

Hall Ticket No: 

University of Hyderabad  
ENTRANCE EXAMINATION 2012  
Ph. D in Earth & Space Sciences

Date: 04.06.2012

Time: 2.00-4.00 PM

Marks: 75

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Instructions for the candidates:

1. All questions carry equal marks.
  2. Write your Hall Ticket Number on the OMR Answer Sheet and in the space provided on the question paper.
  3. The question paper consists of Objective Type questions of one mark each. For each question, there are four answers and the answers are to be indicated with capital letters of alphabets viz., A, B, C and D.
  4. The question paper consists of Part 'A' and Part 'B'.
  5. Answers are to be marked on the OMR answer sheet following the instructions provided there upon.
  6. Hand over both the question paper booklet and the OMR answer sheet at the end of the examination.
  7. No additional sheets will be provided. Rough work can be done in the space provided at the end of the booklet.
  8. Non-programmable calculators are allowed.
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PART-A

1. Kepler's second law regarding constancy of aerial velocity of a planet is a consequence of the law of conservation of  
(A) energy (B) angular momentum (C) linear momentum (D) none of these
2. The period of geostationary artificial satellite of earth is  
(A) 6 hours (B) 12 hours (C) 24 hours (D) 365 days
3. The escape velocity of projection from the earth is approximately ( $R = 6400$  km)  
(A) 7 km/sec (B) 112 km/sec (C) 12.2 km/sec (D) 1.1 km/sec
4. If the radius of the earth were to shrink by 1%, its mass remaining the same, the acceleration due to gravity on the earth's surface would  
(A) decrease by 2% (B) remain unchanged  
(C) increase by 2% (D) will increase by 9.8%

A-96

- 5. What is the most common chemical element in the universe?  
 (A) Hydrogen      (B) Oxygen      (C) Nitrogen      (D) Helium
- 6. What is the pH of potable water?  
 (A) 4      (B) 5      (C) 7      (D) 9
- 7. What is the rest mass of a photon?  
 (A) 0.5      (B) 0      (C) 1      (D) 1.1
- 8. Crystals are formed when lava  
 (A) cools slow      (B) cools fast      (D) doesn't cool      (D) None of the above
- 9. The equatorial radius of the Earth is approximately  
 (A) 637 km      (B) 6370 km      (C) 63700 km      (D) 63520 km

10. The following table gives the performance of 100 students in statistics examination.

Marks	50	60	70	80	90	100
No of students	10	20	25	25	10	10

The median and mode(s) are:  
 (A) 70, 70 and 80      (B) 80 and 80      (C) 70 and 70      (D) 40 and 40

- 11. A scatter plot shows  
 (A) The direction and strength of a relationship between two variables.  
 (B) The linear relationship between two variables.  
 (C) The prediction of value one variable knowing the value of the other variable.  
 (D) None of the above

12. Below is the probability distribution function for occurrence of number in the single roll of dice.

x	1	2	3	4	5	6
P(X=x)	1/6	1/6		1/6	1/6	1/6

What is the probability that X = 3?  
 (A) 1/6      (B) 2/6      (C) 1/36      (D) 1/3

- 13. One hundred people were asked the number of Ice creams they consumed during last summer. Five people took no ice creams, 20 people consumed 8 ice creams, 25 people consumed 12 ice creams, 20 people consumed 16 ice creams and 30 persons consumed 32 ice creams. What percent of people consumed 12 or more ice creams?  
 (A) about 25%      (B) about 50%      (C) about 75%      (D) about 10%

14. Suppose that the random variable  $X$  has the following probability distribution

$x$		0	1	2
$(X=x)$		.4	.1	.5

Then  $P(X \leq 1)$  is

- (A) 1.0                      (B) 0.1                      (C) 0.5                      (D) 0.7

15. If the change in the value of  $g$  at the height  $h$  above the surface of the earth is the same as at a depth  $x$  below it, then (both  $x$  and  $h$  being much smaller than the radius of the earth)

- (A)  $x = h$                       (B)  $x = 2h$                       (C)  $x = \frac{h}{2}$                       (D)  $x = h^2$

