

Test Paper : III  
 Test Subject : EARTH, ATMOSPHERIC, OCEAN AND PLANETARY SCIENCES  
 Test Subject Code : A-08-03

Test Booklet Serial No. : \_\_\_\_\_  
 OMR Sheet No. : \_\_\_\_\_  
 Hall Ticket No. 

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 (Figures as per admission card)

**Name & Signature of Invigilator**

Name : \_\_\_\_\_ Signature : \_\_\_\_\_

**Paper : III  
 Subject : EARTH, ATMOSPHERIC, OCEAN AND PLANETARY SCIENCES**

Time : 2 Hours 30 Minutes Maximum Marks : 150

Number of Pages in this Booklet : 16 Number of Questions in this Booklet : 75

**Instructions for the Candidates**

- Write your Hall Ticket Number in the space provided on the top of this page.
- This paper consists of seventy five multiple-choice type of questions.
- At the commencement of examination, the question booklet will be given to you. In the first 5 minutes, you are requested to open the booklet and compulsorily examine it as below :
  - To have access to the Question Booklet, tear off the paper seal on the edge of this cover page. Do not accept a booklet without sticker-seal and do not accept an open booklet.
  - Tally the number of pages and number of questions in the booklet with the information printed on the cover page. Faulty booklets due to pages/questions missing or duplicate or not in serial order or any other discrepancy should be got replaced immediately by a correct booklet from the invigilator within the period of 5 minutes. Afterwards, neither the Question Booklet will be replaced nor any extra time will be given.**
  - After this verification is over, the Test Booklet Number should be entered in the OMR Sheet and the OMR Sheet Number should be entered on this Test Booklet.
- Each item has four alternative responses marked (A), (B), (C) and (D). You have to darken the circle as indicated below on the correct response against each item.  
**Example :**

(A)	(B)	<input checked="" type="radio"/>	(D)
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 where (C) is the correct response.
- Your responses to the items are to be indicated in the **OMR Sheet given to you**. If you mark at any place other than in the circle in the Answer Sheet, it will not be evaluated.
- Read instructions given inside carefully.
- Rough Work is to be done in the end of this booklet.
- If you write your name or put any mark on any part of the OMR Answer Sheet, except for the space allotted for the relevant entries, which may disclose your identity, you will render yourself liable to disqualification.
- You have to return the test question booklet and OMR Answer Sheet to the invigilators at the end of the examination compulsorily and must not carry it with you outside the Examination Hall.
- Use only Blue/Black Ball point pen.**
- Use of any calculator or log table etc., is prohibited.**
- There is no negative marks for incorrect answers.**

**అభ్యర్థులకు సూచనలు**

- ఈ పుట పై భాగంలో ఇవ్వబడిన స్థలంలో మీ హాల్ టికెట్ నంబరు రాయండి.
- ఈ ప్రశ్న పత్రము డెబ్బైఐదు బహుళాప్త ప్రశ్నలను కలిగి ఉంది.
- పరీక్ష ప్రారంభమున ఈ ప్రశ్నాపత్రము మీకు ఇవ్వబడుతుంది. మొదటి ఐదు నిమిషములలో ఈ ప్రశ్నాపత్రమును తెరిచి కింద తెలిపిన అంశాలను తప్పనిసరిగా సరిచూసుకోండి.
  - ఈ ప్రశ్న పత్రమును చూడడానికి కవర్ పేజీ అంచున ఉన్న కాగితపు సీలును చించండి. స్టిక్కర్ సీలులేని మరియు ఇదివరకే తెరిచి ఉన్న ప్రశ్నాపత్రమును మీరు అంగీకరించనద్దు.
  - కవరు పేజీ పై ముద్రించిన సమాచారం ప్రకారం ఈ ప్రశ్నపత్రములోని పేజీల సంఖ్యను మరియు ప్రశ్నల సంఖ్యను సరిచూసుకోండి. పేజీల సంఖ్యకు సంబంధించి గానీ లేదా సూచించిన సంఖ్యలో ప్రశ్నలు లేకపోవుట లేదా నిజప్రతి కాకపోవుట లేదా ప్రశ్నలు క్రమపద్ధతిలో లేకపోవుట లేదా ఏదైనా తేడాలుండుట వంటి దోషపూరితమైన ప్రశ్న పత్రాన్ని వెంటనే మొదటి ఐదు నిమిషాల్లో పరీక్షా పర్యవేక్షకునికి తిరిగి ఇచ్చివేసి దానికి బదులుగా సరిగ్గా ఉన్న ప్రశ్నపత్రాన్ని తీసుకోండి. తదనంతరం ప్రశ్నపత్రము మార్చబడదు అదనపు సమయం ఇవ్వబడదు.
  - పై విధంగా సరిచూసుకొన్న తర్వాత ప్రశ్నాపత్రం సంఖ్యను OMR పత్రము పై అదేవిధంగా OMR పత్రము సంఖ్యను ఈ ప్రశ్నాపత్రము పై నిర్దిష్ట స్థలంలో రాయవలెను.
- ప్రతి ప్రశ్నకు నాలుగు ప్రత్యామ్నాయ ప్రతిస్పందనలు (A), (B), (C) మరియు (D) లుగా ఇవ్వబడ్డాయి. ప్రతి ప్రశ్నకు సరైన ప్రతిస్పందనను ఎన్నుకొని కింద తెలిపిన విధంగా OMR పత్రములో ప్రతి ప్రశ్నా సంఖ్యకు ఇవ్వబడిన నాలుగు వృత్తాల్లో సరైన ప్రతిస్పందనను సూచించే వృత్తాన్ని బాల్ పాయింట్ పెన్ తో కింద తెలిపిన విధంగా పూరించాలి.  
**ఉదాహరణ :**

