

**GG : GEOLOGY AND GEOPHYSICS**

Duration : Three Hours

Maximum Marks :150

**Read the following instructions carefully**

1. This question paper contains **16** printed pages including pages for rough work. Please check all pages and report discrepancy, if any.
2. Write your registration number, your name and name of the examination centre at the specified locations on the right half of the ORS.
3. Using HB pencil, darken the appropriate bubble under each digit of your registration number and the letters corresponding to your paper code.
4. All the questions in this question paper are of objective type.
5. Questions must be answered on **Objective Response Sheet (ORS)** by darkening the appropriate bubble (marked A, B, C, D) using HB pencil against the question number on the left hand side of the ORS. **Each question has only one correct answer.** In case you wish to change an answer, erase the old answer completely. More than one answer bubbled against a question will be treated as a wrong answer.
6. Questions 1 through 20 are 1-mark questions and questions 21 through 85 are 2-mark questions.
7. Questions 71 through 73 is one set of common data questions, questions 74 and 75 is another pair of common data questions. The question pairs (76, 77), (78, 79), (80, 81), (82, 83) and (84, 85) are questions with linked answers. The answer to the second question of the above pairs will depend on the answer to the first question of the pair. If the first question in the linked pair is wrongly answered or is un-attempted, then the answer to the second question in the pair will not be evaluated.
8. Un-attempted questions will carry zero marks.
9. **NEGATIVE MARKING:** For Q.1 to Q.20, **0.25** mark will be deducted for each wrong answer. For Q.21 to Q.75, **0.5** mark will be deducted for each wrong answer. For the pairs of questions with linked answers, there will be negative marks only for wrong answer to the first question, i.e. for Q.76, Q.78, Q.80, Q.82 and Q.84, **0.5** mark will be deducted for each wrong answer. There is no negative marking for Q.77, Q.79, Q.81, Q.83 and Q.85.
10. Calculator **without data connectivity** is allowed in the examination hall.
11. Charts, graph sheets and tables are NOT allowed in the examination hall.
12. Rough work can be done on the question paper itself. Additional blank pages are given at the end of the question paper for rough work.



**Q. 1 – Q. 20 carry one mark each.**

- Q.1 The planet having density less than  $1.0 \text{ gm/cm}^3$  is  
(A) Jupiter (B) Neptune (C) Saturn (D) Uranus
- Q.2 Which mineral in a metamorphic rock indicates high grade metamorphism?  
(A) Chlorite (B) Muscovite (C) Serpentine (D) Sillimanite
- Q.3 Which of the following landforms is formed by organisms?  
(A) Atoll (B) Drumlins (C) Outwash (D) Point bar
- Q.4 The age of the sandstone reservoir in Cambay basin is  
(A) Cretaceous (B) Eocene (C) Holocene (D) Jurassic
- Q.5 Due to *Coriolis* effect, the ocean currents will be deflected towards the right in  
(A) Antarctica (B) Equator  
(C) Southern Hemisphere (D) Northern Hemisphere
- Q.6 The age of the Precambrian – Cambrian boundary (in million years) is close to  
(A) 250 (B) 550  
(C) 1550 (D) 2550
- Q.7 Which of the following minerals is harder than a knife blade?  
(A) Calcite (B) Fluorite (C) Gypsum (D) Quartz
- Q.8 Choose a Proterozoic stratigraphic unit from the following  
(A) Cuddapah Super Group (B) Dharwar Super Group  
(C) Gondwana Super Group (D) Iron Ore Group
- Q.9 The correct pair of naturally occurring fissile isotope of Uranium is  
(A)  $U^{236}$  and  $U^{237}$  (B)  $U^{235}$  and  $U^{236}$  (C)  $U^{235}$  and  $U^{238}$  (D)  $U^{236}$  and  $U^{238}$
- Q.10 In the plate tectonic theory, the “ring of fire” around the Pacific ocean is related to  
(A) convergent plate boundary (B) divergent plate boundary  
(C) hot spots (D) transform fault
- Q.11 The shear wave is  
(A) longitudinal (B) dilatational (C) irrotational (D) equivoluminal
- Q.12 The liquid used in the sensor of a Proton Precession Magnetometer should be rich in  
(A) carbon (B) hydrogen (C) nitrogen (D) oxygen
- Q.13 The dominant process of heat transport in the lithosphere is  
(A) advection (B) conduction (C) convection (D) radiation
- Q.14 The shape of a vertical electric sounding curve over a three layer sequence comprising moist soil (top), fresh water saturated coarse sand (middle) and clay (bottom) is  
(A) A - type (B) H - type (C) K - type (D) Q - type



