7

p-Block Elements

Introduction

Level I

1. *p*-block elements are placed in groups ...*A*... of the Periodic Table. Here, *A* refers to
   (a) 13 – 18 (b) 14 – 16
   (c) 15 – 17 (d) 12 – 18

2. The valence shell electronic configuration of the *p*-block elements is ...I.... Here, I refers to
   (a) $nsnp^2$ (b) ns^2np^{1-6}
   (c) ns^2np^2 (d) $nsnp^6$

3. The absence of *d*-orbitals in ...*A*... period and presence of *d* or *d* and *f* orbitals in ...*B*... elements have significant effects on the properties of elements. Here, *A* and *B* refer to
   (a) *A*-second; *B*-lighter (b) *A*-fourth; *B*-heavier
   (c) *A*-second; *B*-heavier (d) *A*-fourth; *B*-lighter

4. "Properties like atomic sizes, ionisation enthalpy etc., have no influence on *p*-block elements." This statement is
   (a) true (b) false
   (c) partially true (d) cannot be predicted

5. He has ...*A*... configuration. Here, *A* refers to
   (a) $2s^2$
   (b) $1s^1$
   (c) $1s^2\,2p^2$
   (d) $1s^2$

Level II

6. Which group of elements are commonly known as pnicogens?
   (a) Group-13 elements
   (b) Group-14 elements
   (c) Group-15 elements
   (d) Group-16 elements

7. 'Pnicogens' is derived from Greek word ...*A*... meaning ...*B*.... Here, *A* and *B* refer to
   (a) *A*-pniomigs; *B*-suffocation
   (b) *A*-pniomigs; *B*-small
   (c) *A*-pniconide; *B*-small
   (d) *A*-pniconide; *B*-suffocation

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Group-15 Elements

Level I

8. Nitrogen, phosphorus, arsenic, antimony and bismuth belong to
(a) group-14 (b) group-15 (c) group-16 (d) group-17

9. Nitrogen and phosphorus are ...*A*..., arsenic and antimony are ...*B*... and bismuth is a ...*C*.... Here, *A*, *B* and *C* are
(a) *A* – metals; *B* – metalloids; *C* – non-metal
(b) *A* – metals; *B* – non-metals; *C* – metalloids
(c) *A* – non-metals; *B* – metalloids; *C* – metal
(d) *A* – metalloids; *B* – metals; *C* – non-metal

10. What is the percentage of molecular nitrogen by volume of the atomosphere?
(a) 64% (b) 68% (c) 78% (d) 84%

11. Chilesaltpetre is the common name of
(a) $AgNO_3$ (b) $NaNO_3$ (c) $NaSO_4$ (d) AgCl

12. $NaNO_3$ is found in the form of ...I... in plants and animals. Here, I refers to
(a) proteins (b) vitamins
(c) nucleic acids (d) None of these

13. An element *M* belongs to group-15 and it occurs as the founder of the apatite family which are the main components of phosphate rocks. *M* is an essential constituent of animal and plant matter. It is also present in bones as well as in living cells. Identify *M*.
(a) Calcium (b) Magnesium
(c) Either (a) or (b) (d) Phosphorus

14. **Statement I** As, Sb, Bi are found mainly as sulphide minerals.
Statement II Phosphoproteins are present in milk and eggs.
Which of the above statement(s) is/are correct? Choose the correct option.
(a) Only I (b) Only II
(c) Both I and II (d) Neither I nor II

15. Match the terms of Column I with the terms of Column II and choose the correct option from the codes given below.

Column I	Column II
A. N	1. $[Ar]\,3d^{10}\,4s^2\,4p^3$
B. As	2. $[Xe]\,4f^{14}\,5d^{10}\,6s^2\,6p^3$
C. Bi	3. $[He]\,2s^2\,2p^3$

Codes

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

16. **Assertion** (A) Electronic configuration of group-15 elements is extra stable.
Reason (R) The *s*-orbitals are fully filled and *p*-orbitals are half-filled.
Choose the most appropriate option from the choices given below.
(a) Both A and R are correct; R is the correct explanation of A
(b) Both A and R are correct; R is not the correct explanation of A
(c) A is correct; R is incorrect
(d) R is correct; A is incorrect

17. Covalent and ionic radii of group 15 elements
(a) increase down the group upto P and then decrease
(b) increase down the group
(c) decrease upto P and then increase down the group
(d) decrease down the group

18. **Assertion** (A) As to Bi, there is only a small increase in covalent radius.
Reason (R) *d* and/or *f* orbitals are completely filled in heavier elements.
Choose the most appropriate option from the choices given below.
(a) Both A and R are correct; R is the correct explanation of A
(b) Both A and R are correct; R is not the correct explanation of A
(c) A is correct; R is incorrect
(d) R is correct; A is incorrect

19. Ionisation enthalpy of group 15 elements
I. decreases down the group due to the gradual increase in atomic size.
II. it is higher than that of group 14 elements in the corresponding periods.
III. the order of successive ionisation enthalpies is $\Delta_i H_1 < \Delta_i H_2 < \Delta_i H_3$.
Which of these statements is/are true? Choose the correct option.
(a) I and II
(b) II and III
(c) I and III
(d) I, II and III

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20. **Statement I** The electronegativity value, in general, decreases down the group with increasing atomic size.

Statement II Amongst the heavier elements, the difference in electronegativity values is prominent.

Which of the above statement is/are true? Choose the correct option.

(a) Only I (b) Only II
(c) Both I and II (d) None of these

21. Consider the following statements,

I. All the elements of group 15 are polyatomic.
II. Dinitrogen is a diatomic gas while all others are solids.
III. Metallic character decreases down the group.

Which of the above statements are true? Choose the correct option.

(a) I and II (b) I and III
(c) II and III (d) I, II and III

22. In group 15 elements the boiling point ...*A*... from top to bottom and the melting point ...*B*... upto arsenic and then ...*C*... upto bismuth. Here, *A*, *B* and *C* refer to

(a) *A* – increases; *B* – decreases; *C* – increases
(b) *A* – decreases; *B* – decreases; *C* – increases
(c) *A* – increases; *B* – increases; *C* – decreases
(d) *A* – decreases; *B* – increases; *C* – decreases

23. The only element which does not show allotropy is

(a) nitrogen (b) phosphorus
(c) arsenic (d) bismuth

24. The common oxidation states of group 15 elements are

(a) +3 and +5 (b) −3 and −5
(c) −5 and +5 (d) −3, +3 and +5

25. **Statement I** The stability of +5 oxidation state decreases and that of +3 state increases down the group.

Statement II The reason for the above fact is inert pair effect.

Which of these statement(s) is/are false? Choose the correct option.

(a) Only I (b) Only II
(c) Neither I nor II (d) Both I and II

26. **Assertion** (A) Nitrogen is restricted to a maximum covalency of 4.

Reason (R) Only four (one *s* and three *p*) orbitals are available for bonding in nitrogen.

Choose the most suitable option from the choices given below.

(a) Both A and R are correct; R is the correct explanation of A
(b) Both A and R are correct; R is not the correct explanation of A
(c) A is correct; R is incorrect
(d) R is correct; A is incorrect

27. ...*A*... differs from the other members of group 15 due to its small size, high electronegativity, high ionisation enthalpy and ...*B*... of *d*-orbitals. Here, *A* and *B* refer to

(a) *A* – Nitrogen ; *B* – availability
(b) *A* – Phosphorus; *B* – availability
(c) *A* – Nitrogen; *B* – non-availability
(d) *A* – Phosphorus; *B* – non-availability

28. Nitrogen has unique ability to form ...I... bonds with itself and with other elements having ...II...size and ...III...electronegativity. Here, I, II and III are

(a) I – $p\pi$-$p\pi$ multiple; II – high; III – high
(b) I – $p\pi$-$p\pi$ multiple; II – small; III – high
(c) I – $p\pi$-$p\pi$ single; II – small; III – low
(d) I – $p\pi$-$p\pi$ single; II – high; III – low

29. **Assertion** (A) Heavier elements of group-15 do not form $p\pi$-$p\pi$ bonds.

Reason (R) Their atomic orbitals cannot have effective overlapping due to their large size.

Choose the most suitable option

(a) Both A and R are correct; R is the correct explanation of A
(b) Both A and R are correct; R is not the correct explanation of A
(c) A is correct; R is incorrect
(d) R is correct; A is incorrect

30. **Statement I** Single N—N bond is weaker than the single P–P bond due to high interelectronic repulsion of the non-bonding electrons, owing to the small bond length.

Statement II As a result, the catenation tendency is stronger in nitrogen.

Which of the above statement(s) is/are true? Choose the correct option.

(a) Only I (b) Only II
(c) Both I and II (d) None of these

31. I. Covalency of N is restricted to four.
II. N connot form $d\pi - p\pi$ bond as the heavier element can.
III. P and As cannot form $d\pi - d\pi$ bond with transition elements when their compounds like $P(C_2H_5)_3$ and $As(C_6H_5)_3$ act as ligands.

Which of the above statements are true? Choose the correct option

(a) I and II (b) II and III (c) I and III (d) All of these

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32. All the elements of group 15 form hydrides of the type ...*A*.... Here, *A* means
(a) E_2H_5 (b) EH_5 (c) E_2H_3 (d) EH_3

33. The stability of hydrides ...*A*... from NH_3 to BH_3. Here, *A* is
(a) decreases (b) increases
(c) remains constant (d) None of these

34. Arrange the following hydrides in the decreasing order of their basicities NH_3, AsH_3, SbH_3, BiH_3, PH_3
(a) $NH_3 > AsH_3 > SbH_3 > BiH_3 > PH_3$
(b) $NH_3 > PH_3 > AsH_3 > SbH_3 \geq BiH_3$
(c) $BiH_3 > SbH_3 > AsH_3 > PH_3 \geq NH_3$
(d) $PH_3 > BiH_3 > SbH_3 > AsH_3 > NH_3$

35. The two types of oxides formed by the group 15 elements are
(a) EO_3 and E_2O_3 (b) E_2O_3 and EO_5
(c) E_2O_3 and E_2O_5 (d) EO_3 and EO_5

36. N does not form pentahalide due to
(a) availability of *d*-orbitals in its valence shell
(b) availability of *p*-orbitals in its valence shell
(c) non-availability of *p*-orbitals in its valence shell
(d) non-availability of *d*-orbitals in its valence shell

37. **Statement I** In group-15 elements, their pentahalides are more covalent than trihalides.

Statement II All the group 15 elements react with metals to form their binary compounds exhibiting –3 oxidation states.

Which of these statement(s) is/are true?
(a) Only I (b) Only II
(c) Both I and II (d) Neither I nor II

Level II

38. Amongst elements of group 15, the property which decreases down the group is/are
I. electronegativity
II. stability of –3 oxidation state
III. acidic nature of oxides
IV. reducing character of hydrides

Choose the correct option.
(a) I, II and III (b) I, II and IV
(c) II, III and IV (d) I, III and IV

39. Which of the following statement(s) is/are correct about the hydrides of group 15 elements?
I. The hydrides of group 15 elements are ionic and have planar triangular shape.
II. The reducing nature of the hydrides increases down the group.
III. The thermal stability of the hydrides decreases down the group.

Choose the correct option.
(a) II and III (b) I and II
(c) I and III (b) I, II and III

40. The correct arrangement of molecules on the basis of their dipole moment is
(a) $BF_3 > NF_3 = NH_3$ (b) $NH_3 > NF_3 > BF_3$
(c) $NH_3 > NF_3 = BF_3$ (d) $BF_3 > NF_3 > NH_3$

41. Ionic radii (in Å) of Sb^{3+}, Bi^{3+} and As^{3+} follow the order
(a) $Sb^{3+} > Bi^{3+} > As^{3+}$ (b) $Bi^{3+} > As^{3+} > Sb^{3+}$
(c) $Bi^{3+} > Sb^{3+} > As^{3+}$ (d) $As^{3+} > Sb^{3+} > Bi^{3+}$

42. Bond dissociation enthalpy of $E - H$ (E = element) bonds is given below. Which of the compounds will act as strongest reducing agent?

Compound	NH_3	PH_3	AsH_3	SbH_3
Δ_{diss} $(E - H)$ / kJ mol^{-1}	389	322	297	255

(a) PH_3 (b) NH_3 (c) AsH_3 (d) SbH_3

43. Group 15 elements can form compounds in +5 oxidation state. However, Bi forms only one well characterised compound in +5 oxidation state. This compound is
(a) $BiCl_5$ (b) Bi_2S_5 (c) BiF_5 (d) Bi_2O_5

44. Which of the following hydride has the lowest boiling point?
(a) PH_3 (b) AsH_3
(c) SbH_3 (d) NH_3

45. ...*A*... has a greater tendency to form multiple bonds. Here, *A* is
(a) Bismuth (b) Antimony
(c) Nitrogen (d) Arsenic

46. The oxidation state usually shown by P and N are
(a) +5 only (b) +3 only
(c) –3 only (d) Both (a) and (b)

47. The molecule having one sigma bond and two π-bonds is [KCET 2007]
(a) P_4 (b) As_4 (c) Sb_4 (d) N_2

48. Nitrogen forms N_2 but phosphorus is converted into P_4 from P_2. The reason is
(a) $p\pi$-$p\pi$ bonding is weak
(b) multiple bond is formed easily
(c) $p\pi$-$p\pi$ bonding is strong
(d) triple bond is present in phosphorus atoms

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Dinitrogen

Level I

49. Dinitrogen is produced commercially by the ...*A*... and ...*B*... of air. Here, *A* and *B* refer to
(a) liquefaction – *A*; *B* – fractional distillation
(b) liquefaction – *A*; *B* – distillation
(c) poling – *A*; *B* – distillation
(d) poling – *A*; *B* – fractional distillation

50. Boiling points of liquid dinitrogen and liquid O_2 respectively are
(a) 90 K and 77.2 K respectively
(b) 77.2 K and 90 K respectively
(c) 97.2 K and 70 K respectively
(d) 70 K and 97.2 K respectively

51. Complete the following equation

$$NH_4Cl(aq) + ...I.. \longrightarrow ...II... + 2H_2O(l) + NaCl(aq)$$

Here, I and II are
(a) $NaNO_3(aq)$ – I, $N_2(g)$ – II (b) $NaNO_2(aq)$ – I, $H_2(g)$ – II
(c) $NaNO_2(aq)$ – I, $N_2(g)$ – II (d) None of these

52. Very pure nitrogen can be obtained by the thermal decomposition of ...*A*... azide. Here, *A* refers to
(a) barium (b) sodium
(c) Either (a) or (b) (d) None of these

53. Dinitrogen
(a) is a colourless, odourless, tasteless and non-toxic gas
(b) has a very low solubility in water
(c) is rather inert at room temperature
(d) All of the above statements are correct

54. **Statement I** Dinitrogen is inert due to high bond-enthalpy of N≡N bond.

