1) The currently accepted age of Earth is _______ years.
   
   A) 4.6 billion  
   B) 6.4 million  
   C) 4.6 thousand  
   D) 6.4 trillion

2) The _______ forms the relatively cool, brittle plates of plate tectonics.
   
   A) lithosphere  
   B) asthenosphere  
   C) astrosphere  
   D) eosphere

3) A _______ is a well-tested and widely accepted view that best explains certain scientific observations.
   
   A) hypothesis  
   B) law  
   C) theory  
   D) generalization

4) In the early part of the 20th century, _______ argued forcefully for continental drift.
   
   A) Peter Rommel  
   B) Alfred Wegener  
   C) Bill Clinton  
   D) David M. Karl

5) The _______ is an example of an active, continent-continent collision.
   
   A) northern movement of Baja California and a sliver of western California toward the Hawaiian Islands  
   B) northward movement of India into Eurasia  
   C) westward movement of the South American plate over the Nazca plate  
   D) Arabian Peninsula slamming into North Africa under the Red Sea

6) All of the following are or contain evidence used to support the theory of plate tectonics except for _______.
   
   A) changes in the Moon's orbit due to shifting plates  
   B) measurements of plate motions  
   C) ocean floor drilling  
   D) hot spots

7) New oceanic crust and lithosphere are formed at _______ (Hint: read answers carefully).
   
   A) convergent boundaries by submarine eruptions and intrusions of rhyolitic magma  
   B) divergent boundaries by submarine eruptions and intrusions of rhyolitic magma  
   C) convergent boundaries by submarine eruptions and intrusions of basaltic magma  
   D) divergent boundaries by submarine eruptions and intrusions of basaltic magma
8) Which one of the following is an important fundamental assumption underlying the plate tectonic theory?

A) Earth's ocean basins are very old and stable features.
B) Earth's diameter has been essentially constant over time.
C) Earth's magnetic field originates in outer space.
D) Radioactive decay slows down at the extreme pressures of the inner core.

9) _______ most effectively outline the edges of the lithospheric plates.

A) The locations of deep mantle hot spots  
B) Margins of the continental shelves  
C) Lines of active stratovolcanoes  
D) Lines of earthquake epicenters

10) Which of the following best defines a mineral and a rock?

A) A mineral consists of its constituent atoms arranged in a geometrically repetitive structure; in a rock, the atoms are randomly bonded without any geometric pattern.
B) A rock consists of atoms bonded in a regular, geometrically predictable arrangement; a mineral is a consolidated aggregate of different rock particles.
C) In a mineral the constituent atoms are bonded in a regular, repetitive, internal structure; a rock is a lithified or consolidated aggregate of different mineral grains.
D) A rock has an orderly, repetitive, geometrical, internal arrangement of greenish-blue minerals; a mineral is a lithified or consolidated aggregate of greenish-blue rocks.

11) Which of the following is an accurate description of ionic bonding?

A) Nuclei of bonding atoms exchange electrons; the resulting ions are bonded together by the attractive forces between the negative and positive nucleons.
B) Atoms of two different elements share electrons and protons; the resulting compound is bonded together by the strong, binding energy of shared protons.
C) Atoms of different elements, having gained or lost electrons, form negative and positive ions that are bonded together by attractive forces between ions with opposite charges.
D) Nuclei of two different atoms share electrons, and the resulting compound is tightly bonded by the very strong, induced, electronuclear bonds.

12) What is the most abundant element in the Earth's crust by weight?

A) carbon  
B) sodium  
C) chlorine  
D) oxygen

13) Which is the most abundant group of minerals in the Earth's crust?

A) sulfides  
B) chlorides  
C) carbonates  
D) silicates
14) Lava flows are typically finer grained than intrusive igneous rocks. Why?

A) Intrusive magma is cooler because it is well insulated by the surrounding rock.
B) The extrusive magma, because it is deep below the surface, cools very slowly producing very small mineral grains.
C) **The extrusive magma cools quickly so the mineral grains do not have time to grow.**
D) Intrusive magma flows onto the Earth's surface and cools very slowly, allowing many small mineral grains to grow.

15) Consider Bowen's reaction series. Which mineral would you expect to see as a phenocryst (i.e., a relatively large and usually conspicuous crystal) in a porphyritic basalt?

A) migmatite  
B) **olivine**  
C) quartz  
D) sodium-rich plagioclase

16) Which of the following igneous rocks exhibit aphanitic texture (i.e., small crystals that cannot be seen by the eye with or hand lens)?

A) andesite; granite  
B) rhyolite; gabbro  
C) granite; gabbro  
D) **andesite; rhyolite**

17) In a porphyritic volcanic rock, mineral grains making up which part of the rock are the last to crystallize?