- Q.15 The geophysical method that provided a convincing evidence of sea floor spreading is  
 (A) gravity (B) magnetic (C) electric (D) seismic
- Q.16 The difference in the gravity value (in mgal) between the equator and pole is close to  
 (A) 3786 (B) 4586 (C) 5186 (D) 5986
- Q.17 With respect to the Earth-Moon axis, the tidal deformation of the Earth produced by the Moon has the shape of  
 (A) oblate ellipse (B) oblate ellipsoid (C) prolate ellipse (D) prolate ellipsoid
- Q.18 A successful combination of geophysical methods for exploration of kimberlite pipe is  
 (A) gravity and radiometric (B) magnetic and electromagnetic  
 (C) radiometric and magnetic (D) radiometric and seismic
- Q.19 Liquid outer core is evidenced by shadow zone for direct P-wave in the epicentral distance of  
 (A)  $92^\circ$ - $132^\circ$  (B)  $92^\circ$ - $142^\circ$   
 (C)  $102^\circ$ - $132^\circ$  (D)  $102^\circ$ - $142^\circ$
- Q.20 Rift valleys are bounded by  
 (A) normal faults (B) reverse faults (C) strike-slip faults (D) transform faults

**Q. 21 to Q.75 carry two marks each.**

- Q.21 The composition of a sandstone is as follows:  
 Quartz: 55%, Feldspar: 25%, Rock fragments: 1% and Matrix: 19%

Petrographically, the sandstone is classified as

- (A) arkose (B) arkosic wacke  
 (C) lithic arenite (D) quartz wacke

- Q.22 Match the sedimentary structures in Group I with the geological processes in Group II.

Group I

- P. Load casts  
 Q. Cross bedding  
 R. Flutes  
 S. Dropstones

- (A) P – 3 (B) P – 2  
 Q – 2 Q – 1  
 R – 1 R – 5  
 S – 4 S – 4

Group II

1. Turbulent scour  
 2. Melting ice  
 3. Soft sediment deformation  
 4. Biogenic  
 5. Migration of mega ripples

- (C) (D)  
 P – 3 P – 1  
 Q – 5 Q – 4  
 R – 1 R – 5  
 S – 2 S – 2

- Q.23 The phylloides developed in echinoids to  
 (A) increase efficiency in food collection (B) protect it from sinking in muddy substratum  
 (C) burrow deep into the sediments (D) protect it from predators



- Q.24 Two rock samples, P and Q, are characterized by the following well-preserved fossil assemblages:  
 P: abundance of planktonic foraminifera and radiolaria  
 Q: abundance of spore, pollen and vertebrate fossils

Which of the following statements is true about the palaeoenvironmental conditions of the rocks?

- (A) P is estuarine and Q is deep marine (B) P is inter-tidal and Q is terrestrial  
 (C) P is terrestrial and Q is shallow marine (D) P is deep marine and Q is terrestrial
- Q.25 The evidence of Turonian marine transgression in Peninsular India is
- (A) Bagh Beds (B) Niniyur Formation  
 (C) Patcham Formation (D) Umaria Marine Bed

- Q.26 Match the stratigraphic units of India with their age:

Stratigraphic Units

Age

P. Sargur Schist

1. Oligocene

Q. Kopili Shales

2. Eocene

R. Damuda Group

3. Permian

S. Kolhan Group

4. Carboniferous

5. Proterozoic

6. Archaean

(A)

(B)

(C)

(D)

