

Code No: J- 91

Hall Ticket No:

ENTRANCE EXAMINATION 2015

Ph. D in Earth & Space Sciences

Date: 13.02.2015

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 and in the space provided on the question paper.
 3. The question paper consists of Objective Type questions of one mark each.
 4. The question paper consists of Part 'A' and Part 'B'.
 5. **There is negative marking. Each 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 the OMR answer sheet at the end of the examination.
 8. No additional sheets will be provided. Rough work can be done in the space provided at the end of the booklet.
 9. Non-programmable calculators are allowed.
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PART-A

1. Out of the following which one has the longest wavelength:
 - A. Ultraviolet Light
 - B. Gamma Rays
 - C. Infrared Rays
 - D. X-Rays
2. The characteristic mineral of lower mantle
 - A. Rutile
 - B. Anatase
 - C. Perovskite
 - D. Spinel
3. Stishovite is a polymorph of
 - A. Olivine
 - B. Garnet
 - C. Zeolite
 - D. Quartz

4. Pyrope garnet and chrome diopside characteristic minerals of
 - A. Kimberlite
 - B. Lamprophyre
 - C. Lamproite
 - D. Carbonitite
5. The coefficient of correlation ranges between
 - A. 0 and 1
 - B. -1 and +1
 - C. $-\infty$ and $+\infty$
 - D. 1 and 100
6. Why do magmas rise toward Earth's surface?
 - A. Magmas are more viscous than solid rocks in the crust and upper mantle.
 - B. Most magmas are richer in silica than most crustal and upper mantle rocks.
 - C. Magmas, being melts and having gases, are less dense than the adjacent solid rock.
 - D. magmas have higher content of pyroxenes than the surrounding rocks.
7. The particle motion in a compressional wave is
 - A. in the direction of propagation
 - B. opposite to the direction of propagation
 - C. perpendicular to the direction of propagation
 - D. no motion at all
8. If θ is acute and $\operatorname{cosec}\theta=17/8$ then $\cot\theta$ is
 - A. $15/8$
 - B. $8/15$
 - C. $15/17$
 - D. $17/15$
9. If $x=a\cos\theta$ and $y=a\sin\theta$ then eliminating θ we get
 - A. a circle
 - B. Ellipse
 - C. Parabola
 - D. Hyperbola
10. A thrust is a
 - A. Normal fault
 - B. Low angle reverse fault
 - C. Decollement
 - D. Wrench fault
11. Syngenetic deposits are crystallized
 - A. Before the host rocks
 - B. After the host rocks
 - C. Simultaneously with host rocks
 - D. Any of the above
12. Main Central thrust in Himalayan orogen separates.
 - A. Siwalik hills and lesser Himalayan sequences
 - B. Subathu Formation and lesser Himalayan sequences
 - C. Lesser Himalayan sequences and high Himalayan crystallines
 - D. Higher Himalayan sequences with Tibet

13. 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
14. In a vacuum, all electromagnetic waves have the same
- A. speed
 - B. frequency
 - C. phase
 - D. wavelength
15. Which form(s) of energy can be transmitted through a vacuum?
- A. light, only
 - B. sound, only
 - C. both light and sound
 - D. neither light nor sound
16. In addition to CO_2 , increase in one of the following is a potential contributor to global warming in last few decades.
- A. Argon
 - B. Volcanic eruptions
 - C. Methane
 - D. Sulphate aerosols
17. The timescale for ocean mixing in the surface layer is
- A. Hours to days
 - B. Weeks to months
 - C. Hours to months
 - D. Months to years
18. Geostrophic flow is produced by the balance between the Coriolis force and
- A. friction
 - B. friction and pressure gradient force jointly
 - C. centrifugal force and friction jointly
 - D. Pressure gradient force
19. In the northern hemisphere, winds turn anticyclonically with height whenever there is a wind component
- A. from cold to warm air
 - B. warm to cold air
 - C. Not sensitive to the thermal gradient direction
 - D. from high pressure to low pressure
20. The derivative of $\sin x$ at $x=180$ is
- A. 0
 - B. 1
 - C. -1
 - D. undefined

21. If (5,6), (7,8) and (4,10) are the three vertices of a parallelogram taken in order, then the fourth vertex is
- A. (2,-2)
 - B. (-2,8)
 - C. (8,-2)
 - D. (2,8)
22. Which of the following geophysical method is best suited to explore disseminated sulphides
- A. Gravity
 - B. Magnetic
 - C. Seismic
 - D. Induced Polarization
23. The ratio between the characteristic scale for the acceleration and Coriolis force is called
- A. Reynolds number
 - B. Froude number
 - C. Rossby number
 - D. Ekman number
24. The layer in a water body where the rate of change of density in the vertical is maximum is called
- A. Pycnocline
 - B. Thermocline
 - C. Halocline
 - D. Oxycline
25. The shape of the Earth can be better explained as
- A. Sphere
 - B. Circle
 - C. Oblate spheroid
 - D. None of the above

