

GG : GEOLOGY AND GEOPHYSICS*Duration* : Three Hours*Maximum Marks* :150**Q. 1 - Q. 20 carry one mark each.****Q.1** The planet having density less than 1.0 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° - 132°
- (B) 92° - 142°
- (C) 102° - 132°
- (D) 102° - 142°

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
- (C) quartz wacke

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

Group I	Group II
P. Load casts	1. Turbulent scour
Q. Cross bedding	2. Melting ice
R. Flutes	3. Soft sediment deformation
S. Dropstones	4. Biogenic
	5. Migration of mega ripples

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

Q.23 The phyllodes developed in echinoids to

- (A) increase efficiency in food collection
 (B) protect it from sinking in muddy substratum
 (C) burrow deep into the sediments
 (C) 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
 (C) 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
 (C) 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

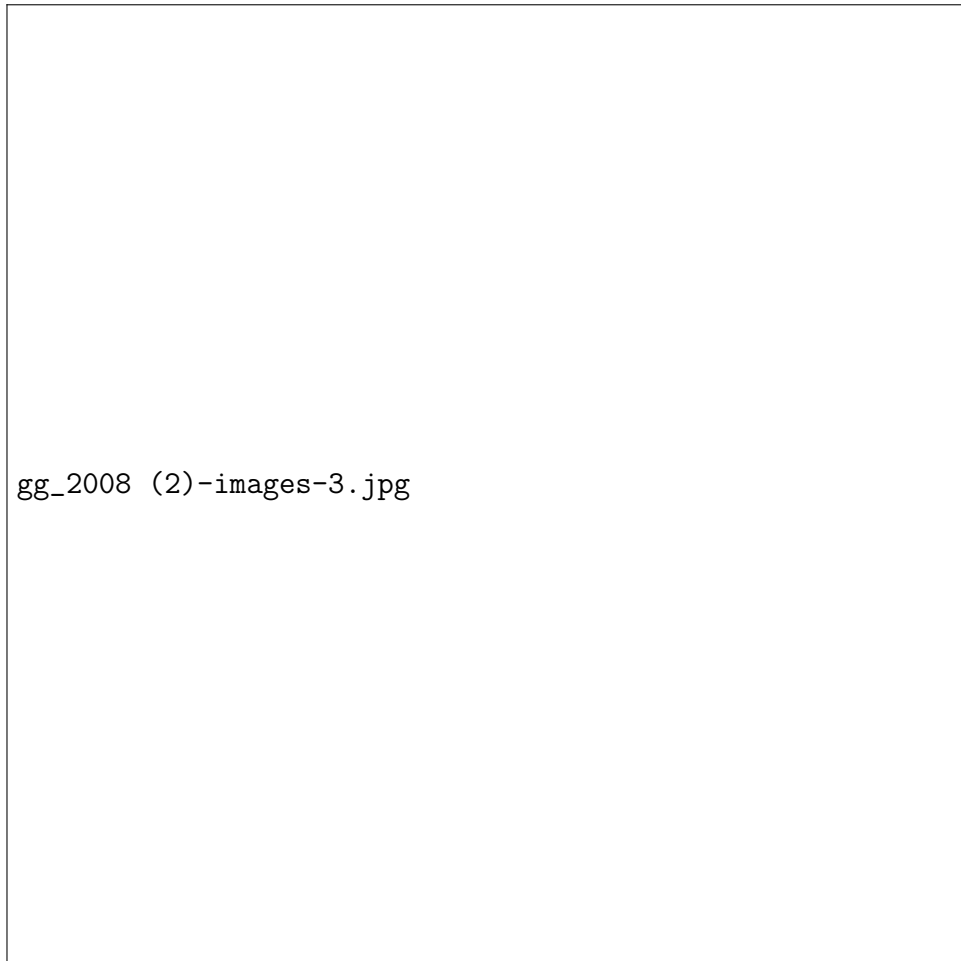
- (A) P - 5, Q - 3, R - 4, S - 1

(B) P - 4, Q - 3, R - 1, S - 5

(C) P - 6, Q - 1, R - 2, S - 5

(C) P - 6, Q - 2, R - 3, 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) 6

(D) $6/m$

Q.29 Dodecahedron and trapezohedron faces are observed in

(A) beryl

(B) chalcopryrite

(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) P - 4, Q - 2, R - 5, S - 3
(B) P - 3, Q - 3, R - 4, S - 1
(C) P - 3, Q - 2, R - 5, S - 4
(C) P - 3, Q - 1, R - 5, 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) P - 2, Q - 1, R - 3, S - 4
(B) P - 3, Q - 2, R - 1, S - 4
(C) P - 4, Q - 3, R - 2, S - 1
(C) P - 3, Q - 2, R - 4, 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 \AA . What will be its 2θ value (where θ is the glancing angle) on x-ray diffractogram?

