

(First question number is that of the Yellow test)

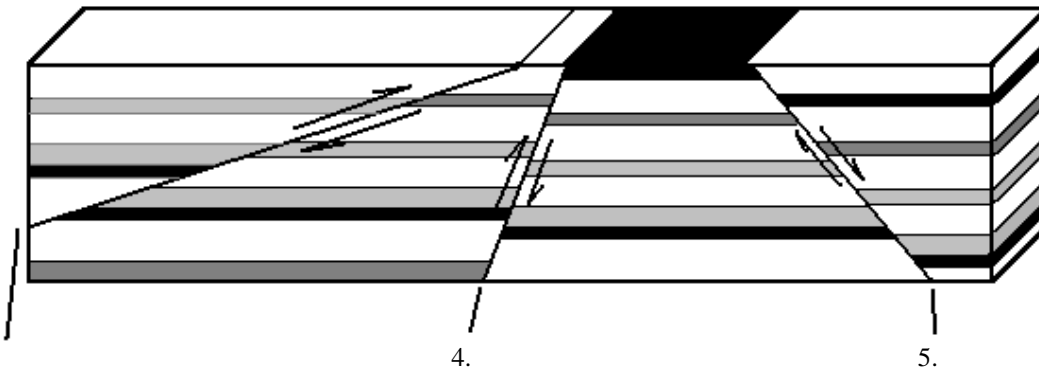
10. 1. Extensive normal faulting in an area is an indication of regional:

- a) *tectonic compression*    **b) *tectonic extension***    c) *metamorphism*    d) *tectonic shear*    e) *tectonic uplift*.

6 . 2. The Anatolian Fault trends east-west across northern Turkey and has been responsible for several major earthquakes. At this fault, the northern block has moved to the west (left) and the southern block to the east (right) without much vertical movement. This is an example of a:

- a) *dip-slip fault*    **b) *left-lateral strike slip fault***    c) *right-lateral strike-slip fault*    d) *thrust fault*  
e) *reverse fault*.

Questions 3-5 refer to the diagram below



7. 3. In this type of fault the upper block has moved up along a low-angle fault plane relative to the lower block. This type of fault is a:

- a) *reverse fault*    b) *thrust fault*    **c) *normal fault***    d) *strike-slip fault*    e) *nobody's fault*

8. 4. In this type of fault the upper block has moved up relative to the lower block. This type of fault is a:

- a) *reverse fault***    b) *thrust fault*    c) *normal fault*    d) *strike-slip fault*    e) *not my fault*

9. 5. In this type of fault the upper block has moved down relative to the lower block. This type of fault is a:

- a) *reverse fault*    b) *thrust fault*    **c) *normal fault***    d) *strike-slip fault*    e) *your fault*

11. 6. The angle measured from the horizontal, perpendicular to strike, to any tilted planar feature in the rock such as bedding, is the:

- a) *inclination*    b) *strike*    c) *declination*    **d) *dip***    e) *tilt*.

12. 7. The age of most metamorphic rocks in Colorado is:

- a) *less than 550 million years*    b) *more than 4 billion years*    **c) *between 1000 and 2000 million years***  
d) *about 6000 years*    e) *less than 65 million years*

13. 8. The Hadean Eon includes the time of the accretion of the planet up about 4000 million years ago and constitutes about what percentage of Earth history?

- a) *5%*    **b) *15%***    c) *25%*    d) *50%*    e) *85%*

14. 9. Dinosaurs roamed the land surface from about 250 million to about 65 million years ago. This era is subdivided into the Triassic, Jurassic, and Cretaceous which together are known as the:

- a) *Hadean*    b) *Proterozoic*    c) *Phanerozoic*    **d) *Mesozoic***    e) *Pleistocene*

15. 10. Which of the following radioactive isotopes is formed in the atmosphere by cosmic ray bombardment?

- a)  $^{14}\text{C}$**     b)  $^{40}\text{K}$     c)  $^{87}\text{Rb}$     d)  $^{238}\text{U}$     e)  $^{235}\text{U}$

16. 11. A proton in an atomic nucleus loses a positron ( $\beta^+$ ) (positively charged electron) and turns into a neutron. Which of the following accurately describes beta+ (positron) emission?