Statement II With rapid increase in temperature the reactivity decreases.

Which of the above statement(s) is/are correct? Choose the most appropriate option.
(a) Only I (b) Only II
(c) Both I and II (d) Neither I nor II

55. Complete the following reactions

$$6Li + ...I... \xrightarrow{Heat} 2Li_3N$$

$$3Mg + N_2 \xrightarrow{Heat} II$$

$$N_2(g) + 3H_2(g) \overset{773K}{\rightleftharpoons} ...III..$$

$$\Delta_f H^{\ominus} = -46.1 \text{ kJ mol}^{-1}$$

Here, I, II and III refer to
(a) I — N_2; II — Mg_3N_2; III — NH_3
(b) I — $2N_2$; II — Mg_3N; III — NH_3
(c) I — $2N_2$; II — Mg_3N; III — $2NH_3$
(d) I — N_2; II — Mg_3N_2; III — $2NH_3(g)$

Level II

56. Nitrogen lacks *d*-orbital in its valence shell and hence it cannot
(a) exhibit orbital hybridisation
(b) exhibit the oxidation state of +5
(c) form oxides with oxidation state of greater than +3
(d) have covalency greater than three

57. Which of the following are properties of nitrogen?
I. Nitrogen bond
II. Allotropy
III. Catenation
IV. Low boiling point

Choose the correct option.
(a) I, II and III (b) I, III and IV
(c) II, III and IV (d) I, II and IV

58. The reason behind the low reactivity of nitrogen is
(a) stable configuration
(b) small atomic radius
(c) high dissociation energy
(d) high electronegativity

59. On heating, ammonium dichromate and barium azide separately, we get
(a) N_2 with ammonium dichromate and NO with barium azide
(b) N_2O with ammonium dichromate and NO_2 with barium azide
(c) N_2O with ammonium dichromate and NO with barium azide
(d) N_2 in both cases

60. **Assertion** (A) P_4 is more reactive than N_2.

Reason (R) Phosphorus has less electron gain enthalpy than nitrogen.
(a) Both A and R are correct; R is the correct explanation of A
(b) Both A and R are correct; R is not the correct explanation of A
(c) A is correct; R is incorrect
(d) R is correct; A is incorrect

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मैं प्रमाणित करता हूं कि ...

Ammonia

Level I

61. ...*A*... is present in small quantities in air and soil where it is formed by the nitrogenous organic matter.

Here, *A* is

(a) Nitrogen (b) Ammonia
(c) NO (d) None of these

62. $NH_2CONH_2 + 2H_2O \longrightarrow ...A...$

$\rightleftharpoons 2NH_3 + H_2O + ...B...$

In the above equation *A* and *B* are

(a) $(NH_4)_2CO_3 - A$; $CO_2 - B$
(b) $(NH_4)_2CO_3 - A$; $CO - B$
(c) $(NH_4)CO_3 - A$; $CO - B$
(d) $(NH_4)CO_3 - A$; $CO_2 - B$

63. $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

$\Delta_f H^{\ominus} = -46.1 \text{ kJ mol}^{-1}$

The above reaction of manufacturing NH_3 is of

(a) Mond's process (b) Hall-Heroult process
(c) van Arkel method (d) Haber's process

64. The optimum conditions for the production of ammonia are

I. A pressure of 200×10^5 Pa
II. A temperature of ~ 700 K
III. Iron oxide with small amounts of K_2O and Al_2O_3 is used as catalyst

The correct option is

(a) I and II (b) I and III (c) I, II and III (d) II and III

65. **Statement I** Ammonia is a colourless gas with a pungent order.

Statement II Its freezing and boiling points are 198.4 and 239.7 respectively. Which of the above statement(s) is/are correct? Choose the most appropriate option.

(a) I is true (b) II is true
(c) Both I and II are true (d) None of these

66. The shape of ammonia molecule is

(a) trigonal pyramidal with the nitrogen atom at the apex
(b) square planar with the nitrogen atom at the apex.
(c) tetrahedral with the nitrogen atom at the apex
(d) None of the above

67. I. $ZnSO_4(aq) + 2NH_4OH(aq) \longrightarrow \underset{A}{Zn(OH)_2(s)} + (NH_4)_2SO_4(aq)$

II. $FeCl_3(aq) + NH_4OH(aq) \longrightarrow \underset{B}{Fe_2O_3 \cdot xH_2O(s)} + NH_4Cl(aq)$

Here, *A* and *B* refer to

(a) *A* – brown and; *B* – white
(b) *A* – brown and; *B* – brown
(c) *A* – white and; *B* – brown
(d) *A* – white and; *B* – white

68. Ammonia molecule is a Lewis base due to

(a) the presence of a lone pair of electrons on the N-atom of NH_3
(b) the absence of a lone pair of electron on the N-atom of NH_3
(c) Either (a) or (b)
(d) None of the above

69. The use(s) of ammonia is/are

I. to produce various nitrogenous fertilisers
II. in the manufacture of nitric acid.
III. as a refrigerant

The correct option is

(a) I and II (b) II and III
(c) I and III (d) I, II and III

70. The colour of $[Cu(NH_3)_4]^{2+}$ complex is

(a) light blue (b) deep blue
(c) light green (d) deep green

Level II

71. Liquid ammonia is used in refrigeration due to its

(a) high dipole moment (b) basicity
(c) stability (d) heat of vaporisation

72. ...*A*... has largest bond angle.

(a) PH_3 (b) NH_3
(c) SbH_3 (d) AsH_3

73. The correct statement(s) related to ammonia is/are

I. NH_3 gives black precipitate with calomel.
II. NH_3 gives white fumes with HCl.
III. NH_3 is oxidised with oxygen at 700°C in the presence of platinum.
IV. NH_3 can be dried by P_2O_5, H_2SO_4 and $CaCl_2$.

Choose the correct option. [AFMC, CBSE AIPMT 2002]

(a) I, II and IV (b) II, III and IV
(c) I, II and III (d) I, II, III and IV

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74. Ammonia water is a good cleansing agent because it
(a) is weakly basic
(b) leaves no residue when wiped out
(c) emulsifies grease
(d) All the above are true

75. NH_3 reacts with HCl. The correct reason(s) is/are
I. NH_3 can donate a pair of electrons.
II. the Cl^- ion formed has a stable configuration.
III. the N atom of NH_3 gains electrons.
IV. a proton in HCl can accept an electron pair from NH_3.
The correct option is
(a) I, II and III (b) I, II and IV
(c) II, III and IV (d) I, II, III and IV

Oxides of Nitrogen

Level I

76. Following statements/properties are about N_2O
I. Chemical name – Nitrogen [I] oxide
II. Oxidation state of nitrogen is +1.
III. Common method of preparation is

$$NH_4NO_3 \xrightarrow{\text{Heat}} N_2O + 2H_2O$$

IV. Colourless gas
Which of the above properties truely belongs to?
(a) I, II and III (b) II, III and IV
(c) I, III and IV (d) I, II, III and IV

77. Match the items of Column I with those of Column II and choose the correct option from the codes given below.

	Column I (Formula)		Column II (Oxidation state of N)
A.	NO	1.	+2
B.	N_2O_4	2.	+3
C.	N_2O_5	3.	+4
D.	N_2O_3	4.	+5

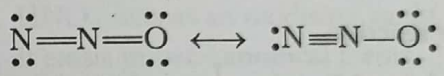
Codes

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

78. $2NO_2 \underset{\text{heat}}{\overset{\text{Cool}}{\rightleftharpoons}} \ldots A \ldots$
Here, *A* means
(a) $NO + NO_3$ (b) N_2O_4
(c) $2NO + NO_3$ (d) $N_2O_4 + NO$

79. Following compounds have planar structure except any one. Find that odd one –N_2O_3, NO_2, N_2O_4, N_2O_5
(a) N_2O_3 (b) N_2O_4
(c) N_2O_5 (d) NO_2

80. I. N_2O is a linear molecule.
II. Its resonating structure is



III. Bond length of N—N and N—O is 113 pm and 119 pm respectively in N_2O.
The correct statement(s) is/are
(a) Only I (b) Only II
(c) Only III (d) All of these

Level II

81. Oxide of nitrogen which is soluble in alcohol is
(a) N_2O (b) NO_2 (c) N_2O_3 (d) NO

82. N_2O_4 molecule is completely changed into two NO_2 molecules at
(a) –10°C (b) – 40°C (c) 140–150°C (d) 420°C

83. The correct order for the decreasing acidic strength of oxides of nitrogen is
(a) $N_2O_5 > N_2O_3 > N_2O_4 > NO > N_2O$
(b) $NO > N_2O > N_2O_3 > N_2O_4 > N_2O_5$
(c) $N_2O > NO > N_2O_3 > N_2O_4 > N_2O_5$
(d) $N_2O_5 > N_2O_4 > N_2O_3 > NO > N_2O$

84. The dimerisation of NO_2 as the temperature is lowered is accompanied by
(a) a decrease in pressure
(b) the formation of a colloid
(c) an increase in pressure
(d) a decrease in paramagnetism

85. ...*M*... oxide of nitrogen is called mixed anhydride. Here, *M* refers to
(a) N_2O_5 (b) NO (c) NO_2 (d) N_2O_4

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Nitric Acid

Level I

86. HNO_2, $H_2N_2O_2$ and HNO_3 are the ...I... of nitrogen. Here, I means
(a) oxyacids (b) oxoacids
(c) acids (d) None of these

87. In the laboratory, HNO_3 is prepared as
(a) $NaNO_3 + H_2SO_4 \longrightarrow NaHSO_4 + HNO_3$
(b) $3NaNO_3 + 2H_2SO_4 \longrightarrow NaHSO_4 + HNO_3$
(c) $NaNO_3 + H_2SO_4 \longrightarrow 2NaHSO_4 + 3HNO_3$
(d) None of the above

88. Commercially, nitric acid is prepared by
(a) Haber's process (b) Contact process
(c) Ostwald's process (d) None of these

89. In the reaction,

$$4NH_3(g) + 5O_2(g) \xrightarrow[\text{(from air)}]{I} 4NO(g) + 6H_2O(g)$$

I refers to the catalytic conditions of the reaction. Identify I.
(a) Pt gauge catalyst, 200 K, 4 bar
(b) Pt/Rh gauge catalyst, 500 K, 9 bar
(c) Pt/Rh gauge catalyst, 500 K, 4 bar
(d) Rh gauge catalyst, 200 K, 9 bar

90. Following statements/properties are about nitric acid
I. Its freezing and boiling points are 355.6 K and 231.4 K respectively.
II. Laboratory grade nitric acid contains ~68% of HNO_3 by mass.
III. It has a specific gravity of 1.504.
The correct set of properties of HNO_3 is
(a) I and II (b) II and III (c) I and III (d) I, II and IIII

91. In the gaseous state, HNO_3 exists as a ...*A*... molecule. Here, *A* refers to
(a) planar (b) square planar
(c) trigonal pyramidal (d) trigonal bipyramidal

92. **Assertion** (A) Conc. HNO_3 attacks all metals including noble metals like gold and platinum.
Reason (R) Conc. HNO_3 is a strong oxidising agent.
(a) Both A and R are correct; R is the correct explanation of A
(b) Both A and R are correct; R is not the correct explanation of A
(c) A is correct; R is incorrect
(d) R is correct; A is incorrect

93. **Assertion** (A) Some metals (like Cr, Al) do not dissolve in concentrated nitric acid.
Reason (R) A passive film of oxide is formed at the surface.
Choose the correct option.
(a) Both A and R are correct; R is the correct explanation of A
(b) Both A and R are correct; R is not the correct explanation of A
(c) A is correct; R is incorrect
(d) R is correct; A is incorrect

94. Complete the following equations using correct set of I, II, III and IV as shown below in the place of *A*, *B*, *C* and *D*
(i) $I_2 + 10HNO_3 \longrightarrow ...A... + 10NO_2 + 4H_2O$
(ii) $C + 4HNO_3 \longrightarrow ...B... + 2H_2O + 4NO_2$
(iii) $S_8 + 48HNO_3 \longrightarrow ...C.... + 48NO_2 + 16H_2O$
(iv) $P_4 + 20HNO_3 \longrightarrow ...D... + 20NO_2 + 4H_2O$
I. $4H_3PO_4$ II. $8H_2SO_4$
III. CO_2 IV. $2HIO_3$
The correct set of option is
(a) *A* – I; *B* – II; *C* – III; *D* – IV (b) *A* – II; *B* – IV; *C* – I; *D* – III
(c) *A* – III; *B* – I; *C* – II; *D* – IV (d) *A* – IV; *B* – III; *C* – II; *D* – I