(A) 11.10°

(B) 20.10°

(C) 22.20°

(D) 44.20°

Q.37 The dip slip of a fault is 200 m and the dip amount is 30° . 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) P–3, Q–1, R–2
- (B) P–1, Q–2, R–3
- (C) P–2, Q–1, R–3
- (D) P–3, Q–2, 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 γ and the radius of Earth is R, at what height above the north pole will its magnitude be 30,000 γ ?

- (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) P-2, Q-4, R-1, S-3
 (B) P-3, Q-4, R-2, S-6
 (C) P-4, Q-5, R-6, S-1
 (D) P-6, Q-2, R-1, S-3

Q.49 The plane wave electromagnetic field traveling vertically downward... frequency?

- (A) 7.16×10^7
 (B) 5.16×10^7
 (C) 3.16×10^7
 (D) 1.16×10^7

Q.50 The total intensity of the Earth's magnetic field at the magnetic equator is 33,000 γ . If the horizontal component is 33,000 γ , then the inclination is

- (A) 0° (B) 30° (C) 45° (D) 60°

Q.51 Which one of the following is NOT a magnetic mineral?

- (A) Magnetite
 (B) Ilmenite
 (C) Hematite

(D) Chalcopyrite

Q.52 Match the seismic body wave phases in Group I with their descriptions in Group II

Group I	Group II
P. P	1. Reflected at the core-mantle boundary
Q. PcP	2. Reflected at the Earth's surface
R. PP	3. Travels through the mantle and outer core
S. PKP	4. Travels only through the mantle

(A) P-4, Q-1, R-2, S-3

(B) P-2, Q-4, R-3, S-1

(C) P-1, Q-2, R-4, S-3

(D) P-3, Q-2, R-1, S-4

Q.53 The arrival time difference between the P and S waves at a seismic station is 48 seconds. The approximate distance of the epicentre from the station is

(A) 400 km

(B) 480 km

(C) 520 km

(D) 560 km

Q.54 Which one of the following has the highest seismic wave velocity?

(A) Granite

(B) Basalt

(C) Peridotite

(D) Limestone

Q.55 A sand layer has a porosity of 35% and is fully saturated with water. The bulk density of the sand is (given water density = 1.0 g/cm^3 , grain density = 2.65 g/cm^3)

(A) 1.65 g/cm^3

(B) 1.90 g/cm^3

(C) 2.00 g/cm^3

(D) 2.30 g/cm^3

Q.56 The unit of transmissivity is

- (A) m^2/s (B) m/s (C) m^3/s (D) m^2/day

Q.57 The discharge of a well in a confined aquifer is directly proportional to

- (A) permeability
(B) porosity
(C) transmissivity
(D) storage coefficient

Q.58 In an unconfined aquifer, the drawdown is 2 m at a distance of 100 m from a pumping well. At a distance of 200 m from the well, the drawdown will be approximately

- (A) 0.5 m (B) 1.0 m (C) 1.5 m (D) 2.0 m

Q.59 Which of the following geophysical methods is most suitable for mapping subsurface saline water?

- (A) Gravity
(B) Magnetic
(C) Seismic
(D) Electrical

Q.60 The half-life of C^{14} is 5730 years. The ratio of C^{14} in a fossil wood sample to that in a living tree is 0.25. The age of the fossil wood is approximately

- (A) 2865 years
(B) 5730 years
(C) 11460 years
(D) 17190 years

Q.61 The product of the decay constant and the half-life of a radioactive isotope is

- (A) 0.5 (B) 1.0 (C) $\ln 2$ (D) 2.0

Q.62 Which of the following dating methods is useful for determining the age of archaeological pottery?

- (A) Radiocarbon
(B) Luminescence
(C) K-Ar
(D) Rb-Sr

Q.63 Which of the following is NOT an index fossil of the Mesozoic?

- (A) Ammonites
- (B) Belemnites
- (C) Graptolites
- (D) Rudists

Q.64 The concept of faunal succession was proposed by

- (A) Charles Lyell (B) James Hutton (C) William Smith (D) Charles Darwin

Q.65 The first appearance of trilobites is in which geological period?

- (A) Cambrian
- (B) Ordovician
- (C) Silurian
- (D) Devonian

Q.66 The end of the Permian period is marked by

- (A) largest mass extinction
- (B) first appearance of mammals
- (C) breakup of Pangaea
- (D) first appearance of flowering plants

Q.67 Which one of the following statements is correct?

