Dynamic Planet C – ANSWER KEY

2018 Regional Tournament

- - - NOT FOR STUDENTS - - -

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Total Points Possible: **102**

Multiple Choice [2 pt each]

1. According to the plate tectonic theory, most new crust is formed as the result of:

   A. plate convergence
   B. deposition of sediments along continental margins
   C. extrusion of lava from the liquid outer core
   D. volcanism at mid-ocean ridges

2. _____is the state of gravitational equilibrium between Earth's crust and mantle such that the crust "floats" at an elevation that depends on its thickness and density.

   A. Isostasy
   B. Eustasy
   C. Staticotasy
   D. Glacioisostasy

3. Information about the interior of the Earth comes predominantly from:

   A. the composition of manganese nodules
   B. the distribution of plate tectonic boundaries
   C. seismic waves
   D. glacial ice cores

4. Which of the following is **NOT** a valid method of deriving absolute plate spreading rates?

   A. Hot spots
   B. GPS
   C. Isostatic rebound
   D. Magnetic reversals

5. Who is generally considered to be the father of seafloor spreading as we know it today?

   A. Alfred Wegner
   B. Andrija Mohorovičić
   C. Harry Hess
   D. Arthur Holmes

6. Who first proposed the idea of continental drift?

   A. Harry Hess
   B. Arthur Holmes
   C. Marie Tharp
   D. Alfred Wegner

7. Who first suggested that the rocks forming on the mid-ocean ridges record and preserve the Earth's current magnetic field and strength?

   A. Alfred Wegner
   B. Frederick Vine & Drummond Mathews
   C. Harry Hess
   D. Andrija Mohorovičić

8. When did the supercontinent Pangaea begin to break apart?

   A. about 10,000 years ago
   B. about 10 million years ago
   C. about 200 million years ago
   D. about 570 million years ago

9. What force is responsible for normal faulting in rocks?

   A. Compression
   B. Tension
   C. Shearing
   D. Vertical subsidence

10. What force is responsible for reverse faulting in rocks?

   A. Compression
   B. Tension
   C. Shearing
   D. Vertical subsidence

11. Approximately what percentage of all earthquakes occur at plate boundaries?
   A. 10%
   B. 50%
   C. 75%
   D. 90%

12. At what type of plate boundary do shallow-focus earthquakes occur?

   A. convergent
   B. divergent
   C. transform
   D. all of these

13. Compressive stresses, andesitic magmas, and deep-focus earthquakes are associated with _____

A. subduction zones
B. continent/continent convergence
C. spreading centers
D. transform boundaries

14. What is the east coast of the United States an example of?

A. Active continental margin
B. Convergent plate boundary
C. Divergent plate boundary
D. Passive continental margin
E. Transform plate boundary

15. What type of plate boundary results in the formation of volcanic island arcs?

A. Ocean/Ocean Convergent
B. Ocean/Ocean Divergent
C. Ocean/Continent Convergent
D. Ocean/Continent Divergent
E. None of the Above

16. Near which type of boundary would you expect to find hydrothermal vents?

A. Passive Continental Margin
B. Ocean/Continent Convergent
C. Ocean/Ocean Divergent
D. Ocean/Continent Divergent
E. None of the Above

17. Horst and graben topography is dominated by what kind of fault?

A. Normal
B. Reverse
C. Thrust
D. Strike-slip

18. Which sea is an example of rifting forming an incipient ocean?

A. Baltic Sea
B. Bering Sea
C. English Channel
D. Red Sea

19. Melange deposits are associated with _____ .

A. divergent plate boundaries
B. subduction zones
C. transform plate boundaries
D. all of these

20. Lines on the seafloor that connect rocks of the same age are called:

A. isograds
B. isotopes
C. isochrons
D. isostasy

21. Where do the magnetic vectors of oceanic crust plunge at the steepest angles?

A. Near the poles
B. Near the equator
C. At about 30° latitude
D. At about 60° latitude

22. What is the estimated average speed of mantle convection?

A. 20 mm/yr
B. 40 mm/yr
C. 20 m/yr
D. 1 m/yr

23. What is the Earth's geothermal gradient in the upper crust?

A. 1 °C/km
B. 10 °C/km
C. 25 °C/km
D. 40 °C/km

24. Tiny crystals of iron-rich minerals, such as magnetite, acquire and retain the directional signature of Earth's magnetic field when they cool below the _____ _____ of about 580 °C. Magnetic mineral crystals will lose this magnetism if heated above this point.

