

# IIT JAM

## GEOLOGY

### SOLVED SAMPLE PAPER



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RANK



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IIT JAM-GG

GIOLOGY

(FMTP)

Attempt ALL the 60 questions.

There are a total of 60 questions carrying 100 marks.

**Section-A** contains a total of 30 **Multiple Choice Questions (MCQ)**.

Q.1 - Q.10 carry 1 mark each and Questions Q.11 - Q.30 carry 2 marks each.

**Section-B** contains a total of 10 **Multiple Select Questions (MSQ)**. Questions Q.31 - Q.40 belong to this section and carry 2 marks each with a total of 20 marks.

**Section-C** contains a total of 20 **Numerical Answer Type (NAT)** questions.

Questions Q.41 - Q.60 belong to this section and carry a total of 30 marks.

Q.41 - Q.50 carry 1 mark each and Questions Q.51 - Q.60 carry 2 marks each.

In **Section-A** for all 1 mark questions,  $\frac{1}{3}$  marks will be deducted for each wrong answer. For all 2 marks questions,  $\frac{2}{3}$  marks will be deducted for each wrong answer. In **Section-B** (MSQ), there is **NO NEGATIVE** and **NO PARTIAL** marking provisions. There is **NO NEGATIVE** marking in **Section-C** (NAT) as well.

**Time : 3 Hours****MAX.MARKS : 100****MARKS SCORED :** **SECTION-A (Q. 1-30): MULTIPLE CHOICE QUESTIONS (MCQs)**

- Manebach twin is mainly observed in the mineral orthoclase where the composition plane is  
(A) 010 (B) 001 (C) 100 (D) 111
- From below, which rock is composed of orthopyroxene and plagioclase?  
(A) Gabbro (B) Norite (C) Harzburgite (D) Dunite
- Cataclasites are mainly found in  
(A) Ductile shear zone (B) Brittle shear zone  
(C) Transitional zone (D) All of the above
- Graphite can be found in the host rock like  
(A) Anorthosite (B) Khondalite

- (C) Gabbro (D) Nepheline syenite
5. In a vertical section across a sulphide deposit, the site representing the best situation for supergene enrichment would be
- (A) Above the water table (B) Below the water table  
(C) In the oxidation zone (D) In the zones rich in humus
6. Augite is
- (A) Phyllosilicate (B) Tectosilicate  
(C) Inosilicate (D) Nesosilicate
7. The Spinifex texture is found in
- (A) Dunite (B) Spillite (C) Komatiite (D) Gabbro
8. Most of the current structures in sandy sediments have been formed by flows that are
- (A) Laminar and rapid (B) Laminar and tranquil  
(C) Turbulent and rapid (D) Turbulent and tranquil
9. Under low grade metamorphism, a plagioclase may be pseudomorphed by aggregates of microgranular mixture of albite, zoisite or epidote along with variable amounts of chlorite and actinolite.  
This alteration is called
- (A) Chloritisation (B) Seritisation  
(C) Fenitisation (D) Saussuritisation
10. Which is orthorhombic amphibole among the followings?
- (A) Anthophyllite (B) Edenite  
(C) Tremolite (D) Glaucophane
11. In .....wave the motion of particle is in elliptical orbits in the plane of propagation.
- (A) Primary (B) Secondary  
(C) Rayleigh (D) Love
12. Sun releases energy by
- (A) Nuclear Fission (B) Nuclear Fusion  
(C) Spontaneous combustion (D) Hydrothermal process