16. The relation between escape velocity and orbit velocity is

- (A)  $v_e = \sqrt{2} V_{orb}$                       (B)  $v_e = \frac{1}{\sqrt{2}} V_{orb}$                       (C)  $v_e = 2 V_{orb}$                       (D)  $v_e = \sqrt{3} V_{orb}$

17. A person carrying a weight ' $W$ ' jumped down a wall of height  $h$ . Before he reaches the ground he experiences a load of

- (A) zero                      (B)  $W/2$                       (C)  $W$                       (D)  $2W$

18. The point  $(7, -2)$  lies in ..... quadrant

- (A) I                      (B) II                      (C) III                      (D) IV

19. The distance between the two points  $(-3, 4)$  and  $(9, -1)$  is

- (A) 11                      (B)  $\sqrt{13}$                       (C) 13                      (D) 169

20. The centroid of the triangle formed by the vertices  $A(3, 4)$ ,  $B(2, 4)$  and  $C(-3, -4)$  is

- (A)  $(2/3, 4/3)$                       (B)  $(-2/3, 2)$                       (C)  $(2, 3/2)$                       (D)  $(-2/3, -2)$

21. The slope of the  $3x + 4y - 7 = 0$  is

- (A)  $3/4$                       (B)  $-3/4$                       (C)  $4/3$                       (D)  $-4/3$

22. Ocean surface currents are mainly caused by

- (A) Wind    (B) Tides    (C) salinity differences    (D) density differences

23. Coriolis force arises due to

- (A) Revolution of the earth around the sun  
 (B) rotation of the earth around its axis  
 (C) revolution of the earth-moon system around the sun  
 (D) gravitational attraction of the earth-moon system

24. Hybridization state of sulfur and percent  $d$ -character in  $SF_6$  will be

- (A)  $sp^3d^2$  and 33.3%    (B)  $sp^3d^2$  and 20%    (C)  $sp^3d$  and 33.3%    (D)  $sp^3d$  and 25%

25. The molecule that contains both covalent and ionic bonding  
 (A)  $\text{CCl}_4$  (B)  $\text{CaCl}_2$  (C)  $\text{NH}_4\text{Cl}$  (D)  $\text{H}_2\text{O}$

PART-B

26. The number of moles of oxygen in 1 L air containing 21% oxygen by volume, in standard condition is  
 (A) 0.186 mol (B) 0.21 mol (C) 2.10 mol (D) 0.0093 mol
27. The true shape of the Earth is best described as a  
 (A) perfect sphere (B) perfect ellipse (C) slightly oblate sphere (D) circle
28. What is the metamorphic type of mylonite?  
 (A) Regional metamorphism (B) contact metamorphism  
 (C) dynamic metamorphism (D) All the above
29. Which factor affects recrystallization most?  
 (A) pressure (B) temperature (C) liquid with chemical fluid (D) oxygen
30. Approximately how long does an earthquake P-wave take to travel the first 6500 kilometers after the earthquake occurs?  
 (A) 6.5 min (B) 8 min (C) 10 min (D) 18.5 min
31. During which era did the initial opening of the present-day Atlantic Ocean most likely occur?  
 (A) Cenozoic (B) Mesozoic (C) Paleozoic (D) Late Proterozoic
32. Felsic and mafic are terms used by geologists to describe  
 (A) composition of continental and oceanic crust (B) behavior of earthquake waves  
 (C) the mechanical behavior of rocks (D) none of these
33. The inner core is most likely composed of  
 (A) silicon (B) oxygen (C) sulfur (D) iron
34. The principle of continents being in buoyant equilibrium is known as  
 (A) isostasy (B) the principle of buoyant equilibrium  
 (C) the elastic rebound theory (D) none of these
35. Positive gravity anomalies are often associated with  
 (A) deep ocean trenches (B) ore bodies beneath Earth's surface  
 (C) large cavern systems beneath Earth's surface (D) all of these
36. The S-wave shadow zone is evidence that  
 (A) the outer core is liquid (B) the outer core is composed of iron and nickel oxides  
 (C) the inner core is solid (D) it is very hot near the core