- a) Atomic number unchanged; mass number unchanged
- b) Atomic number increases by 1; mass number unchanged
- c) **Atomic number decreases by 1; mass number unchanged**
- d) Atomic number increases by 1; mass number decreases by 1
- e) Atomic number increases by 1, mass number increases by 1

17. 12.  $^{40}\text{K}$  has a half-life of 1.3 billion years and decays to  $^{40}\text{Ar}$ . Why can't K/Ar dating be used to date sandstone?

- a)  $^{40}\text{K}$  half life too short
- b)  $^{40}\text{K}$  half life too long
- c) **No K in quartz or sandstone**
- d) daughter  $^{40}\text{Ar}$  not retained by quartz or sandstone
- e)  $^{40}\text{K}$  can only be used to date organic K taken from the atmosphere by plants.

18. 13. A conglomerate formation has been intruded by a basalt dike. The basalt was dated radiometrically at 78 million years. Based on this date, we can infer the conglomerate layer to be:

- a) **more than 78 million years old**
- b) 78 million years old
- c) less than 78 million years old
- d) nearly 7000 years old
- e) no inference is possible

19. 14. If the amount of a radioactive isotope is 1/16 the amount originally present, how many half-lives have gone by?

- a) 2
- b) 3
- c) **4**
- d) 8
- e) 16

20. 15. A break in the sedimentary geologic record where the older rocks have been tilted and eroded prior to resumption of sedimentation is called an angular unconformity. Such a break implies:

- a) a nearby subduction zone
- b) major thrust faulting in the area.
- c) An asteroid impact in the area.
- d) a nearby volcanic eruption
- e) **A gap in the sedimentary record of 100 million years or more.**

21. 16. Where in the solar system is the asteroid belt?

- a) Beyond Pluto in the outer solar system
- b) **Between the outer and inner planets**
- c) Between Earth and Mars
- d) Between Saturn and Uranus
- e) Inside the orbit of Mercury

22. 17. Select the prediction(s) inconsistent with the Nebular Hypothesis?

- a) All planets should orbit the Sun in the same direction.
- b) All planets should orbit the sun in a roughly common plane.
- c) **Inner planets should be enriched in volatile elements compared to the outer planets.**
- d) All the above are predictions inconsistent with nebular hypothesis.

23. 18. The outer planets are:

- a) Earth, Mars, Jupiter, Saturn
- b) Mercury, Venus, Earth, Mars
- c) Pluto and Charon
- d) **Jupiter, Saturn, Neptune, Uranus**
- e) Venus, Earth, Mars, Jupiter

24. 19. The Earth is about 12700 km (7950mi) in diameter. The moon is about 3470km in diameter and about 384,000 km away. If the Earth were the size of a grapefruit (6 in or 15 cm diameter) how big and how far away would the moon be?

- a) The size of a pea (6mm) and about a foot (30cm) away
- b) The size of a cherry (2cm) and 3 ft (1m) away
- c) **The size of a golf ball (5cm) and 10 ft (3m) away**
- d) The size of an orange (10 cm) and 20 ft (6m) away
- e) The size of a grapefruit (15cm) and 30ft (10m) away.