(A)	(B)	<input checked="" type="radio"/>	(D)
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 (C) సరైన ప్రతిస్పందన అయితే
- ప్రశ్నలకు ప్రతిస్పందనలను ఈ ప్రశ్నపత్రములో ఇవ్వబడిన OMR పత్రము పైని ఇవ్వబడిన వృత్తాల్లోనే పూరించి గుర్తించాలి. అలాకాక సమాధాన పత్రంపై వేరొక చోట గుర్తిస్తే మీ ప్రతిస్పందన మూల్యాంకనం చేయబడదు.
- ప్రశ్న పత్రము లోపల ఇచ్చిన సూచనలను జాగ్రత్తగా చదవండి.
- చిత్తుపనిని ప్రశ్నపత్రము చివర ఇచ్చిన ఖాళీస్థలములో చేయాలి.
- OMR పత్రము పై నిర్ణీత స్థలంలో సూచించవలసిన వివరాలు తప్పించి ఇతర స్థలంలో మీ గుర్తింపును తెలిపే విధంగా మీ పేరు రాయడం గానీ లేదా ఇతర చిహ్నాలను పెట్టడం గానీ చేసినట్లయితే మీ అనర్హతకు మీరే బాధ్యులవుతారు.
- పరీక్ష పూర్తయిన తర్వాత మీ ప్రశ్నపత్రాన్ని మరియు OMR పత్రాన్ని తప్పనిసరిగా పరీక్షపర్యవేక్షకుడికి ఇవ్వాలి. వాటిని పరీక్ష గది బయటకు తీసుకువెళ్ళకూడదు.
- నీలి/నల్ల రంగు బాల్ పాయింట్ పెన్ మాత్రమే ఉపయోగించాలి.
- లాగరిథమ్ బేబుల్స్, క్యాలిక్యులేటర్లు, ఎలక్ట్రానిక్ పరికరాలు మొదలగునవి పరీక్షగదిలో ఉపయోగించడం నిషేధం.
- తప్పనిసరిగా సమాధానాలకు మార్కుల తగ్గింపు లేదు.





# EARTH, ATMOSPHERIC, OCEAN AND PLANETARY SCIENCES

## Paper – III

1. In X-ray diffraction, the equation,  $n\lambda = 2d\sin\theta$  is known as \_\_\_\_\_ law.

- (A) Roentgen
- (B) Becquerel
- (C) Curie
- (D) Braggs

2. Which one of the following statements is correct ?

- (A) Komatiite is an ultrabasic plutonic rock
- (B) Syenite is an acidic volcanic rock
- (C) Tholeiite is a basic volcanic rock
- (D) Dunite is an Mg rich carbonate rock