13. Spodumene is  
(A) Li bearing mica (B) Li bearing plagioclase  
(C) Li bearing pyroxene (D) Na bearing pyroxene
14. Explosive eruptions often involve rhyolitic magmas. This is because of their  
(A) High silica content (B) High water content  
(C) Low volatile solubility (D) Deep seated nature
15. In an experiment you got the production index value varies from 0.10 to 0.30. What could you assume from this value about the generation of the kerogen?  
(A) Oil generation (B) immature  
(C) gas generation (D) oil cracking
16. Which of the following brachiopods possesses concavo-convex shell  
(A) Atrypa (B) Rhynchonella  
(C) Spirifer (D) Productus
17. What is the volcanic equivalent of the rock tonalite?  
(A) Dacite (B) Quartz andesite  
(C) Latite (D) Trachyte
18. In skarn deposit which mineral/minerals can be found?  
(A) Tremolite (B) Hornblend  
(C) Actinolite (D) Cummingtonite
19. The depth range of the outer core is  
(A) 670 km-2900 km (B) 5150 km-6371 km  
(C) 2900 km-5150 km (D) None of the above
20. In the subduction zone the metamorphic facies found is  
(A) Granulite facies (B) Blueschist facies  
(C) Hornfelsic facies (D) Greenschist facies
21. In the closure of the fold the dip of the dip is 300 towards 1100. The plunge of the fold axis in that area is....  
(A) 450 (B) Same as dip of the bed  
(C) 600 (D) None of the above





27. In Gondwana stratigraphy shallow marine and lacustrine bot type sof environ-  
ments are found in
- (A) Talchir series (B) Panchet series  
(C) Umia series (D) Raniganj series
28. Angiosperms appear first in rocks of which geological age?
- (A) Upper Gondwana (B) Middle Gondwana  
(C) Lower Gondwana (D) None of the above
29. Hornflesic texturest is found in
- (A) Contact metamorphism (B) Blue schist  
(C) Green schist (D) None of the above
30. Which is an example of Rugosa coral
- (A) Halysites (B) Favosites  
(C) Zaphrentis (D) Cyclolites

**SECTION-B (Q. 31-40): MULTIPLE SELECT QUESTIONS (MSQs)**

31. The foraminifera found in the temperature range 16o-30o C
- (A) Quinqueloculina (B) Textularia  
(C) Rotalia (D) Bolivina
32. A single specimen selected by the author assuming it as an ideal form for his  
new species is
- (A) Paratype (B) Neotype  
(C) Holotype (D) Sysntype
33. Identify the correct match
- (A) Parallel fold = class 2 (B) Similar fold = class 2  
(C) Parallel fold = class 1B (D) Similar fold = class 1B
34. The age of the Pakhal series is equivalent to
- (A) Kaladgi rocks  
(B) Cuddupah rock  
(C) Vindhyaans  
(D) Bababudan rocks of Dharwar Supergroup

35. The expression of the quadratic elongation is  
 (A)  $(l' - l)/2$       (B)  $\ln(l'/l)$       (C)  $(l'/l)^2$       (D)  $(1+e)^2$
36. Which one is having the sense of rotation  
 (A)  $\theta$  type      (B) C-type      (C) S-type      (D) Mica fish
37. If the beds are nearly horizontal their out crop pattern will follow the  
 (A) Contours      (B) Length of bed  
 (C) Dip      (D) Strike
38. In the Mohr's circle the radius of the circle should be  
 (A)  $(\mu_1 + \mu_2) / 2$       (B)  $(\mu_1 - \mu_2) / 2$   
 (C)  $\mu_1 + \mu_2$       (D)  $\mu_1 - \mu_2$
39. Flysh deposits are mainly  
 (A) Pre kinematic      (B) Synkinematic  
 (C) Post kinematic      (D) None of the above
40. Which is/are true  
 (A) Gastropoda is bilaterally symmetrical  
 (B) Cephalopoda mostly asymmetrical  
 (C) Gastropoda and cephalopoda are univalved  
 (D) Cephalopoda is bilaterally symmetrical

**SECTION-C (Q. 41-60): NUMERICAL ANSWER TYPE (NATs)**

41. In the case of recumbent fold, the fold axis lies in ..... of the stereographic projection.
42. The silicon oxygen ratio in single chain inosilicate is .....
43. If the dip separation of the fold is 20 m. the throw of the fault is.....
44. The hardest oxide in the Mohr's scale of hardness.....
45.  $2\text{Mg}_2\text{SiO}_4 + 3\text{H}_2\text{O} = \dots\dots\dots + \text{Mg}(\text{OH})_2$ .
46. When  $\sigma_2$  is vertical then the fault is.....
47. If the density of A medium is 4 times of the B medium, the ratio of S wave velocities in these two medium as  $S_A : S_B = ?$