37. The mean radius of the earth is  $R$ , its angular speed on its own axis is  $w$  and the acceleration due to gravity at earth's surface is  $g$ . The cube of the radius of the orbit of a geo-stationary satellite will be  
 (A)  $r^2g/w$  (B)  $R^2w^2/g$  (C)  $RGw^2$  (D)  $R^2g/w^2$
38. A thin uniform, circular ring is rolling down an inclined plane of inclination  $30^\circ$  without slipping. Its linear acceleration along the inclined plane will be  
 (A)  $g/2$  (B)  $g/3$  (C)  $g/4$  (D)  $2g/3$
39. When body is raised to a height equal to radius of earth, the Potential energy change is  
 (A)  $MgR$  (B)  $\frac{MgR}{2}$  (C)  $2MgR$  (D) none of these
40. The radii of the earth and the moon are in the ratio  $10 : 1$  while acceleration due to gravity on the earth's surface and moon's surface are in the ratio  $6 : 1$ . The ratio of escape velocities from earth's surface to that of moon surface is  
 (A)  $10 : 1$  (B)  $6 : 1$  (C)  $1.66 : 1$  (D)  $7.74 : 1$
41. If by applying a force, the shape of a body is changed, then the corresponding stress is known as  
 (A) Tensile stress (B) Bulk stress (C) Shearing stress (D) Compressive stress
42. The physical evidence that the core is composed mostly of iron is  
 A) the known mass of Earth requires material of high density at the core  
 B) scientists have sampled the core and determined its composition  
 C) volcanoes regularly erupt material from the core to the surface  
 D) all of these
43. Convection is likely occurring in  
 A) the mantle (B) the outer core  
 C) both the mantle and the outer core (D) throughout the Earth
44. The interior composition and structure of Earth have been deduced in part from  
 A) studies of meteorites (B) deep drilling projects  
 C) analyses of the behavior of seismic waves (D) all of these
45. Heat inside Earth  
 interior A) is generated by radioactive decay (B) is uniform throughout the  
 C) decreases with increasing depth (D) none of these
46. Heat flow to the surface of Earth  
 A) varies from place to place (B) is highest in areas of active volcanism  
 C) is lowest in stable continental interiors (D) all of these

- 47. The boundary between the crust and mantle
  - A) coincides with the boundary between the asthenosphere and lithosphere
  - B) is marked by a change in velocity of seismic waves
  - C) is the source of the S-wave shadow zone
  - D) none of these
  
- 48. The composition of the upper mantle is known because
  - A) samples of mantle rock have been analyzed
  - B) meteorites are believed to be similar to the mantle
  - C) some caves on Earth extend into the mantle
  - D) none of these
  
- 49. Area of triangle formed by the vertices (0,0), (-7,0) and (0,4) is
  - A) 14
  - B) -14
  - C) 28
  - D) -28
  
- 50. The value of  $\sin 30^\circ \cdot \cos 60^\circ + \cos 60^\circ \cdot \sin 30^\circ =$ 
  - A) 0
  - B) 1
  - C) -1/2
  - D) -1
  
- 51. Value of  $\cos 1^\circ \cdot \cos 2^\circ \cdot \cos 3^\circ \dots \dots \dots \cos 179^\circ =$ 
  - A) 1
  - B) -1
  - C) 0
  - D) None of these
  
- 52. If  $\theta$  is acute and  $\cot \theta = 15/8$  then  $\cot \theta$  is
  - A) 17/8
  - B) 8/15
  - C) 15/17
  - D) 17/15
  
- 53. When moisture-laden winds are blocked by a mountain chain, intense rainfall happens as in Western Ghats regions. In such cases which one of the following factors is dominantly responsible for intense precipitation?
  - (A) Mountain heights
  - (B) Mountain orientation with respect to wind direction
  - (C) Ascent induced by latent heat of condensation of water vapor
  - (D) Vegetation on the mountain slopes
  
- 54. During storms, thatched roofs of huts are lifted and are carried away by wind. The basic principle that governs the process is
  - (A) Bernoulli's principle
  - (B) Coriolis force
  - (C) Pascal's law
  - (D) Archimedes principle
  
