

University of Hyderabad

ENTRANCE EXAMINATION 2011-2012

Ph. D in Earth & Space Sciences

Date/Day: 03.06.2011, Friday

Time: 2.00 - 4.00 PM

Marks: 75

Instructions for the candidates:

1. All questions carry equal marks.
2. Write your Hall Ticket Number on the OMR Answer Sheet given to you. Also write the Hall Ticket Number in the space provided above.
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. **There is negative marking. Every wrong answer carries 0.33 mark.**
6. Answers are to be marked on the OMR answer sheet following the instructions provided there upon.
7. Hand over both the question paper booklet and the OMR answer sheet at the end of the examination to the Invigilator.
8. No additional sheets will be provided. Rough work can be done in the question paper itself / space provided at the end of the booklet.
9. Non-programmable calculators are allowed.

PART-'A'

1. If the radius of the Earth were increased by a factor of 3 and its mass remained the same, then the acceleration due to gravity on the Earth would
 - A) reduce by a factor of 9
 - B) increase by a factor of 9
 - C) increase by a factor of 3
 - D) reduce by a factor of 3
2. Which body is in equilibrium?
 - A) a satellite moving around Earth in a circular orbit
 - B) a cart rolling down a frictionless incline
 - C) an apple falling freely toward the surface of Earth
 - D) a block sliding at constant velocity across a tabletop

3. On the surface of Earth, a spacecraft has a mass of 2.00×10^4 kilograms. What is the mass of the spacecraft at a distance of one Earth radius above Earth's surface?
- A) 5.00×10^3 kg
 - B) 4.90×10^4 kg
 - C) 2.00×10^4 kg
 - D) 1.96×10^5 kg
4. What is the magnitude of the electrostatic force between two electrons separated by a distance of 1.00×10^{-8} meter?
- A) 2.56×10^{-22} N
 - B) 2.30×10^{-12} N
 - C) 2.30×10^{-20} N
 - D) 1.44×10^{-1}
5. In a vacuum, all electromagnetic waves have the same
- A) speed
 - B) frequency
 - C) phase
 - D) wavelength
6. The diagram below represents the path of an object after it was thrown. What happens to the object's acceleration as it travels from A to B? [Neglect friction.]



- A) It decreases
 - B) It increases
 - C) It remains the same
 - D) None of the above
7. If the sum of all the forces acting on a moving object is zero, the object will
- A) slow down and stop
 - B) change the direction of its motion
 - C) accelerate uniformly
 - D) continue moving with constant velocity
8. As an object falls freely, the kinetic energy of the object
- A) decreases
 - B) increases
 - C) remains the same
 - D) All above

9. The Coriolis force acting on a freely falling body over the Earth's equator is
- A) Zero
 - B) eastwards
 - C) westwards
 - D) northwards
10. Variation of the acceleration due to gravity (g) on the Earth with latitude is such that
- A) g is the same at all latitudes
 - B) g increases with latitude
 - C) g decreases with latitude
 - D) g decreases with latitude only at the equator
11. A satellite orbiting at 3600 km height would take for one complete revolution around the Earth
- A) 48 hr
 - B) 24 hr
 - C) 36 hr
 - D) 12hr
12. A planet situated at 2 Astronomical units from the sun will go round the sun in
- A) 8 years
 - B) $\sqrt{8}$ years
 - C) 2 years
 - D) 4 years
13. An alpha particle is
- A) He nucleus
 - B) Ne nucleus
 - C) deuterium nucleus
 - D) Tritium nucleus
14. The de Broglie wavelength of two particles with momenta p and $2p$ is are in the ratio
- A) 1:2
 - B) 2:1
 - C) 1:4
 - D) 4:1
15. The probability of decay of a radioactive atom with a decay constant λ in an interval of time Δt is given by
- A) $\lambda \Delta t$
 - B) $\lambda / \Delta t$
 - C) $\Delta t / \lambda$
 - D) $\lambda + \Delta t$

16. Scale height is
- A) directly proportional to temperature(T)
 - B) inversely proportional to temperature(T)
 - C) directly proportional to T^2
 - D) inversely proportional to T^2
17. Dry adiabatic lapse rate is given by
- A) 10°C/km
 - B) 100°C/km
 - C) 1°C/km
 - D) 0.1°C/km
18. The atmospheric pressure is roughly
- A) 2 kg/m^2
 - B) 1 kg/cm^2
 - C) 2 kg/cm^2
 - D) 1 kg/m^2
19. Earth's angular momentum vector is directed
- A) northwards
 - B) eastwards
 - C) southwards
 - D) any direction depending on latitude
20. Vorticity is defined as
- A) the divergence of velocity potential
 - B) the curl of velocity potential
 - C) the curl of velocity
 - D) the gradient of velocity potential
21. Geostrophic flow occurs
- A) parallel to longitudes
 - B) parallel to latitudes
 - C) parallel to isobars
 - D) parallel to isotherms
22. If a linear regression fitted as $y = 0.05 + 12.5x$ then the predicted value of y when $x=10$ is
- A) 125.00
 - B) 125.50
 - C) 120.00
 - D) 125.05
23. The half-life of radioactive radon is 3.8 days. The time at the end of which $1/20^{\text{th}}$ of the radon sample will remain undecayed, is (given $\log_{10}e=0.4343$)
- A) 3.8 days
 - B) 16.5 days
 - C) 33 days
 - D) 76 days