PART-B

26. Geometric and Radiometric distortions in remote sensing caused due to:
- A. Motion of platform relative to earth and platform attitude
 - B. Earth curvature and non-uniformity of illumination
 - C. Variation in sensor characteristics
 - D. All of the above
27. The water entrapped in sediments are:
- A. Juvenile water
 - B. Connate water
 - C. Plutonic water
 - D. Meteoric water
28. The first primitive mammals have appeared during.
- A. Triassic
 - B. Paleocene
 - C. Carboniferous
 - D. Permian

29. The temperature within the earth increases with depth at a rate of approximately
- 10°/km
 - 15°/km
 - 30°/km
 - 100°/km
30. If RM and IM represents remnant and induced magnetizations, Koenigsberger ratio is defined as
- IM/RM
 - RM/IM
 - IM*RM
 - IM-RM
31. Acoustic impedance is defined as
- Velocity * density
 - Velocity/density
 - Velocity + density
 - None of the above
32. Average density of the earth crust is
- 5.4 gm/cc
 - 10.5 gm/cc
 - 2.67 gm/cc
 - 1.1 gm/cc
33. The great mass extinction event occurred during
- Permian
 - Jurassic
 - Cambrian
 - Eocene
34. India separated from Seychelles during
- 65 Ma
 - 83 Ma
 - 123 Ma
 - 140 Ma
35. A satellite is moving around the Earth in a circular orbit with a velocity V . If the gravitational force of the Earth were to suddenly disappear, then the satellite would
- move with a velocity V , tangentially to its circular orbit.
 - fall towards the surface of the Earth.
 - move radially outwards with a velocity V .
 - spirally move away from the Earth.
36. 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
- v_e
 - $v_e/3$
 - $9 v_e$
 - $3v_e$

37. The tropical cyclones occur relatively rarely in the following tropical ocean basin
- North Indian Ocean
 - Northwest Pacific
 - North Atlantic
 - South Atlantic.
38. Western boundary currents are due to
- meridional overturning
 - thermal gradient
 - Sverdrup transport
 - geostrophy
39. The waves for which the phase speed varies with wave number are called
- Non-dispersive waves
 - Fourier waves
 - Stationary waves
 - Dispersive waves
40. Coesite is a high pressure polymorph of
- Diopside
 - Hypersthene
 - Olivine
 - Quartz
41. The mineral assemblage quartz-sapphirine is characteristic of
- Granulite facies
 - Eclogite facies
 - Ultra high temperature metamorphism
 - Blue schist facies
42. The characteristic assemblage of eclogite facies
- Lawsonite – glucophane-chloritoid
 - Garnet – diopside-ilmanite
 - Garnet – pigeonite-epidote
 - Garnet – omphacite-rutile
43. Name the wind blowing spirally outwards clockwise
- Cyclone
 - Thunder storm
 - Anticyclone
 - Tornadoes
44. Karst terrain is characterized by
- Solution channels
 - Closed depressions
 - Sinkholes and caves
 - All of the above
45. One Darcy is equal to
- $0.1 \times 10^{-10} \text{ cm}^2$
 - $0.015 \times 10^{-8} \text{ cm}^2$
 - $0.987 \times 10^{-8} \text{ cm}^2$
 - $0.987 \times 10^{-6} \text{ cm}^2$