3. A very large joint which can be traced over an extensive area is described commonly as a

- (A) Columnar joint
- (B) Plunging fold
- (C) Dome
- (D) Master joint

4. Match the following

List I (Species)		List-II (Phylum)	
a. Cidaris		1. Coelentrata	
b. Productus		2. Mollusca	
c. Corals		3. Brachipoda	
d. Trigonina		4. Echinodermata	
a	b	c	d
(A) 2	4	1	3
(B) 1	2	3	4
(C) 4	3	1	2
(D) 3	4	2	1

5. **Assertion A:** Different inorganic and organic structures are formed in sedimentary rocks

**Reason R :** The structure 'Petrifaction' is of inorganic origin

- (A) Both A and R are true and R is the correct explanation
- (B) Both A and R are true, but R is not the correct explanation
- (C) A is true but R is false
- (D) A is false but R is true



6. The chemical structures formed in sedimentary rocks are

- I. Striations
  - II. Stylolites
  - III. Nodules
  - IV. Geodes
- (A) I, II and III are correct  
(B) I and II are correct  
(C) II and III are correct  
(D) II, III and IV are correct

7. Oceans may be the source of

- I. Zeolites
  - II. Nodules
  - III. Placer deposits
  - IV. Phosphorites
- (A) II, III and IV are correct  
(B) I, II and IV are correct  
(C) I, II and III are correct  
(D) I, II, III and IV are correct

8. **Assertion A** : Low atomic elements like oxygen (O), hydrogen (H), sulphur (S) and carbon (C) are used in the studies of stable isotope geochemistry.

**Reason R** : Isotopes of above cited low atomic number elements are well fractionated in the course of certain chemical and physical processes occurring in nature, and the variations in isotopic compositions of these elements are easy to determine by mass spectrometer.

- (A) Both A and R are true and R is the correct explanation  
(B) Both A and R are true but R is not the correct explanation  
(C) A is true but R is false  
(D) A is false but R is true



- 9.** Arrange in the decreasing order of Fe-content in the principal layers of the earth, using the number code given below
- I. Oceanic crust
  - II. Continental crust
  - III. Core
  - IV. Mantle
- (A) I, II, III, IV  
(B) II, III, IV, I  
(C) III, IV, II, I  
(D) III, IV, I, II
- 10.** The highest amount of moisture content is present in the coaly matter
- (A) Peat  
(B) Lignite  
(C) Bituminous coal  
(D) Anthracite
- 11.** The percentage of methane and ethane constituents in natural gas is
- (A) 50% to 60%  
(B) 60% to 70%  
(C) 70% to 80%  
(D) 80% to 90%
- 12.** Eastern Ghats of India represents a
- (A) Craton  
(B) Mobile belt  
(C) Rift  
(D) Proterozoic sedimentary basin
- 13.** Eustatic sea level changes occur due to the following reasons
- I. Changes in volume of sea water due to melting of glaciers
  - II. Change in the size of the ocean basins that contains it
  - III. Decrease in the feeding by rivers
- (A) I and III  
(B) I and II  
(C) II and III  
(D) I, II and III
- 14.** The porosity of a rock depends on
- I. Shape of the grain
  - II. Packing of the grain
  - III. Size of the grain
  - IV. Sorting of the grain
- (A) I and II  
(B) I, II, III and IV  
(C) I, III and IV  
(D) I, II and III



15. In Wenner's array of resistivity prospecting, the current electrode separation is \_\_\_\_\_ of the potential electrode separation.

- (A) One fifth
- (B) One third
- (C) Four times
- (D) Three times

16. In pedogenesis, transformation process includes

1. Conversion of organic matter into humus
2. Decomposition of primary to secondary minerals
3. Removal of surface material by erosion and leaching
4. Accumulation of materials in a lower horizon

- (A) 1, 2, 3 and 4 are correct
- (B) 1 and 2 are correct
- (C) 1, 3 and 4 are correct
- (D) 2, 3 and 4 are correct

17. Match List I and List II and identify the correct answer using codes given

<b>List I</b>	<b>List II</b>
<b>(Concept)</b>	<b>(Authors)</b>
a. Uniformitarianism	1. Peltier
b. Geomorphic cycle	2. Agassiz
c. Ice age	3. Davis
d. Morphogenetic regions	4. Hutton
	5. Wood

	a	b	c	d
(A)	2	3	4	5
(B)	4	3	5	1
(C)	4	3	2	1
(D)	1	3	2	4

18. Patterned ground is associated with the climate

- (A) Arid climate
- (B) Tropical climate
- (C) Temperate climate
- (D) Periglacial climate



**19. Assertion A** : Limestone regions stand out as elevated features in arid climates and low lying features in humid climates.