- (A) Stromatolites are produced by cyanobacteria
- (B) Graptolites are benthic organisms
- (C) Rudists are Cenozoic molluscs
- (D) Archaeocyathids are Mesozoic sponges

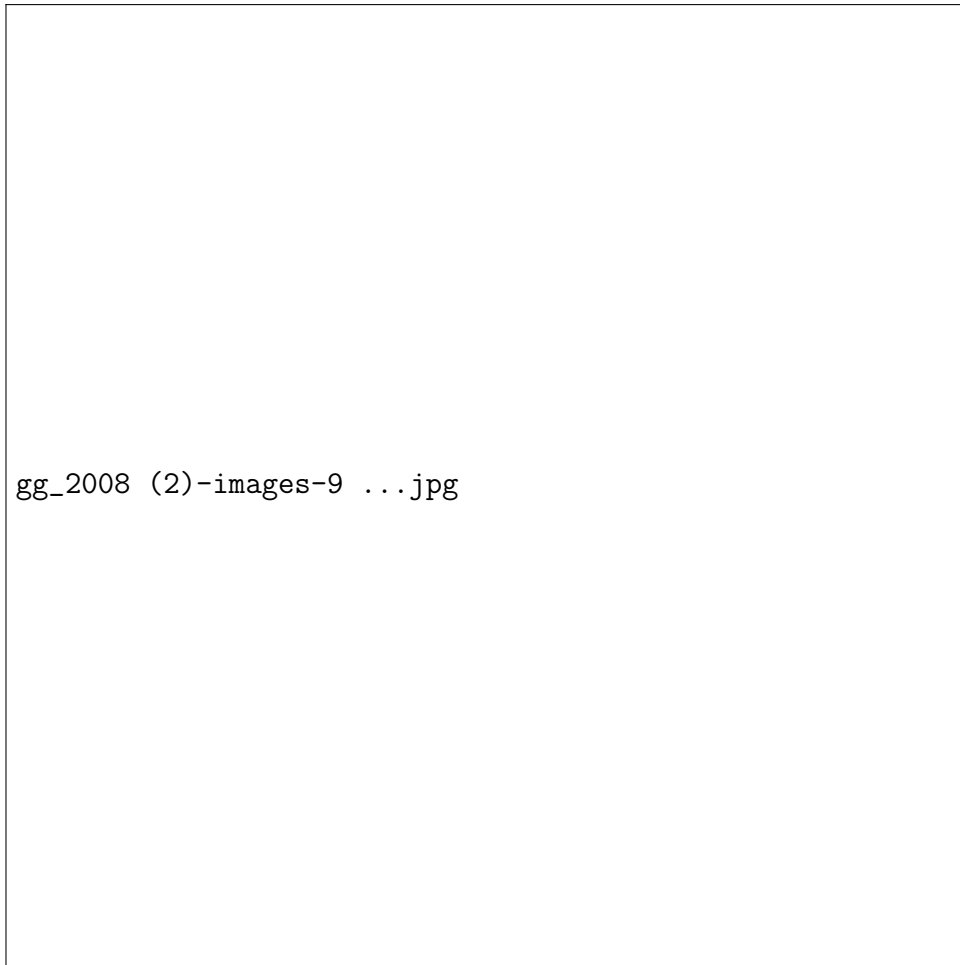
Q.68 Which one of the following is a trace fossil?

- (A) Lingula (B) Planolites (C) Nummulites (D) Belemnites

Q.69 The earliest reptiles appeared during

- (A) Cambrian
- (B) Devonian
- (C) Carboniferous
- (D) Permian

Q.70 Which of the following is a characteristic feature of the class Cephalopoda?



- (A) Presence of radula
- (B) Presence of siphuncle
- (C) Bilateral symmetry
- (D) Possession of operculum