95. Brown ring test for nitrates depends on
I. the ability of Fe^{2+} to reduce nitrates to nitric oxide.
II. it reacts with Fe^{2+} to form a brown coloured complex.
Which of the above statement(s) regarding brown test for nitrates is/are true? Choose the correct option.0
(a) Only I (b) Only II
(c) Both I and II (d) Neither I nor II

96. $NO_3^- + 3Fe^{2+} + 4H^+ \longrightarrow NO + ...I.. + 2H_2O$
$[Fe(H_2O)_6]^{2+} + NO \longrightarrow ...II... + H_2O$
Here, I and II refer to
(a) I – $3Fe^{3+}$; II – $[Fe(H_2O)_5(NO)]^{2+}$ (brown)
(b) I – Fe^{3+}; II – $[Fe(H_2O)_5(NO)]^{2+}$ (brown)
(c) I – $2Fe^{3+}$; II – $[Fe(H_2O)_5(NO)]^{2+}$ (white)
(d) I – $2Fe^{2+}$; II – $[Fe(H_2O)_5(NO)]^{2+}$ (white)

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97. Uses(s) of HNO_3 is/are
(a) in the manufacture of NH_4NO_3
(b) in the preparation of TNT and nitroglycerine
(c) in the pickling of stainless steel, etching of metals and as an oxidiser in rocket fuels
(d) All of the above

Level II

98. **Assertion** (A) HNO_3 makes iron passive.
Reason (R) HNO_3 forms a protective layer of ferric nitrate on the iron surface.
(a) Both A and R are correct; R is the correct explanation of A
(b) Both A and R are correct; R is not the correct explanation of A
(c) A is correct; R is incorrect
(d) R is correct; A is incorrect

99. On heating HNO_3 with P_2O_5, the oxide of nitrogen produced is
(a) NO_2
(b) N_2O_5
(c) N_2O_4
(d) N_2O_3

100. The correct order of increasing acidic strength of oxyacids of group 15 elements is
(a) $H_3SbO_4, H_3PO_4, H_3AsO_4, HNO_3$
(b) $H_3SbO_4, H_3AsO_4, H_3PO_4, HNO_3$
(c) $HNO_3, H_3SbO_4, H_3AsO_4, H_3PO_4$
(d) $H_3PO_4, H_3AsO_4, H_3SbO_4, HNO_3$

101. Reaction of HNO_3 with C, P, S and I gives respectively
(a) CO, H_3PO_4, H_2SO_4 and HIO_2
(b) CO_2, P_2O_5, SO_2 and I_2O_5
(c) CO_2, H_3PO_3, H_2SO_3 and HIO_3
(d) CO_2, H_3PO_4, H_2SO_4 and HIO_3

102. The correct statements about HNO_3 are
I. HNO_3 acts as a dehydrating agent
II. the proteins are converted into xanthoproteins
III. HNO_3 acts as an oxidising agent
IV. it exists in two canonical forms
The correct option is
(a) I, II and III (b) II, III and IV
(c) I, III and IV (d) I, II and IV

Phosphorus Allotropic Forms

Level I

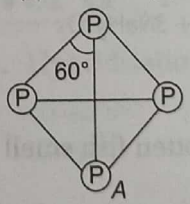
103. White phosphorus is a ...*A*... solid. Here, *A* refers to
(a) translucent white waxy solid
(b) translucent brown waxy solid
(c) transparent brown waxy solid
(d) transparent white waxy solid

104. $P_4 + 3NaOH + 3H_2O \longrightarrow PH_3 + ...I..$
Here, I refers to
(a) NaH_2PO_2
(b) $2NaH_2PO_2$
(c) $3NaH_2PO_2$
(d) None of the above

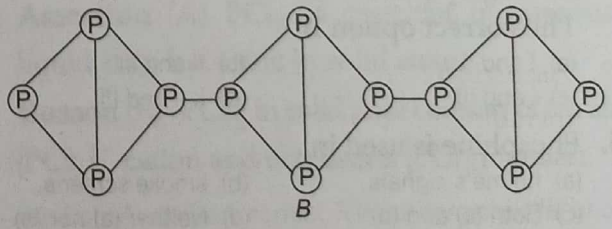
105. **Assertion** (A) White P is less stable and hence, more reactive than other solid phases under normal conditions.
Reason (R) There is an angular strain in the P_4 molecule.
(a) Both A and R are correct; R is the correct explanation of A
(b) Both A and R are correct; R is not the correct explanation of A
(c) A is correct; R is incorrect
(d) R is correct; A is incorrect

106. ...*A*... phosphorus possesses iron grey lustre. Here, *A* is
(a) Red (b) White (c) Black (d) Both (b) and (d)

107. ...I... phosphorus has two forms α-and β-forms. Here, I refers to
(a) Red (b) Black (c) White (d) None of these

108. 

A and


B

A and *B* are the structures of
(a) *A* – red phosphorus; *B* – white phosphorus
(b) *A* – red phosphorus; *B* – black phosphorus
(c) *A* – white phosphorus; *B* – red phosphorus
(d) *A* – black phosphorus; *B* – white phosphorus

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Level II

109. Phosphorus is produced by heating in a furnace
(a) bone ash, silica and coke
(b) bone ash, silica and lime
(c) bone ash, coke and limestone
(d) bone ash, coke and sodium chloride

110. White P is more reactive than N_2 because
(a) ionisation energy of P is low
(b) P—P bond is weaker than N≡N
(c) electronegativity of P is low
(d) All of the above

111. White phosphorus contains ...*A*... molecules and is usually preserved in ...*B*.... Here, *A* and *B* refer to
(a) $A-P_6$; B – water (b) $A-P_4$; B – benzene
(c) $A-P_4$; B – water (d) $A-P_6$; B – kerosene

112. Consider the following statements regarding phsophorus,
I. Phosphorus exists in different allotropic forms.
II. Yellow phosphorus exists as tetrahedral molecular solid.
III. Yellow phosphorus is less reactive than red phosphorus.
IV. Black phosphorus has layer type structure.
The correct statements are
(a) I, II and IV (b) I, II and III
(c) II, III and IV (d) I, III and IV

113. ...*M*... is used in the manufacture of safety matches. Here, *M* refers to
(a) Black phosphorus (b) Red phosphorus
(c) White phosphorus (d) Selenium

114. Red P is less reactive, less volatile and less soluble in non-polar solvent than white/yellow P because
(a) it has high molecular energy
(b) it has low molecular energy
(c) it forms condensation products
(d) it possesses highly polymerised structures

Phosphine

Level I

115. Phosphine is prepared by the reaction of ...*A*... with water or dilute HCl. Here, *A* refers to
(a) calcium phosphide (b) sodium phosphide
(c) Either (a) or (b) (d) None of these

116. The laboratory method of preparation of phosphine is
(a) $Ca_3P_2 + 6H_2O \longrightarrow 3Ca(OH)_2 + 2PH_3$
(b) $Ca_3P_2 + 6HCl \longrightarrow 3CaCl_2 + 2PH_3$
(c) $P_4 + 3NaOH + 3H_2O \longrightarrow PH_3 + 3NaH_2PO_2$
(d) None of the above

117. Phosphine is
I. colourless gas II. rotten fish smell
III. highly poisonous
The correct option is
(a) I and II (b) II and III
(c) I and III (d) I, II and III

118. Phosphine is used in
(a) holme's signals (b) smoke screens
(c) Both (a) and (b) (d) Neither (a) nor (b)

119. **Statement I** PH_3 acts as a Lewis base in the reaction $PH_3 + HI \longrightarrow PH_4I$
Statement II It happens due to the presence of a lone pair on phosphorus atom.
Which of the above statement(s) is/are correct?
(a) Only I is true (b) Only II is true
(c) Both I and II are true (d) None of these

Level II

120. Phosphine is obtained when [MP PMT 1989]
I. red P is heated with NaOH
II. white P is heated with NaOH
III. Ca_3P_2 reacts with water
IV. phosphorus trioxide is boiled with water.
The above mentioned correct statements are
(a) I, II and III (b) II, III and IV
(c) I, III and IV (d) I, II and IV

121. With respect to protonic acids, which of the following statements are not correct?
I. PH_3 is equally basic as NH_3.
II. PH_3 is less basic than NH_3.
III. PH_3 is more basic than NH_3.
IV. PH_3 is amphoteric while NH_3 is basic.
Choose the correct option. [CPMT 1990]
(a) I, II and III (b) II, III and IV
(c) I, II and IV (d) I, III and IV

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122. Gas used in Holme's signals and smoke screens is
(a) phosphine
(b) ammonia
(c) either (a) or (b)
(d) phosphine in Holme's signals while ammonia in smoke screens

123. PH_3 is basic in nature because
(a) it forms PH_4I with HI
(b) it has a lone pair on phosphorus atom
(c) Both (a) and (b)
(d) None of the above

124. Phosphine is ...*A*... basic and like ammonia gives ...*B*... compounds with acids. Here, *A* and *B* refer to
(a) *A*–weakly; *B*–phosphonium
(b) *A*–strongly; *B*–phosphonium
(c) *A*–strongly; *B*–phosphate
(d) *A*–weakly; *B*–phosphate

125. PH_3 produces smokey rings when it comes in contact with air because [IIT JEE 1998]
(a) PH_3 reacts with water vapours
(b) PH_3 reacts with N_2
(c) PH_3 burns in air
(d) PH_3 contains impurities of P_2H_4 which undergo spontaneous combustion

Phosphorus Halides

Level I

126. Phosphorus forms ...*A*... types of halides. Here, *A* refers to
(a) two (b) three
(c) four (d) five

127. ...*M*... is obtained by the action of dry chlorine (not in excess) over heated white phosphorus. Here, *M* refers to
(a) PCl_3 (b) PCl_5
(c) $POCl_3$ (d) None of these

128. The shape of phosphorus trichloride is
(a) tetrahedral (b) pyramidal
(c) trigonal pyramidal (d) linear

129. PCl_5 is a ...*A*... white powder. Here, *A* is
(a) brownish (b) bluish (c) yellowish (d) greenish

130. Complete the following reaction,

$$PCl_5 \xrightarrow{\text{Heat}} \text{Product}(s)$$

The product(s) is/are
(a) PCl_3 (b) Cl_2
(c) $POCl_3$ (d) Both (a) and (b)

131. In gaseous and liquid phases, the structure of PCl_5 is
(a) trigonal pyramidal
(b) tetrahedral
(c) trigonal bipyramidal
(d) trigonal

132. The three ...*A*... P—Cl bonds are equivalent, while the ...*B*... bonds are larger than ...*C*... bonds in PCl_5. Here, *A*, *B* and *C* means
(a) *A* – axial, *B* – two equatorial; *C* – axial
(b) *A* – equatorial; *B* – three equatorial ; *C* – axial
(c) *A* – equatorial; *B* – two axial; *C* – equatorial
(d) *A* – axial; *B* – three axial; *C* – equatorial

133. In the solid state, PCl_5 exists as an ionic solid $[PCl_4]^+[PCl_6]^-$ in which the cation, $[PCl_4]^+$ is ...I... and the anion, $[PCl_6]^-$ is ...II... . Here, I and II refer to
(a) I – tetrahedral; II – linear
(b) I – tetrahedral; II – octahedral
(c) I – octahedral; II – tetrahedral
(d) I – octahedral; II – linear

Level II

134. Hybridisation of P in PCl_5 is
(a) sp^3d^2 (b) sp^2
(c) sp^3 (d) sp^3d

135. **Assertion** (A) PCl_5 is covalent in gaseous and liquid state but ionic in solid state.
Reason (R) PCl_5 in solid state consists of tetrahedral $[PCl_4]^+$ cation and octahedral $[PCl_6]^-$ anion.
(a) Both A and R are correct; R is the correct explanation of A
(b) Both A and R are correct; R is not the correct explanation of A
(c) A is correct; R is incorrect
(d) R is correct; A is incorrect

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136. PCl_5 is prepared by the action of Cl_2 on

(a) P_2O_5 (b) PCl_3
(c) H_3PO_3 (d) P_2O_3

137. Solid PCl_5 exists as

(a) PCl_5 (b) $[PCl_4]^+$
(c) $[PCl_4]^+$ and $[PCl_6]^-$ (d) $[PCl_6]^-$

138. PCl_3 fumes in moisture because

(a) it gets hydrolysed in the presence of moisture giving fumes of HCl
(b) it gets hydrolysed in the presence of moisture giving fumes of Cl_2 gas
(c) it gets reduced
(d) None of the above

Oxoacids of Phosphorus

Level I

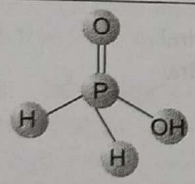
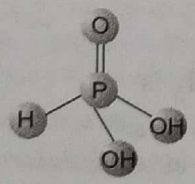
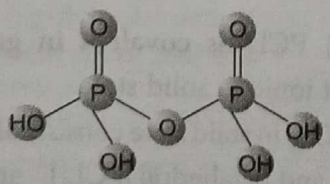
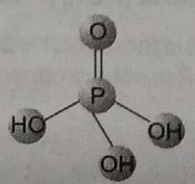
139. Match the terms of Column I with the terms of Column II and choose the correct option from the codes given below.