25. 20. The stable interior part of the continent is known as the

- a) terrane
- b) shield
- c) **craton**
- d) plume
- e) orogeny

26. 21. An episode of mountain building is known as a(n):  
 a) *allocthon*    b) *horst*    c) *graben*    d) *craton*    e) **orogeny.**
27. 22. A small slice of new continental crust added onto the margin of a continent is a(n):  
 a) **accreted terrane**    b) *allocthon*    c) *shield*    d) *craton*    e) *epeirogeny.*
28. 23. Gradual upward and downward movement of crust without extensive deformation is known as:  
 a) *an accreted terrane*    b) *allocthonous*    c) *orogeny*    d) *cratonic*    e) **epeirogeny.**
29. 24. The Canadian Shield is a part of the:  
 a) *Rocky Mountain orogenic belt*    b) *continental hot spot*    c) **North American craton**  
 d) *North American accreted terrane*    e) *Arctic Ocean Basin*
30. 25. The oldest true fossils on Earth are stromatolites, which are mats of calcite produced by bacteria. The oldest of these are about:  
 a) *4.55 billion yrs*    b) **3.4 billion yrs**    c) *2.0 billion yrs*    d) *545 million yrs*    e) *6000 years*
31. 26. Which of the major divisions of life-forms on Earth has membrane-divided organelles and a cytoskeleton?  
 a). *archaea*    b). *bacteria*    c) **eukarya**    d) *viruses*    e) *They all do*
32. 27. Which of the major bio-geochemical cycles (C, N, S, P) involves the production and capture (sequestration) of a major green-house gas?  
 a) **Carbon**    b) *Nitrogen*    c) *Sulfur*    d) *Phosphorus*    e) *Hydrogen*
33. 28. Which of the major divisions of live-forms on Earth includes both multi-celled plants and animals?  
 a) *Archaea*    b) *Bacteria*    c) **Eukarya**    d) *Viruses*    e) *They all do*
34. 29. Pillow lavas form:  
 a) *where lava erupts onto ice*    b) **where lava erupts under water**  
 c) *where ash flows enter the ocean*    d) *from fissure eruptions*    e) *from dormant volcanoes.*
35. 30. Any molten silicate material, whether below the surface or on top in known as a:  
 a) *lava*    b) *intrusion*    c) *pluton*    d) **magma**    e) *volcano.*
36. 31. The earliest part of a basaltic lava flow is relatively cool and viscous. This part of the flow forms a rubbly surface called:  
 a) **aa**    b) *pahoehoe*    c) *ash flow*    d) *nuée ardente*    e) *air fall*
37. 32. A felsic (silicic) volcanic rock typical of continental regions which is commonly light in color and has a relatively low density ( $\rho = 2.5\text{-}2.7 \text{ g/cm}^3$ ) is a:  
 a) *andesite*    b) *basalt*    c) *gabbro*    d) **rhyolite**    e) *lherzolite.*
38. 33. Which of the following is an example of a basalt volcano?  
 a) *Mt St. Helens*    b) *Yellowstone*    c) **Mauna Loa**    d) *Mt Pinatubo*    e) *Mt. Fuji*
39. 34. The most common type volcano that occurs in the ocean basin is:  
 a) *andesite*    b) **basalt**    c) *gabbro*    d) *rhyolite*    e) *lherzolite*
40. 35. Which of the following is an example of an andesite volcano?  
 a) *Kilauea*    b) *Yellowstone*    c) *Mauna Loa*    d) *Mt Pinatubo*    e) **Mt. Fuji**
- 1.36. Most earthquakes occur:  
 a) *at depths greater than 400 km*    b) **at depths less than 100 km**    c) *at passive continent margins*  
 d) *in the central regions of plates (cratons)*    e) *in the lower mantle.*

2. 37. The deepest earthquakes occur at a depth of about:

- a) 50km      b) 100km      c) 400km      **d) 670km**      e) 2900km.

3. 38. Seismic waves that travel through the interior of the Earth and propagate by shear (movement perpendicular to propagation) are:

- a) P-waves      b) body-waves      c) tsunamis      **d) S-waves**      e) surface waves

4. 39. The exact location of the epicenter of an earthquake can generally be determined from:

- a) the time difference between body and surface wave arrivals at three different stations  
**b) The time difference between P- and S-wave arrival times at three stations to determine distance and then using triangulation.**  
c) the exact time of the surface wave arrivals at three different locations  
d) the direction of first movement of the S-wave arrivals at three different stations.  
e) the magnitude of the P-waves at three different stations.

5. 40. The point on the Earth's surface directly above the rupture that causes an earthquake is known as the:

- a) fracture zone      b) Benioff zone      c) subduction zone      d) focus      **e) epicenter**

### **Essay (write your answer on the scan-sheet).**

Where do most volcanoes occur and what types of volcanoes do you expect at the different types of plate boundaries.

Most volcanoes form at plate boundaries (5). At divergent boundaries which are primarily oceanic, one expects basalt volcanoes (5). At ocean-ocean convergent boundaries, one expects andesites and basaltic andesites (5). At ocean-continent convergent boundaries, one would expect andesite to rhyolite volcanoes (5). At transform boundaries and at continent-continent convergent boundaries, one would not expect much volcanism (5).