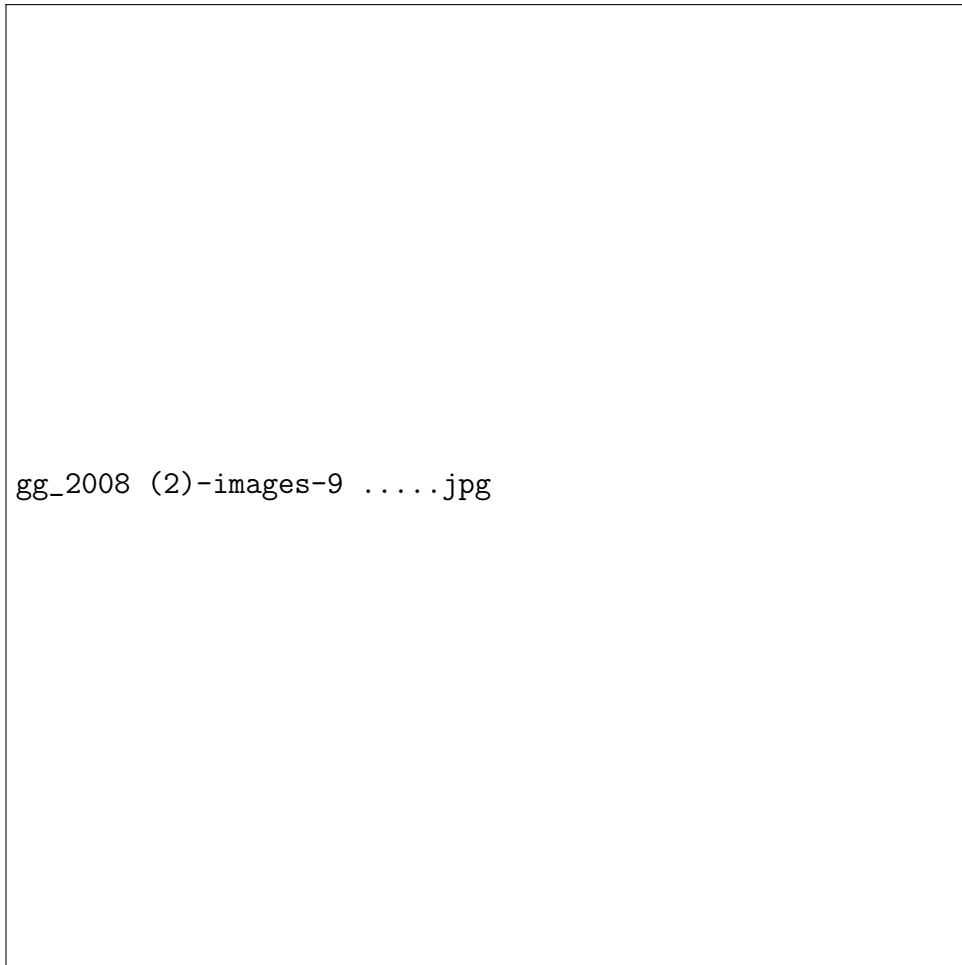
Common Data Questions

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

Q.71 Which of the following microfossils are calcareous?

- (A) Diatoms
- (B) Radiolaria
- (C) Foraminifera
- (D) Spicules of sponges

Q.72 In the binomial nomenclature of fossils, the first word refers to



- (A) family (B) order (C) genus (D) species

Q.73 Which one of the following is NOT a colonial coral?

- (A) Favosites
(B) Halysites
(C) Zaphrentis
(D) Heliophyllum

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 Which of the following is an echinoid?

- (A) Clypeaster
(B) Pentremites
(C) Fagesia
(D) Gryphaea

Q.75 The symmetry of brachiopods is

- (A) bilateral
- (B) radial
- (C) pentameral
- (D) asymmetrical

Linked Answers 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 Which one of the following is an example of a bivalve?

- (A) Pecten
- (B) Spirifer
- (C) Rhynchonella
- (D) Terebratula

Q.77 Which of the following is a rugose coral?

- (A) Favosites
- (B) Halysites
- (C) Zaphrentis
- (D) Heliophyllum

Statement for Linked Answer Questions 78 and 79: The Fe-O bond length in haematite is 2.05 Å and the ionic radius of anion is 1.32 Å.

Q.78 Which of the following is a gastropod?

- (A) Lingula
- (B) Murex
- (C) Belemnites
- (D) Clypeaster

Q.79 Which of the following is a lamellibranch?

- (A) Gryphaea
- (B) Pentremites
- (C) Fagesia
- (D) Rhynchonella

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 gm/cm³.

Q.80 Which of the following is an ammonite?

- (A) Fagesia (B) Clypeaster (C) Lingula (D) Pecten

Q.81 The siphuncle in ammonites is

- (A) ventral (B) dorsal (C) central (D) marginal

Statement for Linked Answer Questions 82 and 83: A P-wave generated from a surface source is incident at an angle of 30° on a horizontal interface and refracted at an angle of 50° 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 gm/cm and 2.5 gm/cm³, respectively.

Q.82 Which one of the following is NOT a cephalopod?

- (A) Nautilus (B) Belemnites (C) Gryphaea (D) Fagesia

Q.83 Which of the following has a heterocercal tail?

- (A) Sharks
(B) Teleosts
(C) Lungfish
(D) Coelacanth

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 $\rho_1 = 10 \Omega\text{m}$, $\rho_2 = 50 \Omega\text{m}$, $\rho_3 = 10 \Omega\text{m}$, thicknesses $h_1 = 50\text{ m}$ and $h_2 = 10\text{ m}$.

Q.84 Which of the following is a placoderm?

- (A) Dunkleosteus (B) Carcharodon (C) Latimeria (D) Sphyrna

Q.85 Which of the following is the oldest era?

- (A) Cenozoic (B) Mesozoic (C) Palaeozoic (D) Proterozoic

END OF THE QUESTION PAPER