A. Boiling Point
B. Curie Point
C. Mathews Point
D. Hess Point

25. The image below is a photograph of the Sidling hill roadcut in western Maryland. What type of geologic fold can be seen in this image?
    A. Anticline
    B. Syncline
    C. Slump
    D. Dome

Fill in the Blank [2 pts each]

26. **Thrust**faults are reverse faults that develop at a very low angle.

27. Plates slide past one another along __**Transform**_ boundaries.

28. The seafloor also has huge, flat, deep areas where sediments have buried the rough volcanic terrain that was created at mid-ocean ridges. These places are called **abyssal plains**..

True or False [2 pts each]

29. Today magnetic North is in the reverse direction as geographic North. (TRUE/**FALSE**)

30. Hypsometry is the measurement of sea-floor elevation relative to sea level. (TRUE/**FALSE**)

31. The Alleghenian orogeny led to the formation of the Pangaea supercontinent. **(TRUE**/FALSE)

Comparing the continental and oceanic crust:

32. Continental crust is younger than oceanic crust. (TRUE/**FALSE**)

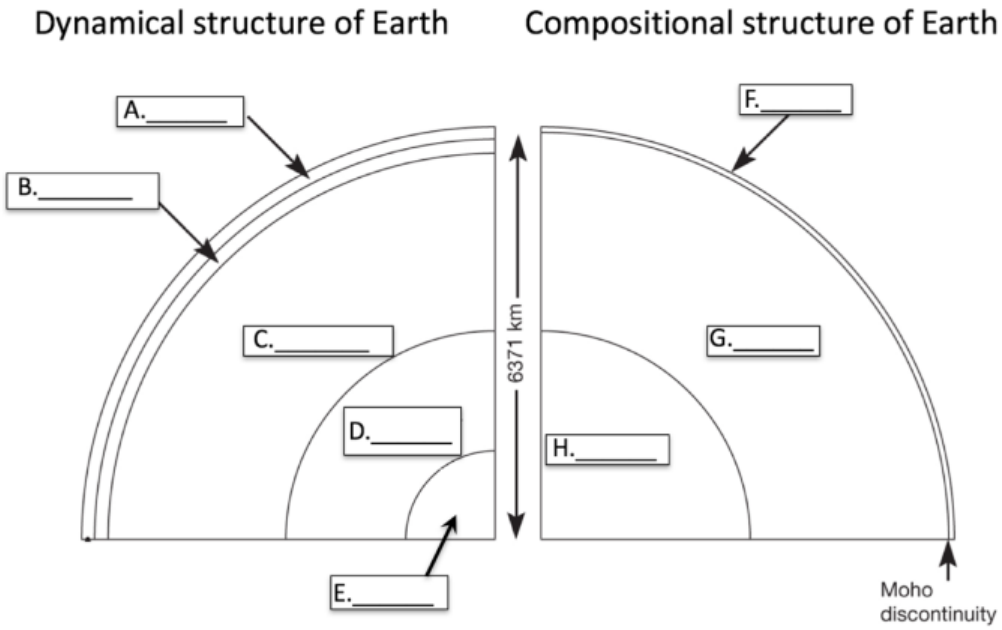
33. Oceanic crust is more dense than continental crust. (**TRUE**/FALSE)