- 55. A geostationary satellite orbiting at an altitude of 36,000 kms has a period of 24 hours. What is the orbital period of a satellite orbiting at an altitude of 1000 km (take the radius of the earth  $\sim 6000$  km)
  - (A)  $4/\sqrt{6}$  hr
  - (B) 2/3 hr
  - (C) 3/2 hr
  - (D) 1/9 hr
  
- 56. In the rain shadow area (leeward side of a mountain), the air mass is characterized by
  - (A) Warm and stable conditions
  - (B) Warm and unstable conditions
  - (C) Cold and stable conditions
  - (D) Cold and unstable conditions

57. If  $\text{CO}_2$  in sea water is increased by the addition of carbonate and bicarbonate ions from rivers, the ocean will become  
(A) More acidic (pH 6.5) (B) neutral in pH (pH 7) (C) less acidic (pH 8.5) (D) more alkaline (pH 8.4)
58. The chief source of atmospheric heat is  
(A) incoming solar radiation  
(B) infrared radiation from the earth  
(C) ultraviolet radiation absorbed by the ozone layer  
(D) far-infrared radiation
59. In the troposphere, core of maximum zonal wind speed is called  
(A) storm track (B) strong westerly (C) mean jet stream axis (D) westerly flow
60. The depth at which thermocline starts in the oceans  
(A) increases from equator to poleward  
(B) decreases from west to east  
(C) increases from west to east  
(D) decreases from equatorial to polar regions
61. Perched water table lies  
(A) above water table  
(B) below water table  
(C) at the same level as water table  
(D) at an angle to water table
62. Eustatic changes in sea level are visibly marked in the  
(A) Pliocene  
(B) Paleocene  
(C) Paleozoic  
(D) Cretaceous
63. The world wide jet stream that occurs in winter above the troposphere resulting from a very steep stratospheric thermal gradient is the  
(A) sub-tropical jet stream  
(B) polar-night jet stream  
(C) sub-polar jet stream  
(D) Arctic jet stream
64. Which one of the following constants is related to radiation?  
(A) Gravitational constant (B) Planck's constant  
(C) Critical constant (D) Boltzmann's constant
65. The velocity of thermal radiation ( $V$ ) is related to the velocity of light ( $C$ ) as  
(A)  $V > C$  (B)  $V < C$  (C)  $V = C$  (D) None of the above

66. Translational kinetic energy of gas molecule, for one mole of the gas, is equal  
(A)  $\frac{3}{2}RT$  (B)  $\frac{2}{3}KT$  (C)  $\frac{1}{2}RT$  (D)  $\frac{5}{2}KT$
67. Kinetic energy per unit volume is given by  
(A)  $E = \frac{3}{2}P$  (B)  $E = \frac{2}{3}P$  (C)  $E = \frac{1}{2}mv^2$  (D) None of these
68. Energy supplied to convert unit mass of substance from solid to liquid state at its melting point is called  
(A) Latent heat of fusion (B) Evaporation  
(C) Solidification (D) Latent heat of fission
69. The r.m.s velocity of the molecules of an ideal gas is C at a temperature of 100K. at what temperature is r.m.s. velocity will be doubled?  
(A) 200 K (B) 400 K (C) 300 K (D) 50 K
70. According to kinetic theory of gases, at absolute zero of temperature  
(A) Water freezes (B) Liquid helium freezes  
(C) Molecular motion stops (D) Liquid hydrogen freezes
71. The catalyst used in the preparation of an alkyl chloride by the action of dry HCl on an alcohol is  
(A) anhydrous  $AlCl_3$  (B)  $FeCl_3$  (C) anhydrous  $ZnCl_2$  (D) Cu
72. The nuclear reactor was invented by  
(A) Enrico Fermi (B) Eduard Jenner  
(C) Alexander Fleming (D) Albert Einstein Torricelli
73. What is the most common chemical element in the universe?  
(A) Hydrogen (B) Oxygen (C) Nitrogen (D) Helium
74. What is the rest mass of a photon?  
(A) 0.5 (B) 0 (C) 1 (D) 1.1
75. Meniscus of mercury in capillary is  
(A) Concave (B) Convex (C) Plane (D) Cylindrical