# Earth Sciences 023a - Planet Earth: Shaken and Stirred Earth Sciences 123a - The Dynamic Earth

# Midterm Examination (Fall 2006) Value: 30% of final mark

November 2, 2006 10:30 - 11:20, NS 145

### ANSWERS.

#### Use this as a study tool for the final exam.

1. Referring to the portion of the periodic table below, determine the number of neutrons in the D) 1232 km/hnucleus of <sup>40</sup>K.

# A) 21

- B) 22
- C) 19
- D) 17
- E) None of the above.

2. This scientist's gold-foil experiment showed that  $\overrightarrow{B}$  4.7 most of the mass of an atom is in the nucleus:

- A) Dimitri Mendeleev
- B) Neils Bohr

#### C) Ernest Rutherford

- D) J.J. Thomson
- E) John Dalton
- 3. The Hertzsprung-Russell diagram is:
- A) None of the below
- B) A diagram for illustrating chemical reactions in C) Hanging objects swing. Vibration like passing of the Earth
- C) A chart for classifying stars
- D) A procedure used to measure volcanic hazard
- E) A chart used to classify planets in the solar system

4. The following evidence supports the nebula theory for the origin of the solar system:

#### A) All planets orbit in the same direction

- B) Some planets are gas giants
- C) The Sun is a class-G star
- D) Earth still has much of its primordial heat
- E) All of the above
- 5. The surface temperature of the Sun is:

- A) More than twice as hot as any part of Earth
- B) Approximately 15000 C

C) More than  $10^6$  C

D) Unknown

E) Approximately 6000 C

6. The world's deepest oceanic trench, the Mariana trench, is 10.911 km deep. How fast would a tsunami travel in this water depth?

- A) 1277 km/h B) 1332 km/h
- C) 789 km/h
- E) 1177 km/h
- 7. A seismometer located 111 km from the epicentre of a shallow earthquake records an amplitude of 6000 microns. The surface-wave magnitude  $(M_s)$  is:
- A) 4.1
- C) 5.6
- D) 5.4 E) 7.6

8. A Modified Mercalli Intensity Level of VI corresponds to the following physical effects:

- A) Damage nearly total. Objects thrown into the air.
- B) General panic. Underground pipes broken. Conspicuous cracks in ground.
- light trucks.
- D) Felt by all. Many frightened and run outdoors.
- E) Not felt, but detected instrumentally.

9. Major factors that caused the Kobe earthquake to be so disastrous are:

- A) Kobe is a densely packed city that sits right on a fault line.
- B) Soft, water saturated soils amplified the shaking
- C) Traditional homes in Kobe have heavy tile roofs (to reduce damage from typhoons).
- All of the above. D)
- E) None of the above.

10. The tectonic plates near Kobe and Tokyo, Japan are:

A) North American plate, Nazca plate and Juan de Fuca plate

B) Indian plate, Eurasian plate and Cocos plate C) Caribbean plate, North American plate and Eurasian plate

D) Pacific plate, Indian plate, Farallon plate
E) The Philippine Sea plate, Eurasian plate and North American plate

11. During the 1987 eruptions on the Big Island of Hawaii, what was the ratio of viscosity of pahoehoe lava to that of water?

A) 100 B) 6.0221415 × 10<sup>23</sup> C) 8 D) 1.0 x 10<sup>6</sup> E) 10,000

12. At what temperature does basaltic lava begin to form a black skin?

#### A) 800 C

B) 6000 F

- C) 300 C
- D) 100 C
- E) 1200 C

13. Methane has a chemical formula of  $CH_4$  (four hydrogen atoms and one carbon atom). Referring to the periodic table from question 1, how many molecules are contained in 1 g of methane? Recall that the molar weight of a compound is found by adding up the atomic weights according to the chemical formula.

A)  $7.504 \times 10^{22}$ B)  $1.876 \times 10^{23}$ C)  $3.752 \times 10^{22}$ D)  $7.504 \times 10^{21}$ E)  $1.876 \times 10^{19}$ 

- 14. In physics, the term *atom* comes from:
- A) The ancient Egyptian word for "as small as possible"
- B) Latin for "in the beginning"
- C) The ancient Greek work for "indivisible"
- D) The origin is unknown.
- E) A term used in minor hockey.
- 15. A stratovolcano is also known as:

- A) A cinder cone
- B) A shield volcano
- C) A parasitic cone
- D) A composite cone
- E) A splatter cone.