48. When older rocks are surrounded by younger rocks, it is called.....
49. The scale of the map has been transformed from 1:50000 to 1: 250000.  
In previous map 10 cm long horizontal body is now..... cm in new map.
50. Scalenohedron has ..... faces.
51. A mid-ocean-ridge-basalt (MORB) source contains 0.206 ppm La, 0.054 ppm Lu, and 13.2 ppm Sr. The mineralogical composition of this source is 65% ol, 24% opx, 6% cpx, and 5% gt. In case of modal batch melting of this source, what will be the bulk distribution coefficients for these three elements?  
Use the following element/mineral Kds:

	Ol	Opx	Cpx	Gt
La	0.00045	0.00125	0.037	0.007
Lu	0.00315	0.049	0.235	5.6
Sr	0.0015	0.016	0.1	0.008

52. The dip of the plane is  $30^\circ$  and the vertical stress on the plane ( $\sigma_1$ ) is 10 N and the parallel to the plane ( $\sigma_2$ ) is 5 N. what is the value of the  $\sigma_N$  ?
53. What will be the distance of earth from sun in astronomical unit according to Bode's law ?
54. If Poisson's ratio is 0.5 and the young's modulus is  $1.2 \cdot 10^7$  N/m<sup>2</sup>. What is the value of bulk modulus?
55. The half life of any element is 5000 years. What is the value of its disintegration constant of that element ?
56. Based on 8 oxygen atoms, the number of silicon atoms in a plagioclase of composition  $Ab_{30}An_{70}$  is \_\_\_\_ (answer in one decimal place).
57. In an aquifer the coefficient of transmissibility (T) is 1.2 ft<sup>3</sup>/ft/day, hydraulic gradient (I) is 0.3 ff/ft and width of the section (L) through which the discharge occur is 10 ft. What will be the discharge of the day?
58. The fault plane has heave amount 8 m and the dip of the fault plane is  $45^\circ$ . The dip separation of the fault plane is.....



59. In stereographic projection, the poles of the fold axes cluster in the opposite side of the periphery, so the fold will be.....
60. If any outcrop the antiform is showing synform and the slope (m) & plunge (n) are in the same direction. Then what is the relation in between m and n?

VPM CLASSES

## ANSWER KEY

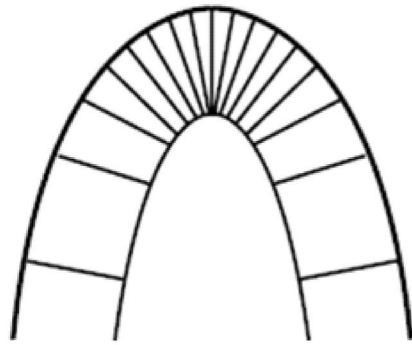
## FMTP

Ques	1	2	3	4	5	6	7	8	9	10
Ans	B	B	B	B	B	C	C	D	D	A
Ques	11	12	13	14	15	16	17	18	19	20
Ans	C	B	C	A	A	D	B	A	C	B
Ques	21	22	23	24	25	26	27	28	29	30
Ans	B	B	C	A	B	C	C	C	A	C
Ques	31	32	33	34	35	36	37	38	39	40
Ans	A,B	C	B,C	A,B	C	B,C,D	A	B	B	C,D
Ques	41	42	43	44	45	46	47	48	49	50
Ans	Peripheri	1:3	10	Corundum	$Mg_3Si_2O_5(OH)_4$	Strike slip	1:2	Inlier	2	24
Ques	51	52	53	54	55	56	57	58	59	60
Ans	0.0112	11.3	1.6	$0.8 \times 10^7$	$1.3 \times 10^{-4}$	2.3	3.6	8	Vertical	$n > m$