P – 5

P – 4

P – 6

P – 6

Q – 3

Q – 3

Q – 1

Q – 2

R – 4

R – 1

R – 2

R – 3

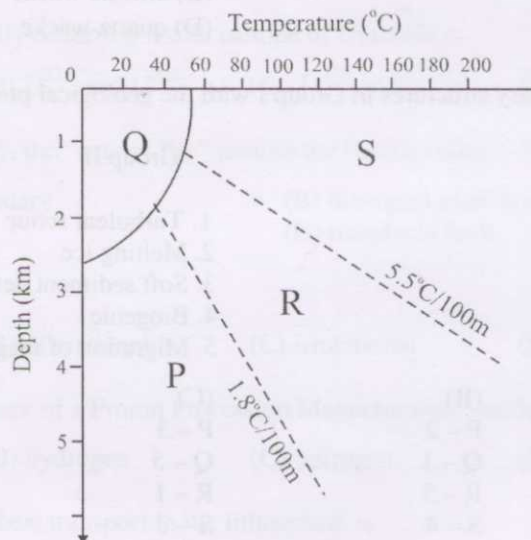
S – 1

S – 5

S – 5

S – 5

- Q.27 In the following depth – temperature profile the broken lines indicate geothermal gradients. The zone in which oil and gas are likely to be generated and trapped is



- (A) P (B) Q (C) R (D) S
- Q.28 If a horizontal mirror plane is added to a pyramid having three-fold symmetry, the resultant symmetry of the  $c$ -axis will be

- (A) 3m (B)  $\bar{3}$  (C)  $\bar{6}$  (D) 6/m

- Q.29 Dodecahedron and trapezohedron faces are observed in  
 (A) beryl (B) chalcopyrite (C) fluorite (D) garnet
- Q.30 The crystal system of biotite is  
 (A) hexagonal (B) monoclinic (C) orthorhombic (D) tetragonal
- Q.31 The {0001} section of a uniaxial mineral can be distinguished from an isotropic mineral in thin section by  
 (A) extinction angle (B) pleochroism (C) relief (D) interference figure
- Q.32 Match the landforms in Group I with geomorphic processes in Group II

Group I		Group II	
P. Paired terrace		1. Glacial erosion	
Q. Cirque		2. Glacial deposition	
R. Barchan		3. River rejuvenation	
S. Kames		4. Wind erosion	
		5. Wind deposition	
(A)	(B)	(C)	(D)
P-4	P-2	P-3	P-3
Q-2	Q-3	Q-2	Q-1
R-5	R-4	R-5	R-5
S-3	S-1	S-4	S-2

- Q.33 Match the ore/mineral deposits in Group I with genetic processes in Group II

Group I		Group II	
P. Kyanite		1. Chemical sedimentation	
Q. Laterite		2. Chemical weathering	
R. Banded iron ore		3. Metamorphic	
S. Platinum		4. Magmatic	
(A)	(B)	(C)	(D)
P-2	P-3	P-4	P-3
Q-1	Q-2	Q-3	Q-2
R-3	R-1	R-2	R-4
S-4	S-4	S-1	S-1

- Q.34 The scale of an aerial photograph acquired from a height of 5000 m using a camera having focal length of 200 mm, is  
 (A) 1 : 5000 (B) 1 : 20000 (C) 1 : 40000 (D) 1 : 60000
- Q.35 The ratio of axial stress to corresponding axial strain for elastic material is known as  
 (A) Bulk modulus (B) Poisson's ratio (C) Shear modulus (D) Young's modulus
- Q.36 An x-ray beam of wavelength  $\lambda = 1.541 \text{ \AA}$  is incident on a cubic crystal having lattice spacing of  $4 \text{ \AA}$ . What will be its  $2\theta$  value (where  $\theta$  is the glancing angle) on x-ray diffractogram?  
 (A)  $11.10^\circ$  (B)  $20.10^\circ$  (C)  $22.20^\circ$  (D)  $44.20^\circ$

