**MC:** **OE:** **CT:** **TE:**

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**School Name: _____ Team Number: _____**

**Student Names: _____**

# Dynamic Planet - C

## 2018 New Jersey Science Olympiad State Finals Tournament
## March 13, 2018

*All answers must be **clearly circled** or **written** within the space provided on this exam booklet. This exam is worth a total of **70 points**, the point distribution for each question is given. In the event that two or more teams score the same amount of points, a tiebreaker will be awarded to the team that scores the highest amount of open ended points. In the event that this too results in a tie, a second tiebreaker will be awarded to the team that submits its exam within the lowest amount of elapsed time. You have **50 minutes** to complete this exam. **Good luck!***

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Multiple Choice **(40 points)**

1. Boundaries that form where lithospheric plates are breaking apart to move away from each other are called:
   A) transform boundaries
   B) divergent margin boundaries
   C) suture zone boundaries
   D) subduction boundaries

2. The Alpine-Himalayan mountain chain formed by:
   A) rifting
   B) transform faulting
   C) continental collision
   D) continent to ocean subduction

3. The abyssal plain of the Atlantic ocean lies directly adjacent to the:
   A) continental slope
   B) continental rise
   C) continental shelf
   D) continental crust

4. In Plate Tectonic theory, a transform fault is associated with:
   A) places where crust is being generated
   B) places where crust is being destroyed
   C) places where crust is being neither generated nor destroyed
   D) places where crust is being both generated and destroyed

5. The seismic discontinuity that marks the base of the crust of the Earth is known as the what?
   A) Mohorovicic discontinuity
   B) Lehmann discontinuity
   C) Karato discontinuity
   D) Gutenberg discontinuity

6. What type of seismic wave causes the most damage during an earthquake:
   A) shear
   B) compressional
   C) expansional
   D) surface

7. The Hawaiian Islands originated from magma:
   A) intruding along the boundary between two lithospheric plates
   B) formed within an island arc
   C) injected along a mid-ocean fracture zone
   D) coming from a hot spot within the mantle

8. When spreading centers reach above the ocean's surface, they typically form which of the following types of volcanoes:
   A) shield
   B) composite
   C) stratovolcano
   D) cinder cone

9. Andesitic magmas typically erupt above:
   A) hot spots
   B) divergent plate boundaries
   C) subduction zones
   D) fissure eruptions

10. (Fill in the blank) The crust and mantle are _____ layers of the Earth's structure.
    A) mechanical
    B) rheological
    C) chemical
    D) compositional

11. (Fill in the blank) The asthenosphere and lithosphere are _____ layers of the Earth's structure.
    A) mechanical
    B) rheological
    C) chemical
    D) compositional

12. The mantle is analogous to which of the following layers of Earth:
    A) asthenosphere
    B) lithosphere
    C) mesosphere
    D) all of the above

13. The crust is analogous to which of the following layers of Earth:
    A) asthenosphere
    B) lithosphere
    C) mesosphere
    D) all of the above

14. Continental margins facing the edges of diverging tectonic plates are called:
    A) passive margins
    B) Pacific-type margins
    C) transform fault margins
    D) active margins

15. According to the Continental Drift Theory, Australia remained attached to Antarctica until the 2 entities drifted apart about how many million years ago:
    A) 80
    B) 120
    C) 250
    D) 350

16. Of the following types of magma formed on Earth, which one generally has the LOWEST gas content?
A) andesitic
B) basaltic
C) plutonic
D) rhyolitic

17. Which of the following is NOT true regarding seismic waves through the Earth:
A) P-waves travel through the mantle
B) S-waves travel through the mantle
C) P-waves travel through the outer core
D) S-waves travel through the outer core

18. A compressional tectonic environment can result in all of the following, except:
A) folded mountains
B) basin and range
C) volcanoes
D) reverse faults

19. Which of the following statements is true about the Andes mountains?
A) they are folded mountains
B) they are volcanic mountains
C) they are near a spreading center
D) they are found along a transform boundary

20. The tectonic environment of Iceland is:
A) a subduction zone
B) folded mountains
C) a mid-ocean ridge
D) a mid-plate hot spot

21. Destruction due to an earthquake does NOT vary because of:
A) rock type
B) amount of human infrastructure
C) proximity to a volcano
D) distance from the epicenter