A) vesicles  
B) pegmatites  
C) phenocrysts  
D) **matrix or groundmass**

18) ________ magma is the most abundant type of magma erupted at oceanic spreading centers.

A) Pegmatitic  
B) Andesitic  
C) **Basaltic**  
D) Granitic

19) Why would a plume of solid silicate rock rising slowly from deep in the mantle begin melting as it neared the base of the lithosphere?

A) The lowered pressures cause rapid heat loss accompanied by melting.
B) The rock heats up and expands at lower pressures, causing it to liquefy.
C) **Temperatures remain high as lowered pressures decrease melting temperatures – the so called process of decompression melting.**
D) All of the above

20) ________ tend to increase the explosive potential of a magma body beneath a volcano.

A) High viscosity; low dissolved gas content  
B) Low silica content, low viscosity  
C) **High viscosity; high dissolved gas content**  
D) Low viscosity; low dissolved gas content
21) Which one of the following statements is true?

A) Granitic magmas in general have higher temperatures than gabbroic magmas.
B) Melting of silicate rocks occurs at lower temperatures at depth.
C) When magma reaches the surface, dissolved gas begin to separate from the melt forming tiny bubbles.
D) Water content has no influence on the melting temperatures of silicate rocks.

22) Clay minerals formed from minerals in gabbro or diorite bedrock illustrate which kind of weathering?

A) proactive  B) syntropical  C) chemical  D) mechanical

23) Why is the humus layer typically thicker in a cool, temperate forest soil than in a tropical rainforest soil?

A) More humus is produced in the tropical rainforest, but it is quickly washed away by heavy rains.
B) In a tropical rainforest, the forest-floor litter is often burned during the dry season.
C) Less humus is produced in the cool, temperate forest but the rate of decay and oxidation is slower than in a tropical rainforest.
D) No humus is produced in a tropical rainforest because the B horizon is poorly developed.

24) Which of the following statements about laterite soils is true?

A) Laterite soils are very rich in nutrients required for vigorous plant growth but often contain no iron or aluminum.
B) Laterites, with proper management, are very suitable for commercial agriculture.
C) Laterite soils readily compact and harden when dried and exposed to sunlight.
D) Laterite soils form only in polar to sub-polar environments.

25) ________, a common mineral found in igneous rocks, is the most abundant mineral in detrital sedimentary rocks.

A) Orthoclase  B) Quartz  C) Biotite  D) Calcite

26) What is probably the single most important, original, depositional feature in sedimentary rocks?

A) sizes of the sand grains  B) compaction of the mud and clay  
C) bedding or stratification  D) degree of lithification

27) Studies of deep-sea sediment cores have contributed greatly to scientific knowledge of ________.

A) how soft-bodied vertebrate organisms are carbonized  B) the origin and direction of deposition of oscillation ripple marks in deep-sea muds
C) climatic changes during the last four million years  D) the biological impacts of pollution on parts of the continental shelves
28) Which of the following sedimentary rock would you expect to have originally been deposited by a very fast-moving mountain stream?

A) siltstone  B) conglomerate  
C) oolitic limestone  D) mudstone

29) Which of the following forms at the highest grade of regional metamorphism?

A) schist  B) slate  C) phyllite  D) shale

30) Which low-grade metamorphic rock, composed of extremely fine-sized mica and other mineral grains, typically exhibits well-developed rock cleavage?

A) schist  B) slate  C) quartzite  D) migmatite

31) _______ is a strong, parallel alignment of coarse mica flakes and/or of different mineral bands in a metamorphic rock.

A) Rock cleavage  B) Foliation  C) Marbleizing  D) Stress streaking

32) Which of the following best describes the conditions of contact metamorphism?

A) Depths are fairly shallow, but temperatures and pressures are so high that the rocks begin to partially melt.  
B) **Pressures are fairly low, the rock is in the upper part of the crust, and heat is supplied from a nearby magma body.**  
C) Heat is generated by shearing and mechanical movements along faults.  
D) Pressures are very high, the rock is deeply buried, and temperatures are raised by the Earth's internal heat.

**BONUS QUESTION (Worth 5 extra credit points)**

33) What was the name of the Yale scientist in the video shown in class on Thursday September 16, 2010 who discussed the long-term carbon cycle consisting of CO₂ emitted from volcanoes and balanced by chemical weathering of rocks on land?

A) Bob Berner  B) Ted Kaczynski  C) Martin Van Buren  D) Maureen Raymo
1) A
2) A
3) C
4) B
5) B
6) A
7) D
8) B
9) D
10) C
11) C
12) D
13) D
14) C
15) B
16) D
17) D
18) C
19) C
20) C
21) C
22) C
23) C
24) C
25) B
26) C
27) C
28) B
29) A
30) B
31) B
32) B