## HINTS &amp; SOLUTION

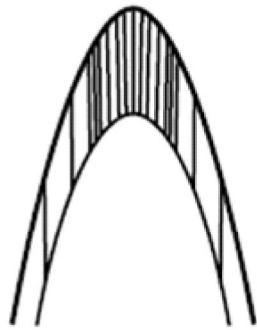
- 1.(B) In the case of Manebach twinning, the composition plane in orthoclase is 001.
- 2.(B) Norite is mainly composed of plagioclase and orthopyroxene.
- 3.(B) Cataclasites are generally found in brittle shear zone.
- 4.(B) Graphite can be hosted by khondalite.
- 5.(B) The enrichment of the copper ore deposits occur under the water table. Water leaches the whole succession from top to bottom and deposits the ore under water table.
- 6.(C) Augite is pyroxene which is mainly single chain inosilicate.
- 7.(C) Komatiite generally shows spinifex texture.
- 8.(D) Current structures are mainly formed in the turbulent and tranquil condition. These fluctuation helps to form the current structure.
- 9.(D) The alteration is called in this case is saussuritisation where zoisite, epidote are formed.
- 10.(A) Among all anthophyllite is the orthorhombic amphibole.
- 11.(C) The particles propagate in an elliptical orbit in the plane of propagation.
- 12.(B) Nuclear fusion of He and H is the main energy source of the Sun.
- 13.(C) Spodumene is Li bearing pyroxene.
- 14.(A) High silica content makes the magma more viscous which make the eruption more explosive.

- 15.(A)** This value is very much indicating for oil generation.
- 16.(D)** Productus has the concave - concave shells among the brachiopodes.
- 17.(B)** Quartz andesite is the volcanic equivalent of tonalite.
- 18.(A)** All are amphiboles but in skarns it would be calcium amphibole. So it is tremolite.
- 19.(C)** That is the depth range of outer core.
- 20.(B)** In subduction zone the high temperature and medium pressure metamorphic facies occur which is blue schist facies.
- 21.(B)** In the closure portion the dip of the beds and the plunge of the fold axis will be equal.
- 22.(B)** The axial plane is inclined (dipping) and the fold axis is horizontal (lies on periphery). So the fold is inclined fold.
- 23.(C)** Dome and basin type of interference pattern is mainly formed when the both folds are upright and the axial plane and fold axis are perpendicular to each other.
- 24.(A)** In the case of crustal thickening by thrusting initially the temperature would be constant but pressure will increase (ITD) after that pressure will be constant and the temperature will be at peak and gradually decrease (IBC).
- 25.(B)** Sharply defined bands parallel to the coiling of whorls bearing fine crescentic growth lines is called selenizone or silt zone.
- 26.(C)** The grain size of coarse sand is in between 0.5-1 mm.
- 27.(C)** In umia formation the traces of lacustrine and shallow marine both types of environments are present.
- 28.(C)** Angiosperms appear in rocks of Lower Gondwan(A).
- 29.(A)** In contact metamorphism, hornfelsic texture is forme(D).
- 30.(C)** Zaphrentis is a rugosa cor(A).
- 31.(A,B)** Quinqueloculina and rotalia are generally found in 16°-30° C temperature range and 15 to 90 m depth in marine environment.
- 32.(C)** A single specimen selected by the author assuming it as an ideal form for his new species is holotype.
- 33.(B,C)** Explanations are given below in diagram.



1B ("parallel" fold)

Class 2, parallel isogons



("similar" fold)

- 34.(A,B) The age of Kaladgi, Cuddapah and Pakhal series are same and it is neoproterozoic.
- 35.(C) If  $l$  is the original length and after elongation the length becomes  $l'$ , then the expression of the quadratic elongation will be  $(l'/l)^2$ .
- 36.(B,C,D) Among all apart from ? type diagram others having the sense of shearing.
- 37.(A) The outcrops of the horizontal beds always follow the contours.
- 38.(B) In the Mohr's circle the radius of the circle always should be the subtraction of the maximum stress and minimum stress divided by 2.
- 39.(B) Flysch deposits are formed simultaneously with the formation of orogeny. It is deposited in the orogenic trough.
- 40.(C,D) Gastropoda and cephalopoda are unrivaled but gastropoda is mostly asymmetric and cephalopoda is bilaterally symmetrical.