22. Which of the following tectonic environments would lead to the formation of the most felsic, silica-rich magma?
W) subduction associated with the Andes Mountains
X) East African Rift Valley
Y) volcanic island arc of Japan
Z) hot spot underneath Yellowstone

23. Which of the following will NOT help crystallize magma?
A) cooling the liquid
B) increasing pressure
C) removing water to raise the melting point
D) increasing temperature

24. What is the effect of plate tectonics on the span of the Atlantic Ocean?
A) general contraction
B) general expansion
C) contraction in some regions, expansion in others
D) neither contraction or expansion

25. What kind of plate tectonic boundary formed the East African rift?
A) divergent
B) convergent
C) thrust
D) transform

26. Which of the following BEST describes what happens to continental crust as glaciers melt and retreat?
A) springs fill in low-lying regions left behind
B) the crust remains deformed, leaving large synclines
C) the crust isostatically rebounds
D) there is no impact on the crust

27. Which one of the following four formations was caused by subduction?
A) Cascade Mountains
B) North American craton
C) Hawaiian Islands
D) folded Himalayan mountains

28. The most explosive type of volcanism would be expected in which of the following locations?
A) mid-ocean ridge
B) hot spot on an oceanic plate
C) continental rift zone
D) ocean-continent subduction zone

29. A fault is an example of which of the following types of strain?
A) brittle
B) elastic
C) plastic
D) dilational

30. Which of the following is NOT a consequence of the apparent stretching of the crust during extension in order to form fault-block mountains?
A) episodes of volcanism
B) doming of the crust
C) higher heat than average
D) accretion of terranes

31. Which of the following does NOT describe the asthenosphere?
A) region of the lower mantle
B) viscous
C) mechanically weak and ductile
D) involved in plate tectonic movements

32. Japan consists of a volcanic island arc and trench system. This is indicative of which type of tectonic plate boundary?
A) divergent
B) convergent
C) thrust
D) transform

33. Which of the following internal layers of the Earth allows for isostasy of the crust?
A) outer core
B) inner core
C) asthenosphere
D) lithosphere

34. Which of the following is NOT used as evidence for plate tectonic theory?
A) deposition of glacial dropstones in Australian bedrock
B) elevation and increased heat flow at the Mid-Atlantic Ridge
C) correlation of fossils between Africa and South America
D) successively deeper earthquakes at the Peru-Chile trench

35. Which of the following features is NOT associated with subduction zone geology?
A) San Joaquin Valley, California
B) accreted terranes of coastal California
C) North Carolina barrier islands
D) Cascade Mountains in Oregon and Washington

36. Who was the 18th century geologist who first developed the concept of uniformitarianism?
A) Cuvier
B) Lyell
C) Hutton
D) Steno

37. Which of the following faults forms in areas characterized by extensional tectonics?
A) normal
B) reverse
C) thrust
D) strike slip

38. Moving away from the ridges, oceanic crust becomes which of the following?
A) hotter and younger
B) hotter and older
C) cooler and older
D) cooler and younger

39. Which of the following volcanoes form in ocean-continent and ocean-ocean convergent plate boundaries?
A) shield volcanoes
B) stratovolcanoes
C) hot spot volcanoes
D) basaltic volcanoes

40. Alfred Wegener believed that which of the following caused the continents to move?
A) strong earthquakes
B) strong winds
C) the rotation of the Earth's magnetic field
D) the spinning of the Earth

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Open Ended **(30 points)**

41. What role did the earth's magnetic poles play in our discovery that the lithosphere is not stationary? **(4 points)**

42. What role does the Wilson Cycle play in the formation of ocean basins? **(4 points)**

43. Describe strike-slip (define right-lateral and left-lateral slips as well), normal, and reverse faults and at which boundaries they occur. How do they differ from each other? *Write response on next page.* **(9 points)**

44. How does the distribution of land-mass affect climate change? **(4 points)**

45. In the formation of magma, how does decompression melting differ from flux melting? Describe each in relation to partial melting of sediments and rock formation during plate activity. **(7 points)**

46. Match the mineral, rock, or material to the layer of the earth it is most likely found in (crust, mantle, outer core, or inner core). *Answer on lines below.* **(6 points)**

A. Mica _____
B. Ore _____
C. Spinel _____
D. Hornblende _____
E. Olivine _____
F. Platinum _____