Column I (Formula)	Column II (Oxidation state of P)
A. H_3PO_2	1. +1
B. H_3PO_3	2. +3
C. $H_4P_2O_6$	3. +4
D. H_3PO_4	4. +5

Codes

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

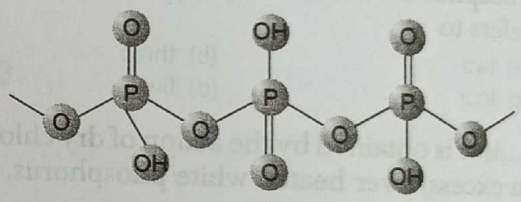
140. Match the Column I with Column II and choose the correct option from the codes given below.

Column I	Column II
A. 	1. H_3PO_3 orthophosphorous acid
B. 	2. H_3PO_2 hypophosphorous acid
C. 	3. H_3PO_4 orthophosphoric acid
D. 	4. $H_4P_2O_7$ pyrophosphoric acid

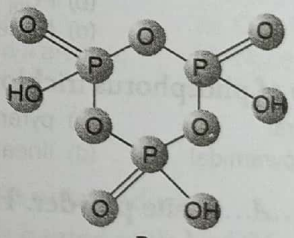
Codes

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

141. The structure shown below are of



A



B

The correct choice is

(a) *A* –polymetaphosphoric acid, *B* – pyrophosphoric acid
(b) *A* – polymetaphosphoric acid, *B* – cyclotrimetaphosphoric acid
(c) *A* – orthophosphoric acid, *B* – pyrophosphoric acid
(d) *A* – pyrophosphoric acid, *B* – orthophosphoric acid

142. ...*A*... is orthophosphorous acid and ...*B*... is pyrophosphoric acid. Here, *A* and *B* are

(a) *A*– H_3PO_4; *B*– H_3PO_2
(b) *A*– H_3PO_2; *B*–H_3PO_4
(c) *A*– H_3PO_3; *B*–$H_4P_2O_7$
(d) *A*– $H_4P_2O_7$; *B*–H_3PO_3

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143. Match the items of Column I with those of Column II and III and choose the correct option from the codes given below.

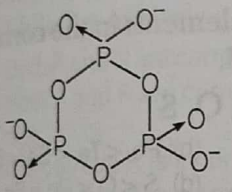
Column I (Formula)	Column II (Characteristic bonds and their number)	Column III (Preparation)
A. Pyrophosphorous ($H_4P_2O_5$)	1. Four P—OH, Two P=O, One P—P	I. $P_4O_{10} + H_2O$
B. Hypophosphoric ($H_4P_2O_6$)	2. Three P—OH, One P=O	II. $PCl_3 + H_3PO_3$
C. Orthophosphoric (H_3PO_4)	3. Two P—OH, Two P—H, Two P=O	III red P_4 + alkali

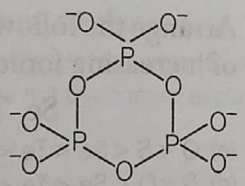
Codes

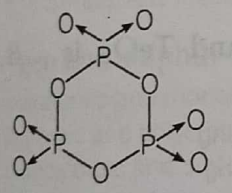
	A	B	C		A	B	C
(a)	2(III)	1(II)	3(I)	(b)	3(II)	2(I)	1(III)
(c)	1(I)	2(II)	3(III)	(d)	3(II)	1(III)	2(I)

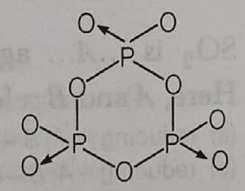
Level II

144. The correct structure of cyclo trimetaphosphate is

(a) 

(b) 

(c) 

(d) 

145. Phosphorous acid is syrupy because of
(a) van der Waal's forces
(b) strong covalent bond
(c) hydrogen bonding
(d) None of the above

146. There is a slight difference in acidic strength of the H_3PO_4, H_3PO_3 and H_3PO_2 because
(a) number of unprotonated oxygen atoms responsible for increase of acidity due to inductive effect, remains the same
(b) phosphorus oxides are less basic
(c) phosphorus in these acids exists in different oxidation states
(d) phosphorus is not a highy electronegative element

147. In trimetaphosphate ion, the number of O atoms, P—O—P bonds and unit negative charges are respectively
(a) 3, 6, 3
(b) 9, 6, 3
(c) 6, 6, 3
(d) 9, 3, 3

148. **Assertion** (A) H_3PO_2 is a dibasic acid.

Reason (R) Two H-atoms are directly attached to P.
(a) Both A and R are correct; R is the correct explanation of A
(b) Both A and R are correct; R is not the correct explanation of A
(c) A is correct; R is incorrect
(d) R is correct; A is incorrect

Group-16 Elements

Level I

149. Oxygen, sulphur, selenium, tellurium and polonium constitute group ...I... of the Periodic Table. These elements are also known as ...II..., derived from ...III... word for ...IV... and points to the association of sulphur and its congeners with ...V...

Choose the appropriate set of words from the choices given below to complete the passage.
(a) I – 15; II – chalcogens; III – Greek; IV – copper; V – brass
(b) I –16; II – chalcogens; III – Greek; IV – brass; V – copper
(c) I – 16; II – pnicogens; III – Latin; IV – brass; V – copper
(d) I – 15; II – pnicogens; III – Latin; IV – copper; V – brass

150. Consider the following statements,
I. Oxygen is the most abundant of all the elements on earth.
II. Abundance of sulphur in the earth's crust is only 0.03–0.1%
III. Traces of sulphur occur as hydrogen sulphide in volcanoes.
IV. Organic materials such as eggs, proteins, garlic, onion, mustard, hair and wool contain sulphur.

Which of the above mentioned statements are correct?
Choose the most appropriate option.
(a) I, II, IV (b) I, II, III (c) II, III, IV (d) I, II, III and IV

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151. Match the terms of Column I with the terms of Column II and choose the correct option from the codes given below.

Column I (Sulphates)	Column II (Chemical formula)
A. Gypsum	1. $CaSO_4 \cdot 2H_2O$
B. Epsom salt	2. $BaSO_4$
C. Barytes	3. $MgSO_4 \cdot 7H_2O$

Codes

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

152. I. Atomic and ionic radii of group-16 elements decrease from top to bottom.

II. Ionisation enthalpy decreases down the group 16.

The correct statement(s) is/are

(a) Only I (b) Both I and II
(c) Only II (d) Neither I nor II

153. **Assertion** (A) Oxygen has less negative electron gain enthalpy than sulphur.

Reason (R) Oxygen has a compact nature.

(a) Both A and R are correct; R is the correct explanation of A
(b) Both A and R are correct; R is not the correct explanation of A
(c) A is correct; R is incorrect
(d) R is correct; A is incorrect

154. Oxygen has the second highest electronegativity value amongst the elements. The highest electronegativity value is of ...*A*... .

Here, *A* refers to

(a) chlorine (b) fluorine
(c) sulphur (d) None of these

155. The physical properties of group 16 elements are

I. polonium is a metal and is radioactive.

II. all these elements exhibit allotropy.

III. with increase in atomic number, the melting and boiling point increases down the group.

The option with correct set of properties is

(a) I and II (b) II and III
(c) I and III (d) I, II and III

156. One element of group 16 shows anomalous behaviour. Identify this element.

(a) Selenium (b) Polonium
(c) Oxygen (d) None of these

157. **Assertion** (A) Oxygen has a covalency of four.

Reason (R) *d*-orbitals are absent in oxygen.

(a) Both A and R are correct; R is the correct explanation of A
(b) Both A and R are correct; R is not the correct explanation of A
(c) A is correct; R is incorrect
(d) R is correct; A is incorrect

158. **Statement I** Acidic character increases from H_2O to H_2Te.

Statement II The reason is a decrease in bond enthalpy for the dissociation of H–*E* bond down the group.

Which of the above statement(s) is/are true?

(a) Only II (b) Neither I nor II
(c) Only I (d) Both I and II

159. All the hydrides (of group 16 elements) except ...I... possess reducing property and this character ...II... from H_2S to H_2Te. Here, I and II refer to

(a) I – H_2Se; II– decreases (b) I – H_2O; II – decreases
(c) I – H_2O; II – increases (d) I – H_2Te; II – increases

160. Arrange the following elements in the correct order of increasing ionic radii.

Se, Te, P, O, S

(a) O < S < Se < Te < Po (b) Po < Te < Se < S < O
(c) S < O < Se < Te < Po (d) S < O < Po < Se < Te

161. SO_2 is ...*A*... agent and TeO_2 is ...*B*... agent. Here, *A* and *B* refer to

(a) reducing – *A*; *B* – reducing
(b) reducing – *A*; *B* – oxidising
(c) oxidising – *A*; *B* – oxidising
(d) oxidising – *A*; *B* – reducing

162. The stability of the halides of group 16 elements decreases in the order

(a) $Br^- > I^- > Cl^- > F^-$ (b) $F^- > I^- > Cl^- > Br^-$
(c) $F^- > Cl^- > Br^- > I^-$ (d) $I^- > Cl^- > Br^- > F^-$

163. The only stable hexahalide is ...I... Here, I refers to

(a) hexachloride (b) hexabromide
(c) hexaiodide (d) hexafluoride

164. Hexahalides of group 16 elements

I. are gaseous in nature.

II. have octahedral geometry.

III. SF_6 is exceptionally stable for steric reasons.

Which of the above mentioned statement(s) is/are correct?

(a) I and II (b) II and III
(c) Only III (d) I, II and III

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165. Tetrafluorides have ...I... hybridisation and ...II... structure. Here, I and II refer to
(a) sp^3 – I; trigonal pyramidal – II
(b) sp^3d – I; tetrahedral – II
(c) sp^3d – I; trigonal bipyramidal – II
(d) sp^3d – I; tetrahedral – II

166. The characteristic feature of 'sea-saw' geometry is
(a) one of the equatorial position is occupied by lone pair of electrons
(b) one of the axial position is occupied by lone pair of electrons
(c) no fixed position is assgined to the lone pair of electrons
(d) None of the above

167. ...*A*... are dimeric in nature. Here, *A* refers to
(a) Dihalides (b) Monohalides
(c) Hexahalides (d) Tetrahalides

168. **Assertion** (A) Elements of group-16 usually show lower value of first ionisation enthalpy as compared to the corresponding periods of group-16.
Reason (R) Group-15 elements have extra stable half-filled *p*-orbitals electronic configuration.
(a) Both A and R are correct; R is the correct explanation of A
(b) Both A and R are correct; R is not the correct explanation of A
(c) A is correct; R is incorrect
(d) R is correct; A is incorrect

169. Oxygen and sulphur exist as
(a) polyatomic and monoatomic respectively
(b) diatomic and polyatomic respectively
(c) monoatomic and diatomic respectively
(d) polyatomic and diatomic respectively

170. Half-life of polonium is of
(a) 138 days (b) 56 days (c) 13.8 days (d) 110 days

171. Oxygen shows only negative oxidation state as –2 except in the case of ...*A*... where its oxidation state is ...*B*... . Here, *A* and *B* refer to
(a) $OF_2 - A$; $+3 - B$ (b) $OF_2 - A$; $+2 - B$
(c) $OCl_2 - A$; $+2 - B$ (d) $OCl_2 - A$; $+3 - B$

172. H_2O has strong hydrogen bonding which is absent in H_2S. The possible reason could be
(a) small size of oxygen
(b) high electronegativity of oxygen
(c) both (a) and (b)
(d) large size of oxygen

173. Oxidation states of O in OF_2 and O_2F_2 respectively are
(a) +1 and +2 respectively (b) +1 and +3 respectively
(c) +2 and +3 respectively (d) +2 and +1 respectively

174. I. Group-16 elements form oxides of two types.
II. These oxides of both the types are acidic in nature.
The correct statement(s) is/are
(a) Only I (b) Only II
(c) Both I and II (d) None of these

175. Polonium occurs in nature as a decay product of ...I... and ...II... minerals. Choose the most suitable words to complete the sentence.
(a) I – thorium; II – uranium (b) I – thorium; II – selenium
(c) I – tellurium; II – selenium (d) I – uranium; II – tellurium

176. Oxygen and sulphur are ...*A*... ; selenium and tellurium are ...*B*... whereas polonium is a ...*C*... . Here, *A*, *B* and *C* are
(a) *A* – metals; *B* – non-metals; *C* – metalloid
(b) *A* – non-metals; *B* – metalloids; *C* – metal
(c) *A* – metalloids; *B* – metals; *C* – non-metal
(d) *A* – metals; *B* – metalloid; *C* – non-metal

177. Oxygen forms about ...*A*... by mass of earth's crust while dry air contains ...*B*... oxygen by volume. The correct set of percentage is
(a) *A* – 46.6%; *B* – 20.946%
(b) *A* – 20.946%; *B* – 46.6%
(c) *A* – 10.12%; *B* – 36.7%
(d) *A* – 36.7%; *B* – 10.12%

178. Galena is a sulphide of
(a) zinc (b) copper
(c) lead (d) None of these

Level II

179. Sulphur is a solid while oxygen is a gas because
(a) molecular weight of sulphur is much higher than that of oxygen
(b) oxygen is a stronger oxidising agent than sulphur
(c) oxygen is composed of discrete molecules whereas sulphur is polymeric
(d) boiling point of oxygen is much lower than that of sulphur