**Reasoning R** : limestone is susceptible to chemical weathering and resistant to physical weathering.

- (A) Both 'A' and 'R' are true and 'R' is the correct explanation
- (B) Both 'A' and 'R' are true and 'R' is not the correct explanation
- (C) 'A' is true but 'R' is false
- (D) 'A' is false but 'R' is true

**20.** Occlusion is a process associated with

- (A) Condensation
- (B) Precipitation
- (C) Temperate cyclone
- (D) Cloud formation

**21.** Clouds which have a streak line form are called

- (A) Stratus
- (B) Nimbus
- (C) Cumulus
- (D) Cirrus

**22.** Subsidence inversion is produced well above the earth's surface on account of

- (A) Ocean currents
- (B) Air current
- (C) Cold current
- (D) Electric current

**23.** World Forest Day is observed on

- (A) March 21
- (B) April 22
- (C) June 5
- (D) May 22

**24.** India is divided into \_\_\_ biogeographic zones and \_\_\_ biogeographic provinces.

- (A) 5, 10
- (B) 8, 20
- (C) 10, 25
- (D) 15, 35



**25. Assertion A :** Natural balance of the ecosystem is not only in between production and consumption but also includes energy flow.

**Reasoning R :** Green plants are autotrophic while decomposers are saprotrophs.

- (A) Both 'A' and 'R' are true and 'R' is the correct explanation
- (B) Both 'A' and 'R' are true and 'R' is not the correct explanation
- (C) 'A' is true but 'R' is false
- (D) 'A' is false but 'R' is true

**26. Which of the following location is significant for renewable energy generation ?**

- (A) Sasan
- (B) Kayathar
- (C) Kaiga
- (D) Mundra

**27. Identify the correct statement**

- (A) The headquarters for Botanical Survey of India is located at Dehradun
- (B) Project Tiger was launched in April 1975
- (C) Mangroves in India account for about 5% of world's Mangrove vegetation
- (D) Bharatpur Wildlife Sanctuary is located in Karnataka

**28. Which of the statements is correct ?**

- (A) Son is a major tributary river for Ganges and it joins the northern bank Ganges
- (B) Rivers Bhagirathi and Alkananda join at Rudraprayag to form Ganges
- (C) Subansiri is a principal tributary river for Mahanadi
- (D) Godavari basin is the second largest in India covering nearly 10% of total area of the country





29. Which of the following statements are correct about the impact of Green Revolution on Indian agriculture ?
- (1) Increases productivity levels of certain crops
  - (2) Increases regional disparities in agricultural development
  - (3) Widened the gap in the productivity levels between the crops
  - (4) Widened the gap in the economic levels between the farming communities
- (A) 1, 2, 3 and 4  
(B) 1, 2 and 3  
(C) 1, 3 and 4  
(D) 1, 2 and 4
30. As per 2011 census, the correct ranking of States in terms of highest sex-ratio
- (A) Kerala, Andhra Pradesh, Mizoram, Manipur, Chattisgarh
  - (B) Kerala, Andhra Pradesh, Tamilnadu, Manipur, Chattisgarh
  - (C) Kerala, Tamilnadu, Meghalaya, Chattisgarh, Manipur
  - (D) Kerala, Tamilnadu, Andhra Pradesh, Chattisgarh, Manipur
31. No information is lost by regular sampling provided that the ratio of sampling frequency to highest frequency is
- (A) less than 0.5
  - (B) between 0.5 – 1.0
  - (C) between 1.0 – 1.5
  - (D) greater than 2.0
32. If mass is very long in the Y-direction and has a uniform cross-section of arbitrary shape in XZ planes the gravity attraction derives from a
- (A) Newtonian potential
  - (B) Geoid potential
  - (C) Logarithmic potential
  - (D) Induction potential
33. Gravity potential satisfies \_\_\_\_\_ equation in free space.
- (A) Laplace's
  - (B) Poission's
  - (C) Maxwell's
  - (D) Linear