41. Periphery. The axial plan of the recumbent fold is horizontal so the periphery of the stereogram represents the axial plane so the fold axis lies in the periphery.
42. **1:3**
43. Throw/dip separation =  $\cos 60^\circ$  so the throw of the fold is dip separation.  $\cos 60^\circ = 20$ .  $\cos 60^\circ = \mathbf{10\ m}$ .
44. **Corundum.**
45.  $\text{Mg}_3\text{Si}_2\text{O}_5(\text{OH})_4$  where olivine ( $\text{Mg}_2\text{SiO}_4$ ) and water reacts to form serpentinite ( $\text{Mg}_3\text{Si}_2\text{O}_5(\text{OH})_4$ ).
46. Strike slip fault.
47. S wave velocity =  $\sqrt{(\sigma / \rho)}$ , Where  $\mu$  is bulk modulus of the medium and  $\rho$  is the density  
 So  $S_A / S_B = \sqrt{(\rho_B / \rho_A)} = \sqrt{(1/4)} = 1/2 = \mathbf{1:2}$ .
48. **Inlier.**
49. The scale has been small 5 times so the body will be now  $10/5 = \mathbf{2\ cm}$ .
50. **24.**
51. For modal batch melting, melt contains the same proportions of the various minerals as the unmelted source (i.e., 65% ol, 24% opx, 6% cpx, 5% gt).  
 DO (La) =  
 $(0.65 \times 0.00045) + (0.24 \times 0.00125) + (0.06 \times 0.037) + (0.05 \times 0.007) = 0.0032$   
 DO(Lu) =  
 $(0.65 \times 0.00315) + (0.24 \times 0.049) + (0.06 \times 0.235) + (0.05 \times 5.6) = 0.3079$   
 DO (Sr) =  
 $(0.65 \times 0.0015) + (0.24 \times 0.016) + (0.06 \times 0.100) + (0.05 \times 0.008) = \mathbf{0.0112}$ .
52.  $\sigma_N = (\sigma_1 + \sigma_2) / 2 + (\sigma_1 - \sigma_2) \cos 2\theta / 2 = 15/2 + 15 \cdot \cos 60^\circ / 2 = \mathbf{11.25\ N}$ .
53. According to Bode's law  
 The distance in astronomical unit(D) = 0.4 when  $n = 1$  and  
 $= 0.4 + 0.3 \cdot 2^{n-1}$ , where  $n \geq 2$

So the distance of earth ( $n = 3$ ) from sun in astronomical unit is  $= 0.4 + 0.3 \cdot 2^{3-1} = 1.6 \text{ AU}$ .

54.  $K = E/3(1-2n)$ , where  $K$  = bulk modulus,  $E$  = the young's modulus and  $n$  = Poisson's ratio.

$$\text{So, } K = 1.2 \times 10^7 / 3(1-0.5) = 0.8 \times 10^7 \text{ N/m}^2$$

55.  $T_{0.5} = 0.693/\lambda$ , where  $T_{0.5}$  is half life and  $\lambda$  is the disintegration constant.

$$\text{So, } \lambda = 0.693/5000 = 1.3 \times 10^{-4}$$

56. The formula of albite =  $\text{NaAlSi}_3\text{O}_8$ .

The formula of anorthite =  $\text{CaAl}_2\text{Si}_2\text{O}_8$

For composition  $\text{Ab}_{30}\text{An}_{70}$ , the no. of aluminum in the formula will be

$$1 \text{ Na} = 1 \text{ Al, so } 0.3 \text{ Na} = 0.3 \text{ Al}$$

$$1 \text{ Ca} = 2 \text{ Al, so } 0.7 \text{ Na} = 1.4 \text{ Al}$$

Total Al =  $0.3 + 1.4 \text{ Al} = 1.7 \text{ Al}$ , if the number of Si in the formula is  $n$  then,

$$0.3 \times 1 + 0.7 \times 2 + 1.7 \times 3 + n \times 4 = 8 \times 2$$

$$0.3 + 1.4 + 5.1 + 4n = 16, 4n = 9.2, \text{ so } n = 2.3.$$

57. The discharge = T.I.L =  $1.2 \times 0.3 \times 10 = 3.6 \text{ ft}^3/\text{day}$ .

58. heave/dip separation =  $\tan \theta$ , where  $\theta$  is the dip amount of the fault plane.

$$\text{So dip separation} = \text{heave} / \tan \theta = 8 / \tan 45^\circ = 8 \text{ m} (\tan 45^\circ = 1).$$

59. Fold will be vertical or upright fold where the fold axes are vertical.

60.  $n > m$ , in that case the antiform will show synform in outcrop as closure towards the observer.