34. Continental crust is thicker than oceanic crust. (**TRUE**/FALSE)

35. Continental crust contains a higher percentage of mafic minerals than oceanic crust. (TRUE/**FALSE**)

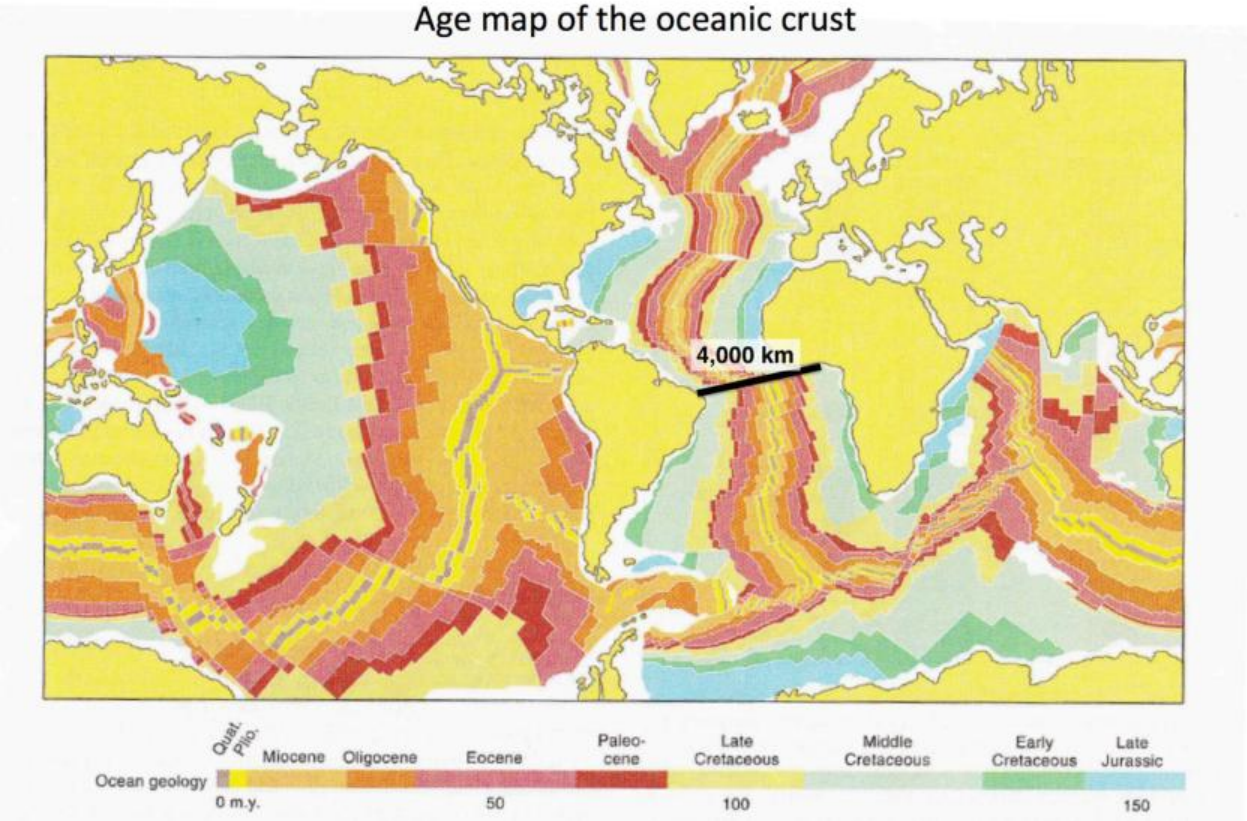
Diagram

36. Label the layers of the Earth on the diagram below. On the left-hand side of the diagram, label the 5 layers that are defined based on how resistant materials are to flowing or shearing (i.e. how the layer moves). On the right-hand side of the diagram, label the 3 layers of the Earth defined based on what kind of rocks and minerals it's made of. [1pt each]



A. Lithosphere
B. Asthenosphere
C. Mesosphere
D. Liquid Outer Core [also accept answer: Outer core]
E. Solid Inner Core [also accept answer: Inner core]
F. Crust
G. Mantle
H. Core

Computation



37. Use the Age map of oceanic crust (Above) for this question. Assuming that the Atlantic Ocean began forming 120 million years ago, and has been spreading steadily ever since, calculate the FULL seafloor spreading rate at the equator near the Romanche Fracture Zone. (Give your answer in units of cm/year.) [6 pts]

    0.33 cm/yr

38. The Mayflower landed on Plymouth rock roughly 400 years ago. Using the rate of seafloor spreading you calculated in the previous question, estimate how much wider the Atlantic Ocean is now than it was when the first pilgrims arrived in Plymouth. [6 pts]

    132 cm wider now

39. Geologist Peter Bird calculated that the Earth's lithosphere is being both created and destroyed at a rate of about 3.4 km^2/yr. At this rate, and given that the Earth's surface area is about 510,000,000 km^2 how long would it take to recycle the Earth's entire lithosphere? [6 pts]

    150,000,000 years

40. If typical mantle rock contains 0.05 weight percent potassium, while a typical granite contains 4 weight percent potassium, what is the minimum amount of mantle rock that would have to be differentiated (for example, through partial melting and fractional crystallization) to create 10 kg of granite? [6 pts]

    800 kg

Tie-Breakers

41. At any given time, about how many volcanoes are erupting on Earth on average? [1pt]

    A. 2
    B. 20
    C. 200
    D. 2,000

42. What type of plate boundary formed the Tibetan plateau? [1pt]

    A. Ocean/Ocean Convergent
    B. Ocean/Continent Convergent
    C. Continent/Continent Convergent
    D. Continent/Continent Divergent
    E. None of the Above

43. Name the three orbital parameters with Milankovitch cycles.

[1pt for each]

Eccentricity, Axial Tilt Precession