24. The phase change represented by the equation $I_2(S) \longrightarrow I_2(g)$
- A) sublimation
 - B) condensation
 - C) melting
 - D) boiling
25. Transition elements have greater tendency to form complexes because
- A) they have vacant d-orbital
 - B) they have two electrons in the outermost orbit
 - C) they have variable oxidation states
 - D) they have large size

PART- 'B'

26. If the potential difference applied to a fixed resistance is doubled, the power dissipated by that resistance
- A) remains the same
 - B) doubles
 - C) halves
 - D) quadruples
27. The parameter always increases with depth in the ocean is
- A) temperature
 - B) salinity
 - C) density
 - D) oxygen content
28. Increase in the mean temperature of the earth by 2°C would cause the atmospheric water vapour content to
- A) double
 - B) halve
 - C) increase by 7%
 - D) increase by 14%
29. If the escape velocity of a rocket from the surface of the Earth is v_e , then the escape velocity of the same rocket from the surface of a planet whose acceleration due to gravity as well as radius are 3 times that of the Earth is
- A) v_e
 - B) $v_e/3$
 - C) $9 v_e$
 - D) $3v_e$

30. Compared to the mass and charge of a proton an antiproton has
A) the same mass and the same charge
B) greater mass and the same charge
C) the same mass and the opposite charge
D) greater mass and the opposite charge
31. For undisturbed, horizontal strata of sedimentary rocks, their age
A) increases from top to bottom
B) decreases from top to bottom
C) can be determined from their color
D) is the same
32. Which of the geological era is the youngest in the geologic time scale?
A) Precambrian
B) Mesozoic
C) Paleozoic
D) Cenozoic
33. A particle that is composed of two up quarks and one down quark is a
A) meson
B) proton
C) neutron
D) positron
34. Radio waves and gamma rays traveling in space have the same
A) frequency
B) wavelength
C) period
D) speed
35. The acceleration due to gravity of the Earth reduces by 1% of its surface value at a height of approximately
A) 32 km
B) 64 km
C) 16 km
D) 100 km
36. The force of attraction between two charges q and $-2q$ located at $(4\pi\epsilon_0 x)$ m from each other is given by
A) $\frac{-2q^2}{x^2}$
B) $\frac{2q^2}{x^2}$
C) $\frac{-2q^2 (4\pi\epsilon_0)}{x^2}$
D) $\frac{-2q^2}{(4\pi\epsilon_0)^2 x^2}$

37. Scattering of light by electrons is described by
- A) Stark effect
 - B) Zeeman effect
 - C) Raman effect
 - D) Compton effect
38. Harmonic oscillator energy levels are given by
- A) $nh\nu$
 - B) $\left(n + \frac{3}{2}\right) h\nu$
 - C) $\left(n + \frac{1}{2}\right) h\nu$
 - D) $\left(\frac{1}{2}\right) h\nu$
39. Constructive interference takes place when the path difference is
- A) $2n\lambda$
 - B) $(2n+1)\lambda$
 - C) $2n(\lambda + 1)/2$
 - D) $(2n+1)(\lambda + 1)/2$
40. Lateral offset in drainage lines is commonly associated with
- A) normal faults
 - B) reverse faults
 - C) thrust faults
 - D) strike-slip faults.
41. Ductile deformation become important when
- A) the temperature is high
 - B) the confining pressure is high
 - C) deformation happens slowly
 - D) all above
42. The coolest sea surface temperatures are found in the
- A) Indian ocean
 - B) Atlantic ocean
 - C) Pacific ocean
 - D) Southern ocean
43. The southwest monsoon occurs during
- A) summer
 - B) winter
 - C) fall
 - D) spring
44. As an air parcel ascends
- A) it warms up continuously
 - B) it cools continuously
 - C) it cools first and warm after release of latent heat by condensation of water vapour
 - D) it warms first and then cools by evaporation of liquid water