- Q.37 The dip slip of a fault is 200 m and the dip amount is  $30^\circ$ . The throw of the fault (m) is  
 (A) 300 (B) 200 (C) 100 (D) 50
- Q.38 Which of the following modes of origin applies to snowball garnet?  
 (A) Pre-tectonic (B) Syn-tectonic (C) Post-tectonic (D) Contact metamorphic
- Q.39 Rocks of which of the following facies form under low geothermal gradient?  
 (A) Blueschist (B) Granulite  
 (C) Hornblende hornfels (D) Sanidinite
- Q.40 Which of the following statements is/are true for porosity of sandstone?  
 P. Porosity increases with sorting of grains.  
 Q. Porosity decreases with sorting of grains.  
 R. Porosity decreases with shale content.  
 S. Porosity increases with shale content.  
 (A) Q (B) P, S (C) P, R (D) S
- Q.41 On crystallization of anorthite, Sr concentration in the magma will  
 (A) decrease (B) increase  
 (C) increase and then decrease (D) remain constant
- Q.42 If the solubility product of gypsum is  $10^{-4.36}$ , the solubility (mol/litre) of gypsum in an ideal aqueous solution will be  
 (A)  $10^{-9.72}$  (B)  $10^{-4.36}$  (C)  $10^{-2.18}$  (D)  $10^{-1.09}$
- Q.43 What is the age of the lignite deposit of Neyveli?  
 (A) Eocene (B) Miocene (C) Oligocene (D) Permian
- Q.44 Find the correct match of mineral pair in Group I with the corresponding crystallization behaviour in Group II
- | Group I                |       | Group II          |       |
|------------------------|-------|-------------------|-------|
| P. Silica – K feldspar |       | 1. Solid solution |       |
| Q. Albite – Anorthite  |       | 2. Peritectic     |       |
| R. Forsterite – Silica |       | 3. Eutectic       |       |
| (A)                    | (B)   | (C)               | (D)   |
| P – 3                  | P – 1 | P – 2             | P – 3 |
| Q – 1                  | Q – 2 | Q – 1             | Q – 2 |
| R – 2                  | R – 3 | R – 3             | R – 1 |
- Q.45 An igneous rock with 50% olivine, 25% orthopyroxene and 25% clinopyroxene by mode will be called  
 (A) dunite (B) harzburgite (C) lherzolite (D) wehrlite

- Q.46 In a gravity survey, if the observation point lies below the datum plane, then for gravity data reduction
- (A) Free-air and Bouguer corrections are positive  
 (B) Free-air correction is positive and Bouguer correction is negative  
 (C) Free-air correction is negative and Bouguer correction is positive  
 (D) Free-air and Bouguer corrections are negative
- Q.47 If the Earth's magnetic field at the north pole is  $60,000 \gamma$  and the radius of Earth is  $R$ , at what height above the north pole will its magnitude be  $30,000 \gamma$  ?
- (A)  $0.26 R$                       (B)  $0.52 R$                       (C)  $0.78 R$                       (D)  $1.04 R$
- Q.48 Match the apparent resistivity type curves observed on the surface in Group I with the subsurface resistivity variations in Group II

Group I		Group II	
P. AK-Type		1. $\rho_1 < \rho_2 > \rho_3 > \rho_4$	
Q. HK-Type		2. $\rho_1 > \rho_2 < \rho_3 > \rho_4$	
R. KQ-Type		3. $\rho_1 > \rho_2 < \rho_3 < \rho_4$	
S. HA-Type		4. $\rho_1 < \rho_2 < \rho_3 < \rho_4$	
		5. $\rho_1 < \rho_2 > \rho_3 < \rho_4$	
		6. $\rho_1 < \rho_2 < \rho_3 > \rho_4$	
(A)	(B)	(C)	(D)
P - 2	P - 3	P - 4	P - 6
Q - 4	Q - 4	Q - 5	Q - 2
R - 1	R - 2	R - 6	R - 1
S - 3	S - 6	S - 1	S - 3

- Q.49 The plane wave electromagnetic field traveling vertically downward in a homogeneous half-space of resistivity  $500 \Omega\text{m}$  varies with depth 'z' as,

$$H_y(z) = H_0 e^{-0.5z} \{ \cos(\omega t - 0.5z) + i \sin(\omega t - 0.5z) \}$$

What is the frequency (in Hz) of the primary field given  $\mu = \mu_0 = 4\pi \times 10^{-7} \text{ h/m}$ ?