180. Water is much less volatile than H_2S because
(a) H_2O has a bond angle of nearly 150°
(b) hydrogen is loosely bonded with the sulphur
(c) sulphur atom is less electronegative than oxygen atom
(d) sulphur atom is more electronegative than oxygen atom

181. Sulphur exhibits valency of 2, 4 and 6 whereas oxygen has a valency of 2 due to
(a) being more electronegative than S
(b) presence of *d*-orbitals in S
(c) S is bigger atom
(d) S has higher ionisation potential

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182. A chalcogen combines directly with hydrogen to form a hydride but with a great difficulty. On burning in air, this chalcogen forms a solid polymeric dioxide and it also has the highest electrical resistance amongst the metals. This chalcogen is
(a) sulphur (b) selenium (c) polonium (d) tellurium

183. **Assertion** (A) Oxyen has highest electron affinity among group-16 elements.
Reason (R) Atomic radius is the smallest of oxygen among group-16 elements.
(a) Both A and R are correct; R is the correct explanation of A
(b) Both A and R are correct; R is not the correct explanation of A
(c) A is correct; R is incorrect
(d) R is correct; A is incorrect

184. The elements of group-16, which show negative oxidation state are
I. Oxygen II. Polonium
III. Tellurium IV. Selenium
Choose the correct option.
(a) I, II and III
(b) II, III and IV
(c) I, III and IV
(d) I, II, III and IV

185. Water has maximum density at
(a) 298 K (b) 277 K
(c) 373 K (d) None of these

186. A certain compound when burnt gives three oxides. The first formed an acidic solution of low pH, the second turned lime water milky and the third turned anhydrous $CuSO_4$ blue. The elements present in the compound are
(a) S, C and H respectively (b) C, S and H respectively
(c) H, S and C respectively (d) S, H and C respectively

187. In the Kipp's apparatus, the reaction gets stopped on closing the outlet because
(a) gas starts coming out from top
(b) the contact between sulphide and the acid is broken by the presence of gas collected in the free surface of the middle chamber
(c) the acid becomes weak
(d) a protective film is formed on iron sulphide

188. On adding Na_2S to sodium nitroprusside solution
(a) $Na_4[Fe(CN)_5NOS]$ complex is formed
(b) $[Fe(CN)_5NOS]^{4-}$ complex is formed
(c) a violet colour is formed
(d) All of the above

Dioxygen

Level I

189. Hydrogen peroxide is readily decomposed into water and dioxygen by catalyst(s)
(a) manganese dioxide (b) finely divided metals
(c) Both (a) and (b) (d) None of these

190. $2SO_2 + O_2 \xrightarrow{I} 2SO_3$

$4HCl + O_2 \xrightarrow{II} 2Cl_2 + 2H_2O$

Here, I and II are
(a) I – $CuCl_2$; II – V_2O_5 (b) I – V_2O_5; II – $CuCl_2$
(c) I – V_2O_5; II – MnO_2 (d) I – MnO_2; II – $CuCl_2$

191. **Assertion** (A) To initiate the reaction between O_2 and a metal, some external heating is required.
Reason (R) Bond dissociation enthalpy of O=O bond is high (493.4 kJ mol^{-1}).
(a) Both A and R are correct; R is the correct explanation of A
(b) Both A and R are correct; R is not the correct explanation of A
(c) A is correct; R is incorrect
(d) R is correct; A is incorrect

192. Oxygen is used in
(a) oxyacetylene welding
(b) the manufacture of steel
(c) oxygen cylinders in hospitals, high altitude flying and mountaineering
(d) All of the above

193. Which of the following does not react with oxygen directly?
(a) Zn (b) Ti (c) Pt (d) Fe

Level II

194. Consider the following statements about oxygen
I. oxygen was discovered by Priestley.
II. oxidation state of oxygen in O_2F_2 is –2.
III. among chalcogens, oxygen has maximum tendency to show catenation.
Which of the above statement(s) is/are correct? Choose the most appropriate option.
(a) Only I (b) Only II (c) I and III (d) II and III

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196. Oxygen shows anomalous behaviour from other members of its family because

I. oxygen shows maximum valency of two.

II. among chalcogens, oxygen is of the smallest size.

III. oxygen exhibits allotropy.

IV. oxygen has no vacant *d*-orbital.

The correct option explaining the reasons is

(a) I, II and III (b) I, II and IV

(c) I, III and IV (d) All of these

196. **Assertion** (A) Di-negative anion of S^{2-} is less common whereas di-negative anion of O^{2-} is quite common.

Reason (R) Covalency of oxygen is two.

(a) Both A and R are correct; R is the correct explanation of A

(b) Both A and R are correct; R is not the correct explanation of A

(c) A is correct; R is incorrect

(d) R is correct; A is incorrect

197. In OF_2 molecule, the total number of lone pairs and bond pairs of electrons present respectively are

(a) 2, 8 (b) 8, 3 (c) 8, 2 (d) 9, 2

198. Correct decreasing order of $O—O$ bond length in O_2, O_3 and H_2O_2 is

(a) $O_2 > H_2O_2 > O_3$ (b) $H_2O_2 > O_2 > O_3$

(c) $H_2O_3 > O_3 > O_2$ (d) $O_2 > O_3 > H_2O_2$

Simple Oxides

Level I

199. Which of the following oxide is amphoteric in nature?

(a) Cl_2O_7 (b) Na_2O (c) N_2O (d) Al_2O_3

200. Consider the following statements and choose the correct option.

(a) Some oxides are acidic (b) Some oxides are basic

(c) Some oxides are neutral (d) All of these are true

201. I. Neutral and amphoteric oxides are same in nature.

II. NO, CO and N_2O are neutral oxides.

Which of the above mentioned statement(s) is/are true?

(a) Only I (b) Only II

(c) Both I and II (d) Neither I nor II

Level II

202. Which of the following oxides is most basic and most acidic respectively?

I. (N_2O_5); II. (H_2O); III. (K_2O); IV. (CaO); V. (SO_3)

Choose the correct option.

(a) II and III

(b) I and V

(c) III and V

(d) IV and I

203. The trioxides which can exist as monomeric molecule is

(a) SO_3 in gaseous state

(b) TeO_3

(c) SO_3 in solid state

(d) SeO_3

Ozone

Level I

204. Ozone (O_3) is

(a) an allotropic form of oxygen

(b) too reactive to remain for long in the atmosphere at sea level

(c) formed from atmospheric oxygen in the presence of sunlight at a height of about 20 km

(d) All the above statements are correct

205. When a slow dry stream of oxygen is passed through a silent electric discharge, conversion of oxygen to ozone (10%) occurs. The product is known as ....*A*.... Here, *A* refers to

(a) ozonised oxygen (b) diatomic oxygen

(c) Both (a) and (b) (d) Neither (a) nor (b)

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(b) I and V

(c) III and V

(d) IV and I

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206. **Assertion** (A) It is necessary to use a silent electrical discharge in preparation of ozone to prevent its decomposition.

Reason (R) Formation of ozone from oxygen is an exothermic process.

(a) Both A and R are correct; R is the correct explanation of A
(b) Both A and R are correct; R is not the correct explanation of A
(c) A is correct; R is incorrect
(d) R is correct; A is incorrect

207. Pure ozone is a pale blue ...*A*..., dark blue ...*B*... and violet-black ...*C*... . Here, *A*, *B* and *C* refer to

(a) *A* – solid; *B* – liquid; *C* – gas
(b) *A* – gas; *B* – liquid; *C* – liquid
(c) *A* – gas; *B* – solid; *C* – liquid
(d) *A* – gas; *B* – liquid; *C* – solid

208. **Statement I** Decomposition of ozone into oxygen results in the liberation of heat and an increase in entropy.

Statement II Ozone is thermodynamically unstable.

Which of the statement(s) is/are correct?

(a) Only I
(b) Only II
(c) Both I and II
(d) Neither I nor II

209. Uses of ozone (O_3) includes

I. as an oxidising agent in the manufacture of $KMnO_4$.
II. as a germicide, disinfectant and for sterilisation.
III. for bleaching oils, flour, ivory, starch, etc.

The correct set of uses of ozone is

(a) I and II
(b) II and III
(c) I and III
(d) All of these

Level II

210. The true statement(s) for ozone are

I. It is an endothermic compound.
II. It is obtained by silent electric discharge of oxygen.
III. It cannnot be considered as an allotrope of O_2.
IV. It can be obtained by the action of UV rays on oxygen.

Choose the correct option.

(a) I, II and III
(b) I, III and IV
(c) I, II and IV
(d) All are true

211. ..... metal looses its meniscus after reaction with ozone. Choose the correct word to fill the blank.

(a) Mercury
(b) Copper
(c) Silver
(d) Lead

212. Starch paper moistened with solution of KI turns blue in ozone because

(a) alkali is formed
(b) iodine is liberated
(c) ozone reacts with litmus paper
(d) oxygen is liberated

213. ...*A*... part of atmosphere consists of ...*B*... layer which does not allow harmful radiation to reach the earth's surface. Here, *A* and *B* refer to

(a) Stratosphere – *A*; ozone – *B*
(b) Stratosphere – *A*; sulphur – *B*
(c) Troposphere – *A*; sulphur – *B*
(d) Troposphere – *A*; ozone – *B*

214. Angular shape of ozone molecule consists of [IIT JEE 2003]

(a) 1 sigma and 1 – π bond
(b) 2 sigma and 2 – π bonds
(c) 1 sigma and 2 – π bonds
(d) 2 sigma and 1 – π bond

215. Consider the following statements about ozone

I. O_3 is formed by the interaction of fluorine.
II. It turns tetramethyl base paper as violet.
III. It turns benzidine paper as brown.

The correct set of true statements is

(a) I and II
(b) II and III
(c) I, II and III
(d) I and III

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Sulphur-Allotropic Forms

Level I

216. I. Sulphur forms only two types of allotropes.
II. Rhombic and monoclinic sulphur are the types of allotropic sulphur.

Which of the above statement(s) is/are true? Choose the correct option.

(a) Only I (b) Only II
(c) Both I and II (d) Neither I nor II

217. Colour of rhombic sulphur is

(a) yellow (b) white
(c) black (d) yellowish white

218. **Assertion** (A) Sulphur shows paramagnetism.

Reason (R) In vapour state sulphur partly exists as S_2 molecule which has two unpaired electrons in the antibonding π^* orbitals.

(a) Both A and R are correct; R is the correct explanation of A
(b) Both A and R are correct; R is not the correct explanation of A
(c) A is correct; R is incorrect
(d) R is correct; A is incorrect

219. I. Melting point of rhombic sulphur is higher than that of monoclinic sulphur.
II. Specific gravity of rhombic sulphur is lower than that of rhombic sulphur.

The incorrect statement(s) is/are

(a) Only I (b) Only II
(c) Both I and II (d) Neither I nor II

220. Both rhombic and monoclinic sulphur have molecules. Choose the suitable option to complete the sentence.

(a) S_4 (b) S_6
(c) S_{10} (d) S_8

221. S_8 ring in both the allotropic forms of S is puckered and has a ...*A*... shape. Here, *A* refers to

(a) crown (b) boat
(c) chain (d) None of these

Level II

222. **Assertion** (A) Both rhombic and monoclinic sulphur exist as S_8 but oxygen exists as O_2.

Reason (R) Oxygen forms $p\pi$-$p\pi$ multiple bonds due to small size and small bond length but $p\pi$-$p\pi$ bonding is not feasible in sulphur.

(a) Both A and R are correct; R is the correct explanation of A
(b) Both A and R are correct; R is not the correct explanation of A
(c) A is correct; R is incorrect
(d) R is correct; A is incorrect

223. Structure of sulphur molecule is

(a) spherical
(b) W-shaped ring
(c) tetrahedral
(d) cubical

Sulphur Dioxide

Level I

224. Two methods of preparation of SO_2 are given below

I. $4FeS_2(s) + 11O_2(g) \longrightarrow 2Fe_2O_3(s) + 8SO_2(g)$

II. $SO_3^{2-}(aq) + 2H^+(aq) \longrightarrow H_2O(l) + SO_2(g)$

Categorise these reactions into laboratory method and industrial method of preparing SO_2 with the help of options given below.

(a) I – industrial; II – laboratory
(b) I – industrial ; II – industrial
(c) I – laboratory; II – industrial
(d) I – laboratory; II – laboratory

225. The molecule of SO_2 is

(a) planar (b) pyramidal
(c) angular (d) None of these

226. $2NaOH + SO_2 \longrightarrow ...A... + H_2O$

$...B... + H_2O + SO_2 \longrightarrow 2NaHSO_3$

Fill in the blank with the suitable words to complete the reactions.

(a) $A - Na_2SO_3$; $B - Na_2SO_3$ (b) $A - NaHSO_3$; $B - Na_2SO_3$
(c) $A - Na_2SO_4$; $B - Na_2O$ (d) $A - NaHSO_3$; $B - Na_2SO_4$

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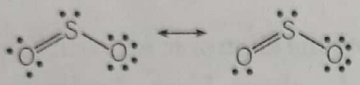
227. The behaviour of sulphur while reacting with water and alkalies is similar to that of

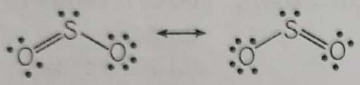
(a) CO (b) O_2 (c) O_3 (d) CO_2

228. SO_2 is a resonance hybrid of the two canonical forms

(a) 

(b) 

(c) 

(d) 

229. $2SO_2(g) + O_2(g) \xrightarrow{\text{Catalyst}} 2SO_3(g)$

Identify the catalyst from the options given below.

