

Section I

N.B. : 1) All questions are compulsory. (40 marks)
2) Select (✓) the correct answer.

- 1) A garnet bearing charnockite has zoned zircon and monazite grains. Zircon cores have high Th/U while rims have low Th/U ratios. The correct inference is
 - a) zircon rims formed after monazite crystallization
 - b) zircon core formed after monazite crystallization
 - c) monazite crystallization preceded garnet crystallization
 - d) zircon rim formed after crystallization of garnet
- 2) In a basin where the rate of sediment supply is higher than the rate of creation of accommodation space, the deposits may
 - a) aggrade
 - b) aggrade and then prograde
 - c) aggrade and then retrograde
 - d) prograde and then aggrade
- 3) Basaltic magma had undergone fractional crystallization of pyroxene and plagioclase the residual magma will be enriched in which of the following trace element- pair compared to the parent magma
 - a) Sr and Ni
 - b) Cr and Sr
 - c) Cr and Ni
 - d) Ce and Zr
- 4) Which one of the natural processes would like remove a large amount of carbon from out atmosphere permanently?
 - a) Increased biological productivity
 - b) Lowering of the temperature of the surface ocean
 - c) Large scale precipitation of carbonates
 - d) Enhanced physical weathering of rocks
- 5) Which of the following mineral has the least number of powder diffraction peaks?
 - a) Gypsum
 - b) Halite
 - c) Zircon
 - d) Quartz

TURN OVER

- 6) A metamorphic rock with preserved relict Igneous texture is identified as
- porphyroblastic
 - Blastoporphyritic
 - Decussate
 - Orthocummulate
- 7) Climbing ripple cross laminations form by movement of medium to very fine sand in
- lower flow regime and sediment starved conditions
 - upper flow regime and sediment surplus conditions
 - lower flow regime and sediment surplus conditions
 - upper flow regime and sediment starved conditions
- 8) Which of the following has lowest albedo (%)?
- Vegetation
 - Desert sand
 - Bare soil
 - Calm water
- 9) A dimensionless number that defines the degree of turbulence in streamflow is known as
- Reynolds number
 - Froude number
 - Manning coefficient
 - Shields parameter
- 10) The age range of reservoir rock in Cambay basin is
- 34 – 15 million years
 - 56 – 34 million years
 - 65 – 56 million years
 - 100 – 65 million years
- 11) In which of the following mantle derived rocks, one is likely to find mantle xenoliths?
- Andesites
 - Mid-oceanic ridge basalts
 - Komatiites
 - Kimberlites
- 12) Which of the following is a time transgressive unit?
- Kioto formation
 - Krol formation
 - Tal formation
 - Zewan formation

TURN OVER

- 13) Which of the following is a characteristic fossil for lower gondwana
- Fenestella
 - Gangamopteris
 - Dichrodium
 - Ptillophylum
- 14) Nagari formation of Siwalik basin is underlain by
- Kamlial formation
 - Chingi formation
 - Dhokpatan formation
 - Pinjor formation
- 15) The age of Muth quartzite is
- Cambrian
 - Ordovician
 - Devonian
 - Permian.
- 16) Assume that a vertical photograph was taken at a flying height of 2500m above sea level by a camera with a lens of a focal length 152mm. determine the scale of photograph of a terrain whose average surface elevation is 980m.
- 1:50,000
 - 1:20,000
 - 1:10,000
 - 1:5,000
- 17) A poorly sorted sedimentary rock is observed to contain abundant angular grains and rock fragments along with fresh feldspar grains. Which one is the most likely tectonic setting for the above?
- Stable continental margin
 - Active continental margin
 - Intra-cratonic margin
 - Ocean trenches
- 18) An aquifer with a total volume of 100,000m³ has a porosity of 10% and specific retention of 5%. The aquifer gets replenished to its maximum capacity every day. What would be the maximum pumping rate at which water can be withdrawn for a period of 5 hours from the aquifer to maintain its specific yield capacity?
- 3,000m³/hr
 - 1,000m³/hr
 - 5,000m³/hr
 - 10,000m³/hr

TURN OVER

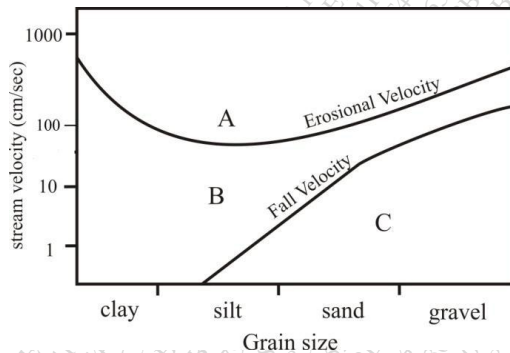
- 19) What is the typical pH of surface ocean water off the coast of Peru?
- It is the same as that of surface ocean waters elsewhere
 - It is slightly higher than that elsewhere in the ocean in La Niña years
 - It is slightly lower than that elsewhere in the ocean in El Niño years
 - It is slightly lower than that elsewhere in the ocean in La Niña years
- 20) Incongruent dissolution of orthoclase in a humid climate weathering profile will result in the formation of
- smectite + silicic acid
 - kaolinite + silicic acid
 - kaolinite + hydrochloric acid
 - chlorite + silicic acid
- 21) The Pliocene-miocene boundary event during which closing and opening of Mediterranean sea resulted in extensive evaporite deposits on the ocean floor is identified as
- Zanclean explosion
 - Messinian salinity crisis
 - Danian impact
 - Cenomanian deposition
- 22) Which one of the following has the lowest value of specific heat?
- Inner core
 - Outer core
 - Lower mantle
 - Upper mantle
- 23) Platinum group elements are _____
- Lithophiles only
 - Chalcophiles only
 - Siderophiles only
 - Both chalcophile and siderophile
- 24) In a magma chamber during the process of differentiation if a large amount of granitic gneiss rock is added due to chamber collapse and assimilated, then the magma changes its composition towards _____
- more ultrabasic
 - more basic
 - more acidic
 - more ultramafic