- (A)  $7.16 \times 10^7$                       (B)  $5.16 \times 10^7$                       (C)  $3.16 \times 10^7$                       (D)  $1.16 \times 10^7$
- Q.50 Wenner survey is performed over a homogeneous ground of resistivity  $200 \Omega\text{m}$ . For the current electrode spacing of  $60 \text{ m}$ ,  $100 \text{ mA}$  current flow is recorded. What will be the magnitude of potential difference (in mV) between potential electrodes?
- (A) 53.0                      (B) 159.2                      (C) 477.7                      (D) 1433.1
- Q.51 Potential Difference (PD) and Gradient of Potential Difference (GPD) are measured along a profile over a massive sulfide body in self-potential survey. Which of the following statements is correct for the anomalies over the center of the body?
- (A) PD is positive and GPD is positive                      (B) PD is positive and GPD is zero  
 (C) PD is negative and GPD is negative                      (D) PD is negative and GPD is zero

- Q.52 Match the phase differences between the quantities of induction phenomena (Group I) with the amount of phase difference in Group II

Group I		Group II	
P. Secondary field with respect to primary field		1. leads by $90^\circ$	
Q. Inphase component of secondary field with respect to primary field		2. lags by $90^\circ$	
R. Quadrature component of secondary field with respect to primary field		3. lags between $90^\circ - 180^\circ$	
S. Quadrature component of secondary field with respect to inphase component of secondary field		4. lags by $180^\circ$	
(A)	(B)	(C)	(D)
P- 4	P- 1	P- 2	P- 3
Q- 1	Q- 2	Q- 3	Q- 4
R- 3	R- 4	R- 1	R- 2
S- 2	S- 3	S- 4	S- 1

- Q.53 Which of the following combinations of electromagnetic field components is measured in magnetotelluric method?

(A) $E_x, E_y, H_x, H_y, H_z$	(B) $E_x, E_y, E_z, H_x, H_z$
(C) $E_x, E_y, E_z, H_y, H_z$	(D) $E_x, E_z, H_x, H_y, H_z$

- Q.54 Which form of partial differential equation is used for the interpretation of electromagnetic anomalies in geophysical prospecting?

(A) Diffusion equation	(B) Laplace's equation
(C) Poisson's equation	(D) Wave equation

- Q.55 A radioactive substance decays to one third of its original value in 6 hours time. What is the half-life (in hours) of the substance?

(A) 3.58	(B) 3.78	(C) 3.98	(D) 4.18
----------	----------	----------	----------

- Q.56 The relation between magnetic latitude ( $\theta$ ) and the magnetic inclination ( $i$ ) is

(A) $2 \tan i = \tan \theta$	(B) $\tan i = 2 \tan \theta$	(C) $\tan i = 2 \tan^2 \theta$	(D) $2 \tan i = \cos \theta$
------------------------------	------------------------------	--------------------------------	------------------------------

- Q.57 To derive magnetic field from gravity field, the Poisson's relation can be used only when the direction of magnetization is

(A) horizontal ( $0^\circ$ )	(B) $45^\circ$	(C) $60^\circ$	(D) vertical ( $90^\circ$ )
------------------------------	----------------	----------------	-----------------------------

- Q.58 Fourier analysis matches the signal by a series of sinusoids. Each member of the series fits an exact number of

(A) one-fourth wavelength	(B) one-third wavelength
(C) half-wavelength	(D) one wavelength

- Q.59 Compton scattering is the physical basis of

(A) Neutron - Gamma logging	(B) Neutron - thermal neutron logging
(C) Natural Gamma logging	(D) Gamma - Gamma logging

- Q.60 If the P-wave velocity is twice that of S-wave velocity in a medium, the Poisson's ratio of the material is