46. The waves in an inviscid barotropic flow of constant depth in midlatitudes, which are due to absolute vorticity conservation and varying Coriolis parameter with latitude are
- Mixed Rossby-Gravity waves
 - Rossby waves
 - Kelvin waves
 - Sound waves
47. The sea surface is higher in subtropics than in subpolar regions due to
- Ekman layer convergence
 - Costal Kelvin waves
 - Baroclinic instability
 - Barotropic instability
48. The two major types of Kelvin waves in the ocean are
- cyclonic and anticyclonic
 - Coastal and Equatorial
 - Euphotic and Aphotic
 - Hypertrophic and Dystrophic
49. If the points $(a,4)$, $(2,2)$ and $(5,5)$ are collinear then $a=$
- 1
 - 2
 - 3
 - 4
50. What is the angle of elevation of sun when the length of the shadow of a pole is $1/\sqrt{3}$ times the height of the pole?
- 30°
 - 60°
 - 120°
 - None of these
51. If the matrices A,B,C are of type 4×3 , 3×2 and 2×1 respectively the $A(BC)$ is of type
- 1×4
 - 4×1
 - 3×3
 - cannot be determined
52. Many divergent plate boundaries coincide with
- transform faults
 - explosive volcanic eruptions
 - the edges of the continents
 - the Mid-Ocean Ridge
53. At transform plate boundaries
- two plates slip horizontally past each other
 - two plates move in opposite directions toward each other
 - two plates move in opposite directions away from each other
 - two plates are subducted beneath each other
54. A typical rate of plate motion is
- | | |
|-------------------------------|--------------------------------|
| A. 3 - 4 centimeters per year | B. 1 - 18 centimeters per year |
| C. 1 kilometer per year | D. 1,000 kilometers per year |

55. If we write the equations: $2x-y+3=0$ and $-x+17y=14$ in the matrix form $AX=B$ then the matrix B^T is equal to
- [3 14]
 - [-3 14]
 - [14 -3]
 - [-14 3]
56. Electromagnetic Radiation is produced
- Whenever the magnetic field is very high
 - Whenever the electric field is very high
 - Whenever the size or direction of an electric or magnetic field fluctuates with time
 - By the flow of rapidly alternating currents in a conducting body
57. The most important water quality parameter for domestic use of water is:
- Carbonate hardness
 - Non-carbonate hardness
 - Coliform group of organisms
 - Chlorides
58. Chemical Oxygen Demand (COD) of a sample is always greater than Biochemical Oxygen Demand (BOD) because it represents
- Biodegradable organic matters only
 - Biodegradable and non-biodegradable organic matter
 - Non-biodegradable organic matter
 - Inorganic matter
59. The atmosphere of early period was rich in
- O_2 , CO_2 , and N_2
 - O_2 and CO_2
 - CO_2 , CH_4 , and N
 - O_2 , CO_2 , and SO_2
60. Crenulation cleavage develops during
- Thrusting
 - Rifting
 - Superimposed deformation
 - Extension
61. Positive Ce anomalies in sediments indicate
- Reducing environments
 - Oxidizing environments
 - Low PH-conditions
 - High PH environment
62. Loess corresponds to
- Eolian deposits
 - Braided river flood plain
 - Alluvial fan
 - Lake deposits

63. Thick sedimentary basins are generally associated with
- A. positive gravity anomalies
 - B. negative gravity anomalies
 - C. zero gravity anomalies
 - D. none of the above
64. Step like gravity anomalies are associated with
- A. folds
 - B. dip slip faults
 - C. antiforms
 - D. batholiths
65. Apparent resistivity data is sensitive to
- A. Vertical variation in resistivity of formations
 - B. Horizontal variation in resistivity of formations
 - C. Inclined variation in resistivity of formations
 - D. Both B and C
66. Electric field is defined as
- A. Force/unit charge
 - B. Unit charge/force
 - C. Force*unit charge
 - D. None of the above
67. Which geophysical method is best suited for exploration of hydrocarbons
- A. Resistivity
 - B. Seismic
 - C. Magnetic
 - D. Telluric
68. Poisson's equation relates
- A. Gravity and magnetic potentials
 - B. Electrical and magnetic potentials
 - C. Gravity and electrical potentials
 - D. All the above
69. Zero length spring is one
- A. With zero length
 - B. Which follows Hooke's law
 - C. Which does not follow Hooke's law
 - D. Which does not exist
70. The difference between sea level at high tide and sea level at low tide is called the
- A. Tidal frequency
 - B. Tidal period
 - C. Tidal range
 - D. Tidal wavelength
71. If 1000 grams of seawater are evaporated, about how many grams of salts are left?
- A. 35
 - B. 75
 - C. 115
 - D. 350

72. What dissolved gas in seawater is responsible for maintaining its pH?
- A. Nitrogen
 - B. Oxygen
 - C. Carbon Dioxide
 - D. Argon
73. The environment when iron and manganese may precipitate together is:
- A. Oxidizing
 - B. Reducing
 - C. Neutral
 - D. Both (a) and (b)
74. The tendency for a body moving on the surface of the Earth to be deflected to the right in the northern hemisphere and left in the southern hemisphere is due to
- A. Milankovitch effect
 - B. Atmospheric effect
 - C. Coriolis effect
 - D. All of the above
75. Diamictites are deposited by
- A. Fluvial activity
 - B. Eolian activity
 - C. Glacial activity
 - D. Impact activity