- 34.** Simpson's rule is a numerical method that approximates the value of a definite integral by using
- (A) Linear relationship
  - (B) Quadratic polynomial
  - (C) Cubic polynomial
  - (D) Least square approximation
- 35.** Which mineral has highest density ?
- (A) Wolframite
  - (B) Uraninite
  - (C) Chromite
  - (D) Covdite
- 36.** The degree to which a substance can be magnetised is determined by its
- (A) Magnetic susceptibility
  - (B) Magnetic induction
  - (C) Intensity of magnetisation
  - (D) Magnetic permeability
- 37.** Gravimeters used in field measurements have a sensitivity of about
- (A) 1.0 m gal
  - (B) 0.1 m gal
  - (C) 0.01 m gal
  - (D) 0.001 m gal
- 38.** In gravity prospecting low frequency signal is associated with
- (A) Regional effects
  - (B) Residual effects
  - (C) Diurnal variations
  - (D) Drift of gravimeter
- 39.** Very low frequency electromagnetic method is used to explore
- (A) Horizontal stratified conducting layers of the earth
  - (B) Vertical or nearly vertical conducting portions of the earth
  - (C) Very deep discontinuities of the earth
  - (D) All the above
- 40.** S.P. log in the water well gives information about
1. porous and permeable formation
  2. clear demarcation between permeable and non-permeable formation
- (A) Only 1 is correct
  - (B) Only 2 is correct
  - (C) Both 1 and 2 are correct
  - (D) None of the above



- 41.** Radioactive logging techniques are used
- (A) Only in cased wells
  - (B) Only in uncased wells
  - (C) Both cased and uncased wells
  - (D) Only in open wells
- 42.** Seismic refraction studies are employed in
1. Oil and natural gas investigations
  2. Ground water investigations
  3. Archaeological investigations
- (A) Only 1 is correct
  - (B) Only 2 is correct
  - (C) Only 3 is correct
  - (D) All the above are correct
- 43.** Subduction zone presents the following type of boundary
- (A) Diverging plate boundary
  - (B) Conservative boundary
  - (C) Convergent plate boundary
  - (D) None of the above
- 44.** The earth quake intensity number '10' on Richter scale can be identified by
- (A) Buildings tremble, parked vehicles rock and wall clock stops
  - (B) Heavy damage to buildings and collapse of reservoir begin
  - (C) Complete destruction and ground badly twisted
  - (D) Buildings raged to ground and life line destroyed
- 45.** Koyana earth quake is an example of
1. Fault induced seismicity
  2. Reservoir induced seismicity
  3. Volcanic induced seismicity
- (A) Only 1 and 3 are correct
  - (B) Only 2 and 3 are correct
  - (C) Only 3 is correct
  - (D) Only 1 and 2 are correct
- 46.** When the temperature of an air mass increases or decreases without addition or removal of heat, the process is called
- (A) Adiabatic process
  - (B) Normal lapse rate
  - (C) Occlusion
  - (D) Thermal inversion



47. The Atlantic Polar Front has its full development during
- (A) Spring
  - (B) Summer
  - (C) Winter
  - (D) Autumn
48. The lower limit of the ionosphere
- (A) 70 – 80 km
  - (B) 80 – 120 km
  - (C) 120 – 160 km
  - (D) 160 – 200 km
49. Radio waves can be detected at great distances especially at night. This is due to the layer
- (A) Mesosphere
  - (B) Stratosphere
  - (C) Lithosphere
  - (D) Ionosphere
50. In a  $T-\Phi$  gram Normand's III proposition is applied to determine
- (A) LCL
  - (B) CCL
  - (C) Thickness of layers
  - (D) Relative humidity
51. Homogeneous nucleation occurs when the air parcel is
- (A) Saturated
  - (B) Super-saturated
  - (C) Unsaturated
  - (D) All of the above
52. In hydrostatic equilibrium the balance will be between
- (A) Pressure gradient and gravity
  - (B) Pressure gradient and Coriolis Force
  - (C) Coriolis Force and gravity
  - (D) Coriolis Force and friction
53. The prime mechanism in the formation of hail is
- (A) Accretion
  - (B) Coalescence
  - (C) Condensation
  - (D) Dissipation
54. In the absence of external forces when the centrifugal and the Coriolis forces are equal and opposite, then the flow is called
- (A) Gradient flow
  - (B) Inertial flow
  - (C) Geostrophic flow
  - (D) Cyclostrophic flow