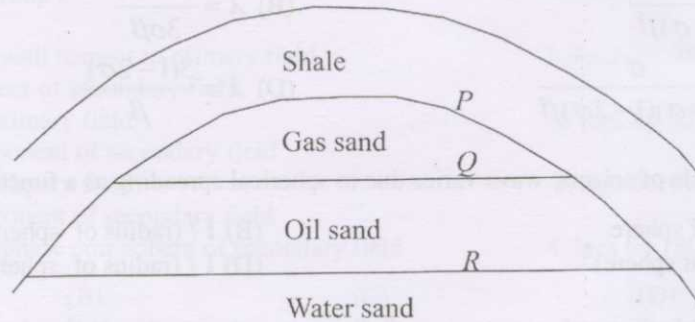
(A) 0.50	(B) 0.33	(C) 0.25	(D) 0.12
----------	----------	----------	----------



- Q.61 The Lamé's coefficient ( $\lambda$ ) can be written in terms of compressibility of the material ( $\beta$ ) and Poisson's ratio ( $\sigma$ ) as
- (A)  $\lambda = \frac{3\sigma}{(1+\sigma)\beta}$  (B)  $\lambda = \frac{(1+\sigma)}{3\sigma\beta}$   
 (C)  $\lambda = \frac{\sigma}{(1+\sigma)(1-2\sigma)\beta}$  (D)  $\lambda = \frac{3(1-2\sigma)}{\beta}$
- Q.62 The amplitude of seismic wave varies due to spherical spreading as a function of
- (A) radius of sphere (B)  $1 / (\text{radius of sphere})$   
 (C)  $(\text{radius of sphere})^2$  (D)  $1 / (\text{radius of sphere})^2$
- Q.63 If  $f$  is the frequency of seismic wave and  $v$  is its velocity, the relation between absorption coefficient ( $\alpha$ ) and quality factor ( $Q$ ) is
- (A)  $\alpha = \frac{\pi f}{Qv}$  (B)  $\alpha = \frac{Qf}{\pi v}$  (C)  $\alpha = \frac{Qv}{\pi f}$  (D)  $\alpha = \frac{\pi Q}{vf}$
- Q.64 In marine seismic surveys, the maximum depth  $d$  (in feet) at which the bubble will break is related to the charge weight  $W$  (in pounds) by the relation
- (A)  $d = 3.8 W$  (B)  $d = 3.8 W^{1/2}$  (C)  $d = 3.8 W^{1/3}$  (D)  $d = 3.8 W^{1/4}$
- Q.65 Considering noise problem (reverberation) in marine seismic work, the frequencies for higher harmonics are expressed by  $f_n = \frac{(2n-1)V_w}{4d_w}$ , where  $f_n$  - frequency of  $n^{\text{th}}$  harmonic,  $V_w$  - velocity of sound in water and  $d_w$  - water depth. The fundamental frequency in terms of the reciprocal of one - way travel time is
- (A) one - fourth (B) one - third (C) one - half (D) three - fourth
- Q.66 In a linear inverse problem having rectangular system matrix that is rank deficient, the inverse solution is
- (A) unique solution (B) least square solution  
 (C) minimum norm solution (D) minimum norm least square solution
- Q.67 In a linear inverse problem having eigenvalues 100, 10, 1, 0.1, 0.01, 0.001, the highest condition number of the system matrix is
- (A) 100000 (B) 10000 (C) 1000 (D) 100
- Q.68 A combination of radioactive logging to detect chlorine in a formation is
- (A) Neutron-thermal neutron log and Gamma-Gamma log  
 (B) Neutron-epithermal neutron log and Neutron-Gamma log  
 (C) Neutron-Gamma log and Gamma-Gamma log  
 (D) Neutron-epithermal neutron log and Gamma-Gamma log
- Q.69 In electrical logging, the measured resistivity of flushed zone is  $19.2 \Omega\text{m}$ , the resistivity of mud-filtrate is  $1.33 \Omega\text{m}$  and the computed value of residual oil saturation in flushed zone is 20%. The value of formation resistivity factor is
- (A) 8.50 (B) 8.85 (C) 9.11 (D) 9.24