(a) V_2O_5 (b) $CuCl_2$
(c) MnO_2 (d) Either (a) or (b)

Level II

230. Which of the following statements are correct for SO_2 gas?

I. It acts as bleaching agent in moist conditions.
II. Its molecule has linear geometry.
III. Its dilute solution is used as disinfectant.
IV. It can be prepared by the reaction of dilute H_2SO_4 with metal sulphide.

The option with correct set of statements is

(a) I and III
(b) II and IV
(c) I and IV
(d) II and III

231. On passing SO_2 gas through an acidified solution of $K_2Cr_2O_7$

(a) the solution gets decolourised
(b) the solution becomes blue
(c) SO_2 is reduced
(d) green $Cr_2(SO_4)_3$ is obtained

232. Ramesh passed moist coloured flowers through a gas of SO_2, the flowers get decolourised because [CPMT 2008]

(a) SO_2 oxidises flower colouring matter
(b) SO_2 reduces flower colouring matter
(c) SO_2 absorbs colouring matter
(d) SO_2 gives colourless product

233. On passing SO_2 gas through cupric chloride solution

(a) the solution becomes colourless
(b) the solution becomes colourless and a white ppt. of Cu_2Cl_2 is obtained
(c) no visibile change takes place
(d) a white ppt is obtained

Oxoacids of Sulphur

Level I

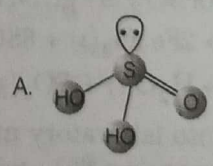
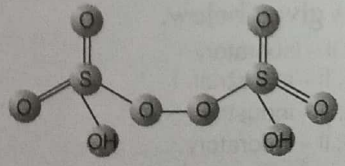
234. Match the terms of Column I with the terms of Column II and choose the correct option from the code given below.

Column I (Oxoacids of sulphur)		Column II (Formula)	
A.	Pyrosulphuric acid	1.	H_2SO_3
B.	Sulphuric acid	2.	H_2SO_4
C.	Peroxodisulphuric acid	3.	$H_2S_2O_8$
D.	Sulphurous acid	4.	$H_2S_2O_7$

Codes

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

235. Match the Column I with Column II and choose the correct option from the codes given below.

Column I (Structure)	Column II (Oxoacids of sulphur)
A. 	1. Peroxodisulphuric acid
B. 	2. Sulphuric acid

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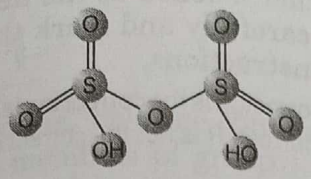
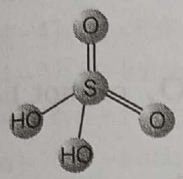
Column I (Structure)	Column II (Oxoacids of sulphur)
C. 	3. Sulphurous acid
D. 	4. Pyrosulphuric acid

Codes

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

236. Oleum is chemically known as
(a) pyrosulphuric acid (b) sulphuric acid
(c) peroxodisulphuric acid (d) sulphurous acid

Level II

237. Peroxoacids of sulphur are
(a) $H_2S_2O_8$ and H_2SO_5 (b) $H_2S_2O_8$ and $H_2S_2O_7$
(c) $H_2S_2O_7$ and $H_2S_2O_6$ (d) H_2SO_5 and $H_2S_2O_7$

238. Consider the following statements,
I. S—S bond is present in $H_2S_2O_6$.
II. In peroxodisulphuric acid ($H_2S_2O_8$) sulphur is in +6 oxidation state.

The correct set of statement is
(a) Only I
(b) Only II
(c) Both I and II
(d) Neither I nor II

Sulphuric Acid

Level I

239. Sulphuric acid is manufactured by the
(a) Contact process (b) Ostwald's process
(c) Haber's process (d) None of these

240. The key step in the manufacture of H_2SO_4 is
(a) burning of sulphur or sulphide ores in air to generate SO_2.
(b) catalytic oxidation of SO_2 with O_2 to give SO_3 in the presence of V_2O_5
(c) absorption of SO_3 in H_2SO_4 to give oleum
(d) Either (b) or (c)

241. Consider the following equation,

$$2SO_2(g) + O_2(g) \xrightarrow{V_2O_5} 2SO_3(g)$$

Which of the following statement(s) is/are incorrect about the above equation?
(a) This reaction is exothermic and reversible
(b) $\Delta H^{\ominus}$ value for this reaction is $-196.6\ kJ\ mol^{-1}$
(c) Low temperature and high pressure are favourable for the maximum yield
(d) None of the above

242. Properties of sulphuric acid are
I. a coloured, dense, oily liquid with a specific gravity of 1.84 at 298 K.
II. freezing point is 283 K
III. boiling point is 611 K
IV. it dissolves in water with the evolution of a large quantity of heat.

The correct set of properties is
(a) I, II and III (b) II, III and IV (c) I, III and IV (d) I, II and IV

243. **Assertion** (A) H_2SO_4 is a stronger acid and has high dissociation constant ($K_{a_1} > 10$).
Reason (R) Greater the value of dissociation constant (K_a), the stronger is the acid.
(a) Both A and R are correct; R is the correct explanation of A
(b) Both A and R are correct; R is not the correct explanation of A
(c) A is correct; R is incorrect
(d) R is correct; A is incorrect

244. The acid forms two series of salts, namely
(a) normal and acid sulphates
(b) normal and basic sulphates
(c) acid and basic sulphates
(d) None of the above

245. The characteristics of H_2SO_4 responsible for the chemical reactions of H_2SO_4 are
(a) low volatility
(b) strong acidic character as well as affinity for water
(c) ability to act as an oxidising agent
(d) All of the above

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246. $C_{12}H_{22}O_{11} \xrightarrow{H_2SO_4}$ Products

Product(s) of the reaction is/are

(a) $12C + 11H_2O$
(b) $11C + 12H_2O$
(c) $5CO + 7CO_2 + H_2O$
(d) $CO_2 + H_2O$

247. H_2SO_4 is used in

(a) petroleum refining
(b) manufacture of paints, pigments and dyestuff intermediates
(c) detergent industry
(d) All of the above are the uses of H_2SO_4

248. An example of acid sulphate is

(a) sodium sulphate
(b) copper sulphate
(c) sodium hydrogen sulphate
(d) None of the above

Level II

249. On adding of conc. H_2SO_4 to a chloride salt, colourless fumes are evolved but in case of iodide salt, violet fumes come out. This is because

(a) HI is of violet colour
(b) HI gets oxidised to I_2
(c) HI changes to HIO_3
(d) H_2SO_4 reduces HI to I_2

250. Hot conc. H_2SO_4 acts as moderately strong oxidising agent. It oxidises both metals and non-metals. Element which gets oxidised by conc. H_2SO_4 into two gaseous products is

(a) Copper
(b) Zinc
(c) Sulphur
(d) Carbon

251. Oleum of fuming H_2SO_4 is

(a) a mixture of H_2SO_4 and HNO_3.
(b) a mixture of conc. H_2SO_4 and oil.
(c) H_2SO_4 which gives fumes of SO_2
(d) H_2SO_4 saturated with sulphur trioxide, *i.e.*, $H_2S_2O_7$.

252. On treating PCl_5 with H_2SO_4, sulphuryl chloride (SO_2Cl_2) is formed as the final product. This shows that H_2SO_4

(a) is a derivative of SO_2
(b) is a monobasic acid
(c) has great affinity for water
(d) has two hydroxyl groups in its structure

Directions (Q. Nos. 253-254) In each of the following questions two statements are given one labelled as the Assertion (A) and the other labelled as the Reason (R). Read these statements carefully and mark the correct choice as per following instructions.

(a) Both A and R are correct; R is the correct explanation of A
(b) Both A and R are correct; R is not the correct explanation of A
(c) A is correct; R is incorrect
(d) R is correct; A is incorrect

253. **Assertion** (A) Conc. H_2SO_4 cannot be used to prepare HI from KI.

Reason (R) Conc. H_2SO_4 acts as a strong oxidising agent.

254. **Assertion** (A) On heating $NaCl(s)$ with conc. H_2SO_4, HCl is produced.

Reason (R) Conc. H_2SO_4 oxidises HCl produced to Cl_2.

255. H_2SO_4 is a

I. dehydrating agent II. sulphonating agent
III. reducing agent IV. highly viscous liquid.

Choose the correct set of choices from the options given below.

(a) I, II and III
(b) II, III and IV
(c) I, III and IV
(d) I, II and IV

256. It is advised to add H_2SO_4 while preparing a standard solution of Mohr's salt to avoid

(a) hydration
(b) oxidation
(c) reduction
(d) hydrolysis

257. Sulphuric acid has great affinity for water because

(a) it hydrolysis the acid
(b) it decomposes the acid
(c) acid decomposes water
(d) acid forms hydrates with water

258. When conc. H_2SO_4 comes in contact with sugar, it becomes black due to [CPMT 1989]

(a) hydration
(b) decolourisation
(c) dehydration
(d) hydrolysis

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Group-17 Elements

Level I

259. Fluorine, chlorine, bromine, iodine and astatine are members of group ...*A*... and are known as ...*B*.... Here, *A* and *B* refer to
(a) *A* – 17; *B* – chalcogens
(b) *A* – 17; *B* – halogens
(c) *A* – 16; *B* – halogens
(d) *A* – 16; *B* – chalcogens

260. Following are the statements related to group-17 elements
I. Sea water contains chlorides, bromides and iodides of sodium, potassium, magnesium and calcium, but is mainly sodium chloride solution.
II. The deposits of dried up seas contain carnallite, $KCl \cdot MgCl_2 \cdot 6H_2O$
III. Certain forms of marine life contain iodine in their system.
Which of the above statements are correct?
(a) I and II (b) II and III
(c) I and III (d) I, II and III

261. Electronic configuration of group 17 elements is
(a) ns^2np^5
(b) ns^2np^6
(c) ns^2np^4
(d) ns^2np^3

262. Consider the following statements.
I. Due to maximum effective nuclear charge, the halogens have the smallest atomic radii in their respective periods.
II. These have low ionisation enthalpy.
III. Halogens have maximum negative electron gain enthalpy.
IV. Fluorine is the most electronegative element in the Periodic Table.
The correct statements are
(a) I, II, III, IV (b) I, II, III
(c) I, III, IV (d) II, III, IV

263. Fluorine and chlorine are ...*A*..., bromine is a ...*B*... and iodine is a ...*C*.... Here, *A*, *B* and *C* refer to
(a) *A* – solids, *B* – liquid: *C* – gas
(b) *A* – solids, *B* – gas: *C* – liquid
(c) *A* – gases, *B* – solid: *C* – liquid
(d) *A* – gases, *B* – liquid: *C* – solid

264. **Statement I** Melting and boiling points of group17 elements steadily increase with atomic number.
Statement II All halogens are coloured.
The incorrect statement(s) is/are
(a) Only II (b) Only I
(c) Neither I nor II (d) Both I and II

265. **Assertion** (A) Electron gain enthalpy of fluorine is less negative as compared to the chlorine, fluorine is a stronger oxidising agent than chlorine.
Reason (R) F—F bond has low dissociation enthalpy and F has high hydration enthalpy.
(a) Both A and R are correct; R is the correct explanation of A
(b) Both A and R are correct; R is not the correct explanation of A
(c) A is correct; R is incorrect
(d) R is correct; A is incorrect

266. **Statement I** All the halogens exhibit –1 oxidation state.
Statement II The oxidation states of +4 and +6 occur in the oxides and oxoacids of chlorine and bromine.
The correct statement(s) is/are
(a) Only I
(b) Only II
(c) Both I and II
(d) Neither I nor II

267. The decreasing oxidising ability of the halogens in aqueous solution down the group is evident from ...*A*.... Here, *A* refers to
(a) standard electrode potential
(b) oxidation state
(c) Either (a) or (b)
(d) None of the above

268. On reaction with water,
I. fluorine oxidises water to oxygen.
II. chlorine and bromine react with water to form corresponding hydrohalic and hypohalous acids.
III. reaction of iodine with water is spontaneous.
Which of the above mentioned statement(s) is/are correct?
(a) Only III (b) Only I
(c) I and II (d) I, II and III

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269. The anomalous behaviour of fluorine is due to
(a) its small size
(b) its highest electronegativity
(c) low F—F bond dissociation enthalpy and non-availability of *d*-orbitals in valence shell
(d) All of the above

Directions (Q. Nos. 270-271) Answer by choosing the correct option from the choices given below.
(a) Both A and R are correct; R is the correct explanation of A
(b) Both A and R are correct; R is not the correct explanation of A
(c) A is correct; R is incorrect
(d) R is correct; A is incorrect

270. **Assertion** (A) Most of the reactions of fluorine are exothermic.
Reason (R) F forms small and strong bond formed by it with other elements.

271. **Assertion** (A) HF is a liquid (boiling point 293 K).
Reason (R) It is due to strong hydrogen bonding.