55. The thermal wind is zero in a \_\_\_\_\_ atmosphere.
- (A) Barotropic
  - (B) Baroclinic
  - (C) Neutral
  - (D) Standard
56. Baroclinic instability arises out of
- (A) Horizontal shear
  - (B) Vertical shear
  - (C) Linear shear
  - (D) No shear
57. The ratio of available potential energy to the total potential energy is
- (A) 1/10
  - (B) 1/100
  - (C) 1/20
  - (D) 1/200
58. The condition for computational instability in a primitive equation model is
- (A)  $\frac{c \Delta t}{\Delta X} \leq \frac{1}{\sqrt{2}}$
  - (B)  $\frac{c \Delta t}{\Delta X} \leq 1$
  - (C)  $\frac{c \Delta t}{\Delta X} \leq \frac{1}{4}$
  - (D)  $\frac{c \Delta t}{\Delta X} \leq \frac{1}{2}$
59. In an equivalent barotropic model
- (A) The wind is constant with height
  - (B) The wind direction is constant with height
  - (C) Wind is constant with height but the wind direction changes with height
  - (D) Wind direction is constant with height but the wind speed changes with height
60. Wheeler and Hendon gives the magnitude of
- (A) Madden Julian oscillations
  - (B) El Nino southern oscillation
  - (C) Quasi biennial oscillations
  - (D) None of the above
61. In the general circulation ocean models the Western boundary currents are
- (A) Ekman boundary layers
  - (B) Munk boundary layers
  - (C) Stommel boundary layers
  - (D) Sverdrup boundary layers



- 62.** In an estuary the salinity of water is reduced due to
- (A) Fresh water input
  - (B) Seawater incursion
  - (C) Incursion of tidal currents
  - (D) None of the above
- 63.** In a baroclinic fluid
- (A) Density is a function of pressure
  - (B) Density is not a function of pressure
  - (C) Density is a function of depth
  - (D) Density is a function of wave height
- 64.** In oceans one can have
- (A) Weather
  - (B) Climate
  - (C) Both weather and climate
  - (D) None of the above
- 65.** Which of the following develop upwelling on a seasonal basis ?
- (A) Somali current
  - (B) East Arabian current
  - (C) South Jaua current
  - (D) All of the above
- 66.** The Somali current is a
- (A) Western boundary current
  - (B) Eastern boundary current
  - (C) Northern boundary current
  - (D) Southern boundary current
- 67.** In sea water the most abundant element present is
- (A) Oxygen
  - (B) Hydrogen
  - (C) Chlorine
  - (D) Sodium
- 68.** The pH value of sea water falls in the range of
- (A) 4 – 6.5
  - (B) 7.5 – 8.4
  - (C) 9 – 15
  - (D) 16 – 26
- 69.** Large volumes of bottom sediments are transported long distances by
- (A) Tidal action
  - (B) Icebergs
  - (C) Storm waves
  - (D) Turbidity currents



70. The continental terrace includes

- I. Continental shelf
- II. Continental rise
- III. Continental slope
- IV. All of the above

- (A) I and II
- (B) I and III
- (C) II and III
- (D) I, II and III

71. Terrigenous sediments of the oceans are deposited by

- (A) Rivers
- (B) Turbidity currents
- (C) Winds
- (D) All of the above

72. Based on the depth, the marine environments are classified into

- (A) Beaches, littoral environment, neretic environment, abyssal environment
- (B) Neretic environment, bathyal environment and abyssal environment
- (C) Littoral environment, bathyal environment and abyssal environment
- (D) All of the above

73. The ecological parameters of the marine environment include

- I. Salinity
- II. Temperature
- III. Substrate
- IV. Food

- (A) I and II are correct
- (B) I, II and IV are correct
- (C) II, III and IV are correct
- (D) I, III and IV are correct

74. One of the following organisms is not a benthic organism

- (A) Ammoniod
- (B) Asterorotalia
- (C) Globigerina
- (D) Elphidium

75. **Assertion A** : an estuary is a river mouth which is affected by the tides of the sea

**Reason R** : an estuary consists of only freshwater

- (A) Both 'A' and 'R' are true and R is the correct explanation
- (B) Both 'A' and 'R' are true but R is not the correct explanation
- (C) 'A' is true but 'R' is false
- (D) 'A' is false but 'R' is true



**Space for Rough Work**