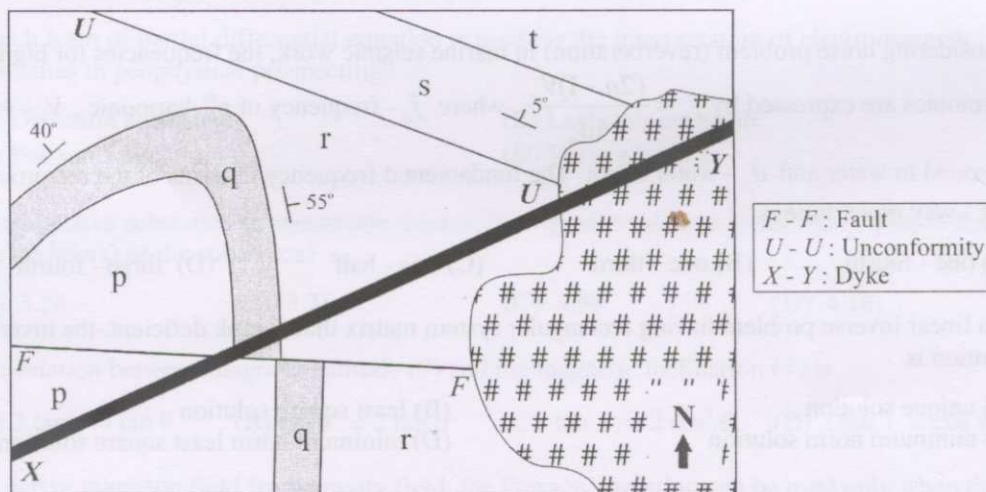
- Q.70 In a seismic reflection survey, lithological boundaries P (Shale and Gas sand), Q (Gas sand and Oil sand) and R (Oil sand and Water sand) computed on the basis of reflection coefficients are shown in figure. Which is the correct sequence of reflection coefficients at these boundaries?



- (A) P (-0.30), Q (+0.20), R (+0.03)  
 (B) P (-0.30), Q (+0.03), R (+0.20)  
 (C) P (+0.20), Q (-0.30), R (+0.03)  
 (D) P (+0.20), Q (+0.03), R (-0.30)

### Common Data Questions

**Common Data for Questions 71, 72 and 73:** The following geological map shows exposures of sedimentary beds p, q, r, s, t and a batholith (hatched) in a flat terrain.



- Q.71 The fold seen in the area is  
 (A) a synform plunging northerly  
 (B) a synform plunging southerly  
 (C) an antiform plunging northerly  
 (D) an antiform plunging southerly
- Q.72 If the fault dips  $70^\circ$  southerly, it is a  
 (A) normal fault with southern upthrown block  
 (B) right lateral strike-slip fault  
 (C) reverse fault with northern upthrown block  
 (D) reverse fault with southern upthrown block
- Q.73 The intrusion of dyke took place  
 (A) after deposition of beds 's' and 't'  
 (B) before deposition of beds 's' and 't'  
 (C) before faulting  
 (D) before folding

**Common Data for Questions 74 and 75:** Two sampled data sets are given as:  $X(n) = \{1, 2, -1, 3\}$  and

$$Y(n) = \{1, -1, 2, \frac{1}{2}\}$$

Q.74 The cross-correlation between these two time series for zero lag is

- (A)  $-\frac{3}{2}$  (B)  $\frac{5}{2}$   
(C) 2 (D) 3

Q.75 The convolution of the data sets results in a time series

- (A)  $\{1, 1, \frac{11}{2}, -4, \frac{17}{2}, -1, 1\}$  (B)  $\{-1, 1, -4, \frac{17}{2}, \frac{1}{2}, -1, 1\}$   
(C)  $\{1, 1, -1, \frac{17}{2}, -4, \frac{11}{2}, \frac{3}{2}\}$  (D)  $\{1, -1, \frac{5}{2}, -4, \frac{17}{2}, 2, 1\}$

**Linked Answer Questions: Q.76 to Q.85 carry two marks each.**

**Statement for Linked Answer Questions 76 and 77:** A mineral assemblage consists of fayalite, ferrosilite and quartz in equilibrium.