45. Logarithm of atmospheric pressure varies with height
A) exponentially
B) linearly
C) quadratically
D) cubically
46. Upwelling over the oceans is proportional to
A) wind strength
B) square of the wind strength
C) cube of the wind strength
D) square root of the wind strength
47. Which of the following is the most powerful greenhouse gas?
A) CO₂
B) CH₄
C) NO
D) N₂O
48. Without the presence of CO₂ in the earth's atmosphere, the mean temperature of the earth would be lower by
A) 15°C
B) 10°C
C) 30°C
D) 100°C
49. Cyclones do not occur in the latitude range of
A) 5°S-5°N
B) 10°N-5°N
C) 10°S-5°S
D) 20°N-10°N
50. In an structural basin, the youngest strata is found
A) at the center of the basin
B) on the margins of the basin
C) half-way between the center and the margins of the basin
D) beneath the older strata.
51. Which geophysical method is preferred to locate disseminated sulphide deposits
A) gravity
B) magnetic
C) IP
D) seismic

52. The difference between molar specific heats at constant pressure and volume (C_p & C_v) is given by
- A) R
 - B) $R/2$
 - C) $2R$
 - D) R^2
53. A continuous variable:
- A) may take on only integer values
 - B) may take on only a finite number of different values.
 - C) may take on an infinite number of values.
 - D) must be any nonnegative real number.
54. Relative frequency is a measure of
- A) skewness
 - B) Probability
 - C) Kurtosis
 - D) Variance
55. Negative skewness of the data indicates
- A) Higher values are more
 - B) Lower values are more
 - C) Normal distribution of the data
 - D) Zero variance
56. If the data follows Normal distribution
- A) Mean is greater than median
 - B) Mode greater than median
 - C) Mean greater than mode
 - D) Mean, Median and Mode are equal
57. Dispersions of two or more series of data which are of different scales can be compared by
- A) Variance
 - B) Standard deviation
 - C) Median
 - D) Coefficient of variation
58. In Mutually exclusive events
- A) Occurrence one event is not influenced by the other events
 - B) Occurrence of one event excludes the occurrence of the other
 - C) All events occur together
 - D) None of the above
59. The probability of occurrence of Head when an unbiased coin is tossed is
- A) 0.5
 - B) 1.5
 - C) 1.0
 - D) 0.05

60. The probability of getting two fives in two rolling of a single dice
A) $1/3$
B) $1/36$
C) $1/2$
D) $1/6$
61. Resistivity sounding is carried out to
A) know vertical variation in resistivity
B) horizontal variation in resistivity
C) both
D) none of the above
62. For applying gravity corrections the shape of the earth is considered as
A) circle
B) spheroid
C) both
D) none of the above
63. Which one of the following geophysical methods is preferable to identify stratigraphic traps associated with oil?
A) magnetotelluric
B) magnetic
C) seismic
D) self potential
64. Which of the following rocks indicate highest grade of metamorphism?
A) chlorite schist
B) hornblende gneiss
C) slate
D) granulite
65. The geological time span of Neogene is
A) 65-55 m.y.
B) 55-33 m.y.
C) 24-1.8 m.y.
D) 1.8-0 m.y.
66. The Sun and Moon positions in quadrature results in
A) Spring tide
B) Neap tide
C) low tide
D) high tide
67. K-T boundary signifies
A) Extinction of dinosaurs
B) presence of dinosaurs
C) Extinction of brachiopod
D) Exists close to the Mohorovicic discontinuity

68. A battery consists of which type of cells
- A) electrolytic
 - B) electrochemical
 - C) electroplating
 - D) electromagnetic
69. The correct order of vanderwalls radius of F, Cl, Br is
- A) $\text{Cl} > \text{F} > \text{Br}$
 - B) $\text{Br} > \text{Cl} > \text{F}$
 - C) $\text{F} > \text{Cl} > \text{Br}$
 - D) $\text{Br} > \text{F} > \text{Cl}$
70. At STP, which substance is the best conductor of electricity
- A) N
 - B) Ne
 - C) S
 - D) Ag
71. Atoms of hydrogen chloride, nitrogen and oxygen combine to form
- A) ionic bonds
 - B) electrovalent bonds
 - C) covalent bonds
 - D) co-ordinated bonds
72. The time interval between two successive passages of the Sun across the meridian of earth at a place is defined as
- A) lunar day
 - B) solar day
 - C) sidereal day
 - D) elliptical day
73. A photoelectric cell converts
- A) electrical energy to light energy
 - B) light energy to electrical energy
 - C) light energy to sound energy
 - D) light energy to heat energy
74. A gas can be liquefied by pressure alone when its temperature is
- A) higher than its critical temperature
 - B) lower than its critical temperature
 - C) equal to its critical temperature
 - D) none of the above
75. A liquid boils at a temperature at which its saturated vapour pressure become
- A) twice the atmospheric pressure
 - B) half the atmospheric pressure
 - C) equal to the atmospheric pressure
 - D) none of the above