false

[E]

24). Lowering atmospheric CO<sub>2</sub> during ice ages could be achieved by

- A) increasing the biological pump and decreasing the rate of the thermohaline circulation
- B) decreasing the biological pump and increasing the rate of the thermohaline circulation
- C) increasing the biological pump and increasing the rate of the thermohaline circulation
- D) decreasing the biological pump and decreasing the rate of the thermohaline circulation

[A]

25). In HNLC (High Nutrient Low Chlorophyll) regions the surface water concentration of nitrate and phosphate is high (i) --- This is because productivity in these oceanic regions is limited by a lack of Fe (ii) --- Export production in these regions could be increased by increasing the wind supply of continental dust to surface waters (iii)

- A) (i), (ii) and (iii) are true
- B) (i) and (ii) are true; (iii) is false
- C) (i) and (iii) are true; (ii) is false
- D) (i) is true; (ii) and (iii) are false
- E) (ii) and (iii) are true; (i) is false

[A]

26). Which of the following will NOT increase the biological pump

- A) increasing the supply of new nutrients to the euphotic zone
- B) increasing the utilization of nutrient in HNLC regions
- C) increasing the density stratification of the water column below the euphotic zone
- D) supplying more continental dust to the southern ocean
- E) increasing "New Production"

[C]

27). The production of calcium carbonate by marine plankton

- A) contributes to lowering atmospheric CO<sub>2</sub>
- B) contributes to increasing atmospheric CO<sub>2</sub>
- C) does not affect atmospheric CO<sub>2</sub>
- D) contributes to lowering atmospheric CH<sub>4</sub>
- E) contributes to increasing atmospheric CH<sub>4</sub>

[B]

28). Which of these statements is FALSE? The phosphorous cycle includes: (i) release of phosphate from continental rocks during weathering --- (ii) uptake of phosphate by land plants and recycling in terrestrial ecosystems --- (iii) supply of dissolved phosphate to the ocean by rivers --- (iv) the release of phosphate to the atmosphere --- (v) the burial of phosphate in marine sediments

- A) (i) is false
- B) (ii) is false
- C) (iii) is false
- D) (iv) is false
- E) (v) is false

[D]

29). The amount of oxygen in the atmosphere is equivalent to..

- A) The amount of carbon in plant biomass
- B) The amount of carbon in limestone
- C) The total amount of organic carbon on Earth
- D) The amount of organic carbon buried in swamps
- E) The amount of inorganic carbon buried in marine sediments

[C]

30). There have been four major episodes of glaciation during Earth history. Which of the following sequences is correct (starting from the earliest and finishing with the most recent event)?

- A) Huronian glaciation; Snowball Earth; Permo-Carboniferous glaciation; Pleistocene glaciation
- B) Huronian glaciation; Snowball Earth; Pleistocene glaciation; Permo-Carboniferous glaciation
- C) Snowball Earth; Huronian glaciation; Pleistocene glaciation; Permo-Carboniferous glaciation
- D) Snowball Earth; Huronian glaciation; Permo-Carboniferous glaciation; Pleistocene glaciation
- E) Snowball Earth; Pleistocene glaciation; Huronian glaciation; Permo-Carboniferous glaciation

[A]

- 31). For which glaciation do we find strong evidence suggesting that the Earth was totally covered by ice
- A) Permo-Carboniferous glaciation
  - B) Pleistocene glaciations
  - C) Snowball Earth
  - D) The last ice age
  - E) None of the above
- [C]
- 32). Which of these factor(s) influence(s) the long term evolution of climate?
- A) Changes in solar radiations
  - B) Position of the continents
  - C) Concentration of greenhouse gases in the atmosphere
  - D) All of the above
  - E) None of the above
- [D]
- 33). Which of the following did NOT help document or explain “Snowball Earth”?
- A) The magnetic properties of volcanic rocks produced at that time were used to establish the latitude of the position of the continents
  - B) We find evidence for the presence of glacier on continents that were close to the equator at the time
  - C) The fact that all continents were close to the equator help explain the occurrence of global glaciation
  - D) Since most land masses were close to the equator, there was little weathering and uptake of atmospheric CO<sub>2</sub>
  - E) As temperature dropped, the polar oceans would have been covered in ice, reducing the Earth’s albedo and further cooling the Earth.
- [D]
- 34). Which of these statements is FALSE?
- A) Glaciation during the Permian/Carboniferous occurred when all continents existing as one land mass called Pangeae
  - B) Glaciation during the Permian/Carboniferous resulted from a drop in atmospheric CO<sub>2</sub> due to the burial of large quantities of organic carbon in swamps, which produced many of the coal deposits exploited today
  - C) Glaciation during the Permian/Carboniferous resulting in a second “Snowball Earth”
  - D) The Mesozoic Era, which followed, was warm because of high atmospheric CO<sub>2</sub> resulting from fast seafloor spreading and continental flooding
  - E) The gradual cooling during the Cenozoic Era is believed to be due to a gradual drop in atmospheric CO<sub>2</sub> concentration driven by increased uptake during weathering largely resulting from the formation of the Himalayas and Tibetan plateau by the collision between Indian and Asia
- [C]
- 35). Identify the incorrect statement
- Milutin Milankovitch
- a) calculated changes in solar radiation hitting the earth as a result of changing orbital parameters
  - b) thought that the northern Hemisphere was important because large land masses are needed on which to grow ice sheets
  - c) claimed that catastrophic events formed the topographic features that we see today
  - d) thought summer insolation determined whether the winter snowfall would persist into the following year
  - e) was not taken seriously for a number of years
- (c)
- 36). Hydrothermal vent fluids have water temperature as high as
- (A) 500°C (B) 50°C (C) 800°C (D) 400°C (E) 120°C
- [D]

37). Species richness in estuaries is \_\_\_\_\_.

(A) high (B) similar to the adjacent marine environment (C) similar to the adjacent riverine environment (D) low

[D]

38). Consider two statements. (i) Tube worms (vestimentiferans) are free living and not parasitic. (ii) Tube worms (vestimentiferans) have well developed digestive system.

(A) (i) true & (ii) false (B) (i) & (ii) both false (C) (i) false & (ii) true (D) (i) & (ii) both true

[A]

39). Zooxanthellae engaged in \_\_\_\_\_ biological interaction with corals.

(A) predatory (B) parasitic (C) mutualistic (D) naturalistic

[C]

40). The fringing reef is \_\_\_\_\_.

(A) a ring shaped coral reef that surrounds a lagoon (B) a coral reef growing around the periphery of an island and separated from it by a lagoon (C) a coral reef found at depth exceeding 100 m (D) a reef that is growing at the edge of a landmass

[D]