272. Arrange following acids in the correct increasing order of their acidic strength; HCl, HBr, HI, HF
(a) HI < HBr < HCl < HF
(b) HF < HCl < HBr < HI
(c) HCl < HBr < HI < HF
(d) HBr < HI < HF < HCl

273. I. Fluorine forms two oxides OF_2 and O_2F_2.
II. OF_2 is thermodynamically stable at 298 K.
III. O_2F_2 oxidises plutonium to PuF_6.
The correct set of statements is
(a) I and II
(b) II and III
(c) I and III
(d) I, II and III

274. Which oxide of the chlorine is used as a bleaching agent for paper pulp and textiles and in water treatment?
(a) Cl_2O (b) ClO_2
(c) Cl_2O_6 (d) Cl_2O_7

275. ...*A*... is used in the estimation of carbon monoxide. Here, *A* refers to
(a) I_2O_5 (b) I_2O_7
(c) BrO_2 (d) BrO_3

276. The ionic character of the metal halides *M*Cl, *M*I, *M*Br, *M*F decreases in the order
(a) *M*F > *M*Br > *M*I > *M*Cl
(b) *M*I > *M*Br > *M*F > *M*Cl
(c) *M*F > *M*Cl > *M*Br > *M*I
(d) *M*Br > *M*F > *M*I > *M*Cl

277. **Statement I** Halogens combine amongst themselves to form a number of compounds known as interhalogens of the types XX', XX_3', XX_5', and XX_7'.
Statement II *X* is a larger size halogen and *X'* is a smaller size halogen.
The correct statement(s) is/are
(a) Both I and II are incorrect (b) Both I and II are correct
(c) I is correct, II is incorrect (d) II is correct, I is incorrect

278. **Interpretation** F cannot exhibit any positive oxidation state.
Conclusion Fluorine exhibits only −1 oxidation state.
Choose the best option from the choices given below.
(a) Both conclusion and interpretation are correct
(b) Both conclusion and interpretation are incorrect
(c) Conclusion is correct, interpretation is incorrect
(d) Conclusion is incorrect interpretation is correct

Level II

279. Reduction potentials of some ions are given below. Arrange them in decreasing order of oxidising power. [NCERT Exemplar]

Ion	ClO_4^-	IO_4^-	BrO_4^-
Reduction potential $E^\ominus$/V	$E^\ominus$ = 1.19 V	$E^\ominus$ = 1.65 V	$E^\ominus$ = 1.74 V

(a) $ClO_4^- > IO_4^- > BrO_4^-$ (b) $IO_4^- > BrO_4^- > ClO_4^-$
(c) $BrO_4^- > IO_4^- > ClO_4^-$ (d) $BrO_4^- > ClO_4^- > IO_4^-$

280. Which of the following is isoelectronic pair? [NCERT Exemplar]
(a) ICl_2, ClO_2 (b) BrO_2^-, BrF_2^+
(c) ClO_2, BrF (d) CN^-, O_3

281. If chlorine gas is passed through hot NaOH solution, two changes are observed in the oxidation number of chlorine during the reaction. They are ...*A*... and ...*B*... . Here, *A* and *B* refer to
(a) *A*–0 to –5; *B*–0 to +2
(b) *A*–0 to 1; *B*–1 to –2
(c) *A*–0 to +5; *B*–0 to –1
(d) *A*–0 to 1; *B*–0 to 2

282. Halogens are placed in the VII A group or group 17 of the Periodic Table because
(a) these are very reactive
(b) these are non-metals
(c) these are electronegative
(d) these have 7 electrons in outermost shell

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283. I. Among halide ions, iodine is the most powerful reducing agent.
II. HOCl is stronger acid than HOBr.
III. HF is stronger acid than HCl
IV. Fluorine is the only halogen that does not show variable oxidation state.
The correct set of statements is
(a) I, II and III
(b) Only II and IV
(c) I, II and IV
(d) I, II, III and IV

284. Among the C—X bond (where, X = Cl, Br, I) the correct decreasing order of bond energy is
(a) C—I > C—Cl > C—Br
(b) C—I > C—Br > C—Cl
(c) C—Cl > C—Br > C—I
(d) C—Br > C—Cl > C—I

285. With increase in molecular weight the boiling point of halogens increase, it happens because [OJEE 2009]
(a) van der Waals' forces increase with increase in number of electrons per mole
(b) bond strength increases due to increase in electronegativity
(c) with the increase in size, molecules undergo association leading to higher stability
(d) None of the above

286. By heating a mixture of ...A... bromine is prepared in the laboratory. Here, A indicates
(a) $MgBr_2 + Cl_2$ (b) $MgBr + H_2SO_4$
(c) KBr + HCl (d) $KBr + MnO_2 + H_2SO_4$

287. Bond length is maximum in
(a) HF (b) HCl
(c) HI (d) HBr

288. Bleaching powder is an example of
(a) a complex salt (b) an acidic salt
(c) a basic salt (d) a mixed salt

Chlorine

Level I

289. Chlorine was discovered in ...I... by ...II... by the action of HCl on ...III... . In ...IV... , the chemist ...V... established its nature and suggested the name chlorine on account of its ...VI... .
Choose the correct option to fill the blanks (I to VI) in the above passage.
(a) I – 1810; II – Scheele; III – MnO_2; IV –1774; V – Davy; VI–colour
(b) I –1774; II – Davy; III – $KClO_4$; IV –1810; V – Scheele; VI – nature
(c) I – 1774; II – Scheele; III – MnO_2; IV –1810; V – Davy; VI – colour
(d) I – 1810; II – Davy; III – $KClO_4$; IV – 1774; V – Scheele; VI – colour

290. $4HCl + O_2 \xrightarrow{CuCl_2} 2Cl_2 + 2H_2O$
The above reaction of chlorine preparation is of
(a) Deacon's process (b) Contact process
(c) Either (a) or (b) (d) None of these

291. Chlorine is obtained by the electrolysis of ...A... and is liberated at ...B... . Here, A and B refer to
(a) NaCl – A; B – anode
(b) brine – A; B – anode
(c) brine – A; B – cathode
(d) NaCl – A; B – cathode

292. Which of the following facts is/are true about chlorine?
(a) It is a greenish yellow gas
(b) It has pungent and suffocating odour
(c) It is about 2-5 times heavier than odour
(d) All of the above

293. Complete the following reactions.
I. $8NH_3$ (excess) $+ 3Cl_2 \longrightarrow$ I
II. $NH_3 + 3Cl_2$ (excess) $\longrightarrow$ II
(a) (I) $6NH_4Cl + N_2$; (II) $NCl_3 + 3HCl$
(b) (I) $NCl_3 + 3HCl$; (II) $6NH_4Cl + N_2$
(c) (I) $NCl_3 + N_2$; (II) $6NH_4Cl + 3HCl$
(d) (I) $6NH_4Cl + 3HCl$; (II) $NCl_3 + N_2$

294. I. $2NaOH$ (cold and dilute) $+ Cl_2 \longrightarrow ...A... + ...B... + H_2O$
II. $6NaOH$ (hot and conc) $+ 3Cl_2 \longrightarrow ...C... + ...D... + 3H_2O$
Here, A, B, C and D refer to
(a) A – NaCl; B – $NaClO_3$; C – NaOCl; D – 5NaCl
(b) A – 5NaCl; B – $NaClO_3$; C – NaOCl; D – NaCl
(c) A – NaCl; B – NaOCl; C – 5NaCl; D – $NaClO_3$
(d) A – 5NaCl; B – NaOCl; C – NaCl; D – $NaClO_3$

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295. Composition of bleaching powder is
(a) $Ca(OCl)_2 \cdot CaCl_2 \cdot Ca(OH)_2 \cdot 2H_2O$
(b) $CaCl_2 \cdot CaOCl_2 \cdot Ca(OH)_2 \cdot 2H_2O$
(c) $Ca(OCl_2) \cdot CaCl_2 \cdot Ca(OH)_2 \cdot 4H_2O$
(d) None of the above

296. Chlorine is used in
(a) the extraction of gold and platinum
(b) bleaching wood pulp
(c) sterilising drinking water
(d) All of the above

Level II

297. Chlorine reacts with hydrocarbons and gives ...*A*... products. Here, *A* refers to
(a) substitution (b) addition
(c) elimination (d) Both (a) and (b)

298. Chlorine is a powerful bleaching agent. Its bleaching action is due to
(a) oxidation (b) reduction
(c) acidic nature (d) None of these

Hydrogen Chloride

Level I

299. I. ...*A*... prepared HCl in 1648.
II. ...*B*... showed that it is a compound of chlorine and hydrogen, in 1810, Name the scientists *A* and *B*. Here, *A* and *B* refer to
(a) *A* – Davy; *B* – Scheele (b) *A* – Scheele; *B* – Davy
(c) *A* – Glauber; *B* – Scheele (d) *A* – Glauber; *B* – Davy

300. HCl gas can be dried by passing through
(a) conc. H_2SO_4 (b) dil. H_2SO_4 (c) conc. HNO_3 (d) dil. HNO_3

301. **Assertion** (A) Dissociation constant (K_a) value of HCl is high, *i.e.*, $K_a = 10^7$.
Reason (R) It is a strong acid in water.
(a) Both A and R are correct; R is the correct explanation of A
(b) Both A and R are correct; R is not the correct explanation of A
(c) A is correct; R is incorrect
(d) R is correct; A is incorrect

Level II

302. Uses of HCl are
(a) in the manufacturing of chlorine, and glucose
(b) for extracting glue from bones and purifying bone black.
(c) in medicine and as a laboratory agent
(d) All of the above

303. When HCl reacts with finely powdered iron, it forms ferrous chloride and not ferric chloride because [MP PMT 1993]
(a) its reaction with iron produces H_2
(b) liberaton of hydrogen prevents the formation of ferric chloride
(c) Both (a) and (b)
(d) None of the above

Oxoacids of Halogens

Level I

304. Fluorine forms only one oxoacid due to
(a) high electronegativity
(b) small size
(c) low electronegativity and large size
(d) Both (a) and (b)

305. **Statement I** Most of the oxoacids of halogens cannot be isolated in pure state.
Statement II These are stable only in aqueous solutions or in the form of their salts.
Which of these statement(s) is/are correct?
(a) Only I
(b) Only II
(c) Both I and II
(d) None of the above

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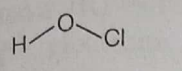
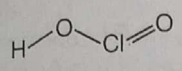
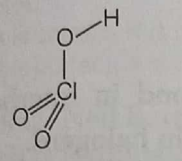
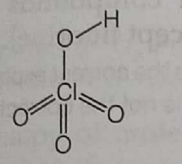
306. Match the Column and choose the correct option from the codes given below.

Column I (Structures)	Column II (Oxoacids of halogens)
A. 	1. Perchloric acid
B. 	2. Chloric acid
C. 	3. Chlorous acid
D. 	4. Hypochlorous acid

Codes

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

Level II

307. The correct order of the decreasing acidic strengths of $HClO, HClO_2, HClO_3, HClO_4$ is [CBSE 2005]

(a) $HClO > HClO_2 > HClO_3 > HClO_4$
(b) $HClO_4 > HClO_3 > HClO_2 > HClO$
(c) $HClO_4 > HClO_2 > HClO > HClO_3$
(d) $HClO_3 > HClO > HClO_4 > HClO_2$

308. The hybrid state of halogen atom is sp^3 in

(a) ClO_4^-
(b) ClO^-
(c) ClO_3^-
(d) (a), (b) and (c)

Interhalogen Compounds

Level I

309. When two ...*A*... halogens react with each other, interhalogen compounds are formed. Here, *A* refers to

(a) same
(b) different
(c) Either (a) and (b)
(d) None of the above

310. **Assertion** (A) Iodine (VII) fluoride should have maximum number of atoms.

Reason (R) The ratio of radii between I and F should be maximum.

(a) Both A and R are correct; R is the correct explanation of A
(b) Both A and R are correct; R is not the correct explanation of A
(c) A is correct; R is incorrect
(d) R is correct; A is incorrect

311. Consider the following statements regarding preparation of interhalogen compounds.

I. These can be prepared by the direct combination.
II. These can be prepared by the action of halogen on lower interhalogen compounds.
III. The product formed depends upon some specific conditions.

The correct set of statements is

(a) I and II (b) II and III (c) I and III (d) I, II and III

312. Match the Column and choose the correct option from the codes given below.

Column I (Reactants)	Column II (Products)
A. $Cl_2 + F_2 \xrightarrow[\text{(equalvolume)}]{437\ K}$	1. $2BrF_3$
B. $I_2 + \underset{\text{(excess)}}{3Cl_2} \longrightarrow$	2. $2ICl$
C. $Cl_2 + \underset{\text{(excess)}}{3F_2} \xrightarrow{573\ K}$	3. $2BrF_5$
D. $Br_2 + 3F_2 \longrightarrow$ (diluted with water)	4. $2ClF$
E. $\underset{\text{(equimolar)}}{I_2} + Cl_2 \longrightarrow$	5. $2ClF_3$
F. $Br_2 + \underset{\text{(excess)}}{5F_2} \longrightarrow$	6. $2ICl_3$

Codes

	A	B	C	D	E	F
(a)	4	5	1	2	3	6
(b)	4	6	5	1	2	3
(c)	3	4	1	2	5	6
(d)	2	3	4	6	1	5

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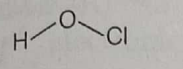
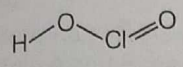
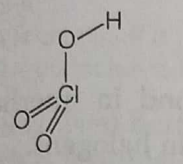
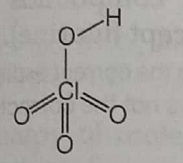
306. Match the Column and choose the correct option from the codes given below.

Column I (Structures)	Column II (Oxoacids of halogens)
A. 	1. Perchloric acid
B. 	2. Chloric acid
C. 	3. Chlorous acid
D. 	4. Hypochlorous acid

Codes

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

Level II

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(a) ClO_4^-
(b) ClO^-
(c) ClO_3^-
(d) (a), (b) and (c)

Interhalogen Compounds

Level I

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(a) same
(b) different
(c) Either (a) and (b)
(d) None of the above

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Reason (R) The ratio of radii between I and F should be maximum.