TURN OVER

- 25) Harzburgite rock is consist of _____
- only clinopyroxene
 - only orthopyroxene
 - orthopyroxene and olivine
 - clinopyroxene and olivine

- 26) In a certain alluvial basin of 200 km², 180 Mm³ of groundwater was pumped in a year and the groundwater table dropped by about 5 m during the year. Assuming no replenishment, the specific yield of the aquifer is:
- 0.45
 - 0.36
 - 0.27
 - 0.18

27)



Identify the dominant process in zones A, B and C.

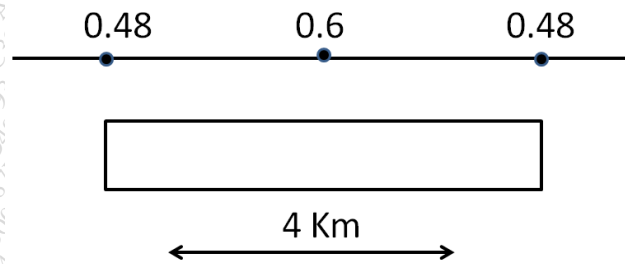
- A = deposition, B = erosion, C = transportation
 - A = transportation, B = erosion, C = deposition
 - A = erosion, B = transportation, C = deposition
 - A = deposition, B = transportation, C = erosion
- 28) At what depth within the Earth's mantle, do the sub-oceanic and sub-continental thermal adiabats meet?
- ~100 km
 - ~200 km
 - ~400 km
 - ~700 km

TURN OVER

- 29) If fayalite mineral in a bedrock has weathered to goethite, what would have been the sequence of weathering reactions?
- oxidation, carbonation, hydrolysis
 - reduction, hydrolysis, oxidation
 - carbonation, hydrolysis, oxidation
 - hydrolysis, carbonation, oxidation
- 30) The ocean sea waves lay a critical role in evolution of global ocean circulation, climate and marine biota. What is the approximate timing of the closing of the Isthmus of panama.
- Miocene
 - Pliocene
 - Eocene
 - Oligocene
- 31) Ediacaran fossils have significance in determining the
- Archean/Proterozoic boundary
 - Precambrian/Cambrian boundary
 - Premian/ Triassic boundary
 - Cretaceous/ Tertiary boundary
- 32) The deepest mixed layer is found at the
- Equator
 - Northern Indian Ocean
 - Sub-tropical gyres
 - Northern Atlantic
- 33) Mohr envelope gives a linear relationship between shear stress and normal stress for failure under compression. The effect of increasing fluid pressure in inducing brittle failure is due to
- lowering of shear stress
 - lowering of differential stress
 - enhancing of differential stress
 - lowering of effective stress

TURN OVER

- 34) Shear strain is measured by changes in
- Length
 - Angle
 - Volume
 - Viscosity
- 35) Along a coastline, the most common types of sand dunes are
- Parabolic and Barchan
 - Parabolic and Transverse
 - Transverse and star
 - Star and longitudinal
- 36) A buried anomalous body in the form of a two-dimensional horizontal plate of width 4.0 km provides, on the Earth's surface, gravity anomalies of 0.6 mgal and 0.48 mgal, respectively, on its centre and edge. The maximum gravity anomaly produced by a plate of width 8.0 km of the same thickness, density contrast and depth would be



- 1.20 mgal
 - 1.08 mgal
 - 0.96 mgal
 - 0.72 mgal
- 37) A large river cutting across a ridge will not display one of the following changes in its morphology and hydraulic properties
- Decrease in width depth ratio
 - Increase in the flow velocity
 - Decrease in channel cross sectional area
 - Increase in mean discharge

TURN OVER

- 38) Which of the following wavelengths can be used for measuring SST during the south west monsoon?
- Visible
 - Infra Red
 - Microwave
 - Thermal IR
- 39) Ocean temperature anomalies last longer than atmospheric temperature anomalies because ocean water
- is salty
 - is denser than air
 - has a higher specific heat
 - does not undergo radiative cooling.
- 40) In an outcrop of a fold on flat ground, older strata are encountered towards North. The structure is a
- syncline plunging towards South
 - anticline plunging towards North
 - syncline plunging toward North
 - non-plunging syncline

Section II

Attempt **any three** questions out of **five**

(30 Marks)

- 1) Explain the contact metamorphism of impure carbonates using phase rule. What is the difference between open system and closed system behavior of carbonates during metamorphism?
- 2) Give a brief note on classification of sandstones. Explain concept of cement and matrix in a sedimentary rock.
- 3) How remote sensing can be used for mineral exploration? . Explain with an Indian case study.
- 4) Describe the stratigraphic sequence in Sighbhum Craton.
- 5) Discuss in detail various textures of contact metamorphic rocks, hence explain the development of post tectonic porphyroblasts.

TURN OVER

Section IIIAttempt **any two** questions out of **four****(30 marks)**

- 1) Explain the various investigations that need to be carried out for the site location of a large gravity dam.
 - 2) Explain in detail atmospheric circulation.
 - 3) Explain various traps for petroleum. Add a note on Bombay offshore basin.
 - 4) Give facies classification & distribution of the Tertiary rocks of Andaman-Nicobar. Discuss the facies associations that can be used to interpret the condition of deposition prevailed during Tertiary in that area.
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