Q.76 The number of components in the system is

- (A) 4 (B) 3 (C) 2 (D) 1

Q.77 The degree of freedom of the mineral assemblage in P-T space is

- (A) 1 (B) 2 (C) 3 (D) 4

**Statement for Linked Answer Questions 78 and 79:** The Fe - O bond length in haematite is  $2.05 \text{ \AA}$  and the ionic radius of anion is  $1.32 \text{ \AA}$ .

Q.78 The correct pair of radius ratio and coordination number is

- (A) 0.220 and 3 (B) 0.380 and 4 (C) 0.553 and 6 (D) 0.770 and 8

Q.79 The electrostatic valency of the cation is

- (A) 0.25 (B) 0.5 (C) 1.0 (D) 3.0

**Statement for Linked Answer Questions 80 and 81:** The gravity anomaly along a profile over a spherical ore body shows a maximum anomaly of 12 mgal at the centre and a value of 6 mgal at a distance of 3600 m from the centre. The density contrast between the ore mass with the surrounding rocks is  $0.4 \text{ gm/cm}^3$ .

Q.80 The computed depth (in m) to the centre of the spherical mass is

- (A) 2340 (B) 2940 (C) 3780 (D) 4680

Q.81 The computed radius (in m) of the spherical mass is

- (A) 1965 (B) 2865 (C) 3250 (D) 3685

**Statement for Linked Answer Questions 82 and 83:** A P-wave generated from a surface source is incident at an angle of  $30^\circ$  on a horizontal interface and refracted at an angle of  $50^\circ$  into the second layer. The velocity in the first medium is 3.5 km/s. Densities in the first and second layer are  $2.3 \text{ gm/cm}^3$  and  $2.5 \text{ gm/cm}^3$ , respectively.

- Q.82 The velocity (in km/s) in the second layer is  
 (A) 5.36 (B) 4.86 (C) 4.55 (D) 4.15
- Q.83 The reflection coefficient for the ratio of reflected and incident P-wave amplitudes at normal incidence is  
 (A) 0.32 (B) 0.28 (C) 0.25 (D) 0.21

**Statement for Linked Answer Questions 84 and 85:** Two students were assigned the same 3-layer Schlumberger resistivity sounding data for interpretation. They interpreted different model parameters. First student interpreted resistivities  $\rho_1 = 10 \text{ }\Omega\text{m}$ ,  $\rho_2 = 50 \text{ }\Omega\text{m}$ ,  $\rho_3 = 10 \text{ }\Omega\text{m}$ , thicknesses  $h_1 = 50 \text{ m}$  and  $h_2 = 10 \text{ m}$ .

- Q.84 Which combination of  $\rho_2$  and  $h_2$  interpreted by the second student is correct according to the principle of equivalence?  
 (A)  $\rho_2 = 25 \text{ }\Omega\text{m}$  and  $h_2 = 5 \text{ m}$  (B)  $\rho_2 = 25 \text{ }\Omega\text{m}$  and  $h_2 = 20 \text{ m}$   
 (C)  $\rho_2 = 100 \text{ }\Omega\text{m}$  and  $h_2 = 20 \text{ m}$  (D)  $\rho_2 = 100 \text{ }\Omega\text{m}$  and  $h_2 = 40 \text{ m}$
- Q.85 Transverse resistance and longitudinal conductance calculated by the second student for the second layer is  
 (A)  $4000 \text{ }\Omega\text{m}^2$ ,  $0.4 \text{ mho}$  (B)  $2000 \text{ }\Omega\text{m}^2$ ,  $0.2 \text{ mho}$   
 (C)  $500 \text{ }\Omega\text{m}^2$ ,  $0.8 \text{ mho}$  (D)  $125 \text{ }\Omega\text{m}^2$ ,  $0.2 \text{ mho}$

**END OF THE QUESTION PAPER**