16. The characteristics of a Strombolian eruption are:

- A) Short-lived, explosive outbursts of pasty lava ejected a few tens or hundreds of meters into the air, ejecting fragments that travel in parabolic paths to construct the volcanic edifice.
- B) A violent explosive eruption in which pyroclastic material is released at a high velocity from a vent. Sustained eruptive column may extend up to 45 km high.
- C) Explosive ejection of blocky fragments, with eruptive columns that are commonly between 5 and 10 km high.
- D) Effusive emission of highly fluid basalt lavas, characterized by steady lava fountaining and the production of thin lava flows.
- E) None of the above.

17. The following methods are commonly used to monitor volcanic activity in order to forecast an eruption:

- A) Measurement of seismicity
- B) Measurement of tilt
- C) Measurement of gas geochemistry
- D) All of the above
- E) None of the above

18. The fault illustrated in the block diagram below is a:

- A) normal fault
- B) strike-slip fault
- C) reverse fault
- D) dormant fault
- E) mixed slip fault



19. A seismogram shows that the P and S arrivals B) 5700 C from an earthquake are separated by 15 seconds. TheC) 5700 F epicentral distance is approximately: D) 3700 C E) 37000 C

- A) 60 km
- B) 120 km
- C) 360 km
- D) 720 km
- E) 125 km

20. The core shadow zone is:

- A) The cause of Earth's magnetic field
- B) A giant crystal growing in Earth's core
- C) A region free of earthquakes
- D) A region where direct P waves are blocked by Earth's core
- E) None of the above
- 21. The radioactive isotope <sup>11</sup>Be has a decay constantE) Fe, C, Ni
- of  $\lambda = 0.0502$  s<sup>-1</sup>. Its half-life is:

A) None of the answers below

- B) 13.81 seconds
- C) 23.02 minutes
- D) 138.1 seconds
- E) 16.32 hours

22. The layer immediately beneath Earth's crust is called the:

- A) rind
- B) mantle
- C) inner core
- D) outer core
- E) asthenosphere

23. Earth's primordial heat comes from:

## A) All of B-D

- B) Gravitational contraction
- C) Core formation (heats mantle by 1000° C)
- D) Heavy meteorite bombardment during the Hadean Period (4.5 - 3.8 Ga)
- E) None of the above

24. The temperature of the core-mantle boundary is C) A belt of highly magnetic rocks approximately

27. A tsunami passes and ocean liner in 2 km of water, with a wave height (amplitude) of 65 cm. How high is the tsunami when it is close to shore in 30m of water?

## A) 2.7 m

## <mark>B) 5.3 m</mark> C) 53 cm

- D) 1.1 m
- E) 0.6 m

28. Electrical conductivity is

- A) Measured by passing an electrical current through the ground
- B) Sensitive to the presence of buried metal objects
- C) A measure of the magnetic properties of an obiect
- D) Both A and B
- E) None of the above
- 29. A Benioff zone is:
- A) A volcanic arc
- B) A gravity anomaly
- D) A region of he Be content
- E) A dipping band of earthquakes in a subduction zone

A) 17000 C

25. The most abundant elements in Earth's crust are:

A) Si, Al and Fe B) H. He and O C) O, Si and Al D) O, Si and Mg E) Si, Fe and C

26. The most abundant elements in the universe are:

# A) H, He and O

- B) H. C and U C) He, O and Al
- D) Si, Al, O

30. Techniques for forecasting earthquakes include:

- A) Analysis of seismic gaps
- B) Precursory phenomena
- C) Calculation of stress triggering
- D) Calculation of recurrence interval

E) All of the above

# **BONUS**

- 30. What change in the Earth system may have triggered an Ice Age that covered the entire surface of the planet?
- A) A sudden drop in intensity of heat from the Sun
- B) A sudden increase in O levels in the atmosphere
- C) A sudden drop in the oceans
- D) Formation of the moon
- E) A sudden increase in greenhouse gases