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(c) A is correct; R is incorrect
(d) R is correct; A is incorrect

311. Consider the following statements regarding preparation of interhalogen compounds.

I. These can be prepared by the direct combination.
II. These can be prepared by the action of halogen on lower interhalogen compounds.
III. The product formed depends upon some specific conditions.

The correct set of statements is

(a) I and II (b) II and III (c) I and III (d) I, II and III

312. Match the Column and choose the correct option from the codes given below.

Column I (Reactants)	Column II (Products)
A. $Cl_2 + F_2 \xrightarrow[\text{(equalvolume)}]{437\ K}$	1. $2BrF_3$
B. $I_2 + 3Cl_2 \longrightarrow$ (excess)	2. $2ICl$
C. $Cl_2 + 3F_2 \xrightarrow[\text{(excess)}]{573\ K}$	3. $2BrF_5$
D. $Br_2 + 3F_2 \longrightarrow$ (diluted with water)	4. $2ClF$
E. $I_2 + Cl_2 \longrightarrow$ (equimolar)	5. $2ClF_3$
F. $Br_2 + 5F_2 \longrightarrow$ (excess)	6. $2ICl_3$

Codes

	A	B	C	D	E	F
(a)	4	5	1	2	3	6
(b)	4	6	5	1	2	3
(c)	3	4	1	2	5	6
(d)	2	3	4	6	1	5

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313. Match the Column and choose the correct option from the codes given below.

Column I (Formula)	Column II (Colour and physical state)	Column III (Structure)
A. ClF_3	I. Colourless gas but solid below 77 K	1. Bent T-shaped
B. IF_5	II. Colourless gas	2. Square-pyramidal
C. IF_7	III. Orange solid	3. Pentagonal bipyramidal
D. ICl_3	IV. Colourless gas	4. Bent T-shaped

Codes

	A	B	C	D
(a)	I(4)	II(3)	III(2)	IV(1)
(b)	III(1)	IV(2)	II(4)	I(3)
(c)	II(1)	I(2)	IV(3)	III(4)
(d)	IV(1)	III(4)	II(3)	I(2)

314. Interhalogen compounds are
(a) covalent molecules
(b) diamagnetic in nature
(c) volatile solids/liquids at 298 K except ClF
(d) All of the above

315. Interhalogen compounds can be used as
I. non-aqueous solvents
II. fluorinating agents
The correct use(s) is/are
(a) Only I (b) Only II
(c) Both I and II (d) Neither I nor II

316. I. IF is detected spectroscopically and is very unstable.
II. BrCl is pure solid at room temperature.
III. ICl_3 dimerises as Cl-bridged dimer (I_2Cl_6).
The correct set of statements is
(a) I and II
(b) I, II and III
(c) II and III
(d) I and III

Level II

317. **Assertion** (A) $X—X'$ bond in interhalogens is weaker than $X—X$ bond in halogens.
Reason (R) Interhalogen compounds are more reactive than halogens (except fluorine).
(a) Both A and R are correct; R is the correct explanation of A
(b) Both A and R are correct; R is not the correct explanation of A
(c) A is correct; R is incorrect
(d) R is correct; A is incorrect

318. "Molecular structures of interhalogen compounds can always be explained on the basis of VSEPR theory". This statement is
(a) true
(b) false
(c) sometimes true sometimes false
(d) cannot be predicted

Group-18 Elements

Level I

319. Group 18 consists of ...*A*... elements. Here, *A* refers to
(a) six (b) seven (c) five (d) eight

320. All noble gases have general electronic configuration ...*A*... except helium which has ...*B*... . Here, *A* and *B* refer to
(a) $A-ns^2np^4; B-1s^2$ (b) $A-ns^2np^6; B-1s^2$
(c) $A-ns^2np^6; B-1s^1$ (d) $A-ns^2np^4; B-1s^1$

321. Due to stable electronic configurations
I. these gases exhibit very high ionisation enthalpy.
II. these have no tendency to accept the electron.
III. these have large positive values of electron gain enthalpy.
the incorrect set of statements is
(a) I, II and III (b) II and III
(c) I and II (d) None of these

322. The only type of interatomic interaction in noble gases is
(a) weak dispersion forces (b) H-bonding
(c) covalent bonding (d) None of these

323. ...*A*... has the lowest boiling point (4.2 K) of any known substance. Here, *A* refers to
(a) argon (b) helium
(c) neon (d) krypton

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324. Noble gases are
(a) monoatomic (b) diatomic
(c) polyatomic (d) None of these

325. **Assertion** (A) Noble gases are least reactive.
Reason (R) All of them have completely filled ns^2p^6 electronic configuration in their valence shell.
(a) Both A and R are correct; R is the correct explanation of A
(b) Both A and R are correct; R is not the correct explanation of A
(c) A is correct; R is incorrect
(d) R is correct; A is incorrect

326. In 1962, Neil Bartlett prepared a ...*A*... compound which is formulated as ...*B*... . Here, *A* and *B* refer to
(a) *A* – red; *B* – $O_2^+ PtF_6^-$ (b) *A* – brown; *B* – $O_2^+ PtF_6^-$
(c) *A* – brown; *B* – $O_2PtF_6^-$ (d) *A* – red; *B* – O_2PtF_6

327. Enthalpy of molecular oxygen is almost identical with that of
(a) neon (b) argon
(c) helium (d) xenon

328. Xenon forms ...I... binary fluorides. Here, I is
(a) two (b) three (c) four (d) five

329. I. $XeOF_4$ has square pyramidal structure.
II. XeF_2 has linear structure.
Which of the above mentioned statement(s) is/are true?
Choose the correct option.
(a) Only I (b) Only II
(c) Both I and II (d) Neither I nor II

330. Does the hydrolysis of XeF_6 lead to a redox reaction?
(a) Yes (b) No
(c) May be (d) Cannot be said

331. Match the Column and choose the correct option from the codes given below.

Column I (Compound)	Column II (Structure)
A. XeF_6	1. Pyramidal
B. $XeOF_4$	2. Square pyramidal
C. XeO_3	3. Distorted octahedral

Codes

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

332. A gas '*X*' is used in filling balloons for meteorological observations. It is also used in gas-cooled nuclear reactors. Identify '*X*'.
(a) Helium (b) Neon
(c) Argon (d) Krypton

333. Match the Column and choose the correct option from the codes given below.

Column I (Uses)	Column II (Noble gases)
A. In discharge tubes and fluorescent bulbs	1. Argon
B. Provides an inert atmosphere in high temperature metallurgical process	2. Helium
C. MRI systems	3. Neon

Codes

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

Level II

334. Noble gases are adsorbed by
(a) finely divided Pd and Pt (b) coconut charcoal
(c) colloidal Pd (d) All of these

335. Noble gases can be separated by
(a) electrolysis of their compounds
(b) adsorption and desorption on coconut charcoal
(c) passing them through some solutions
(d) None of the above

336. The ease of liquefaction of noble gases increases in the order
(a) He > Ne > Ar > Kr > Xe
(b) Xe > Kr > Ar > He > Ne
(c) He < Ne < Ar < Kr < Xe
(d) Xe < He < Ne < Ar < Kr

337. The atomic weight of noble gases is obtained by utilising the relationship [CPMT 2002]
(a) atomic weight = $\frac{\text{valency}}{\text{equivalent weight}}$
(b) atomic weight = equivalent weight × valency
(c) atomic weight = $\frac{\text{equivalent weight}}{\text{valency}}$
(d) 2 × VD = molecular weight = atomic weight

338. Among XeO_3, XeO_4 and XeF_6, the molecules having same number of lone pairs on Xe are
(a) XeO_3 and XeO_4 only (b) XeO_3 and XeF_6 only
(c) XeO_4 and XeF_6 only (d) XeO_3, XeO_4 and XeF_6

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Miscellaneous Questions

339. Mixture of sand and iodine can be separated by
(a) fractional distillation
(b) sublimation
(c) separation is not possible
(d) disolving in water and filtering

340. Compounds formed when noble gases get entrapped in the cavities of crystal lattices of certain inorganic and organic compounds are known as
(a) clathrates (b) hydrates
(c) picrates (d) interstitial compounds

341. In qualitative analysis when H_2S is passed through an aqueous solution of salt acidified with dil. HCl, a black precipitate is obtained. On boiling the precipitate with dil. HNO_3, it forms a solution of blue colour. Addition of excess of aqueous solution of ammonia to this solution gives [NCERT Exemplar]
(a) deep blue precipitate of $Cu(OH)_2$
(b) deep blue solution of $[Cu(NH_3)_4]^{2+}$
(c) deep blue solution of $Cu(NO_3)_2$
(d) deep blue solution of $Cu(OH)_2 \cdot Cu(NO_3)_2$

342. I. Radioactivity of radon is used in the treatment of cancer therapy.
II. In kroll and ICl process of the production of titanium, the inert gas used is argon.
III. Gas used in thermometer is helium.
The correct set of statement is
(a) I, II and III (b) I and II
(c) i and III (d) II and III

343. ...*A*... are fluorochlorobromocarbons used as fire fighting in tanks and armoured personal carriers. Here, *A* refers to
(a) CFC's (b) Halons
(c) Either (a) or (b) (d) None of these

344. In the ring test for NO_3^- ion, a brown ring is formed due to the formation of [KCET 2007]
(a) $FeSO_4 \cdot NO_2$
(b) $FeSO_4 \cdot HNO_3$
(c) $[Fe(H_2O)_5(NO)]^{2+}$
(d) $[Fe(H_2O)_4(NO)_2]^{2+}$

345. A black compound of manganese reacts with a halogen acid to give greenish yellow gas. When excess of this gas reacts with NH_3 an unstable trihalide is formed. In this process the oxidation state of nitrogen changes from ..... [NCERT Exemplar]
(a) –3 to +3 (b) –3 to 0
(c) –3 to +5 (d) 0 to –3

346. Which of the following statements are correct?
I. Among halogens, radius ratio between iodine and fluorine is maximum.
II. Leaving F—F bond, all halogens have weaker X—X bond than X—X' bond in interhalogens.
III. Among interhalogen compounds maximum number of atoms are present in iodine fluoride.
IV. Interhalogen compounds are more reactive than halogen compounds.
The correct option is
(a) I, II and III (b) I, III and IV
(c) II, III and IV (d) Only I and II

347. Match the items of Columns I and II and choose the correct option from the codes given below. [NCERT Exemp

	Column I		Column II
A.	Its partial hydrolysis does not change oxidation state of central atom	1.	He
B.	It is used in modern diving apparatus	2.	XeF_6
C.	It is used to provide inert atmosphere for filling electrical bulbs	3.	XeF_4
D.	Its central atom is in sp^3d^2 hybridisation	4.	Ar

Codes

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

Directions (Q. Nos. 348-352) In the follow questions a statement of assertion followed b statement of reason is given. Choose the correct ans out of the following choices.
(a) Both A and R are correct; R is the correct explanation
(b) Both A and R are correct; R is not the correct explan of A
(c) A is correct; R is incorrect
(d) R is correct; A is incorrect

348. **Assertion** (A) ClF_3 exists but FCl_3 does not e
Reason (R) F is more electronegative than C

349. **Assertion** (A) PH_3 forms bubbles when pa slowly in water but NH_3 dissolves.
Reason (R) NH_3 is water soluble.

350. **Assertion** (A) Nitric oxide is paramagnet gaseous state.
Reason (R) Solid of nitric oxide obtaine cooling is diamagnetic.

351. **Assertion** (A) SF_6 is known but SCl_6 is not.
Reason (R) Due to small size of F.

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Miscellaneous Questions

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(b) sublimation
(c) separation is not possible
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II. In kroll and ICl process of the production of titanium, the inert gas used is argon.
III. Gas used in thermometer is helium.
The correct set of statement is
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343. ...*A*... are fluorochlorobromocarbons used as fire fighting in tanks and armoured personal carriers. Here, *A* refers to
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345. A black compound of manganese reacts with a halogen acid to give greenish yellow gas. When excess of this gas reacts with NH_3 an unstable trihalide is formed. In this process the oxidation state of nitrogen changes from ..... [NCERT Exemplar]
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I. Among halogens, radius ratio between iodine and fluorine is maximum.
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III. Among interhalogen compounds maximum number of atoms are present in iodine fluoride.
IV. Interhalogen compounds are more reactive than halogen compounds.
The correct option is
(a) I, II and III (b) I, III and IV
(c) II, III and IV (d) Only I and II

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

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Reason (R) Solid of nitric oxide obtained on cooling is diamagnetic.

351. **Assertion** (A) SF_6 is known but SCl_6 is not.
Reason (R) Due to small size of F.

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352. **Assertion** (A) In the preparation of H_2SO_4 by contact process, SO_3 is not absorbed directly in water to form H_2SO_4.

Reason (R) Acid fog is formed, which is difficult to condense.

353. A substance on treatment with dilute H_2SO_4 librates a colourless gas which

I. turns acidified dichromate solution green

II. produces turbidity with baryta water

These reactions indicate the presence of

(a) S^{2-} (b) NO_2^- (c) SO_3^{2-} (d) CO_3^{2-}

354. A student accidentally splashes few drops of conc. H_2SO_4 on his cotton shirt. After a while, the splashed parts get blackened and the holes appear. This happens because sulphuric acid

(a) heats up the cotton

(b) removes the elements of water from cotton

(c) causes the cotton to react with water

(d) dehydrates the cotton with burning

355. The oxyacids of S having —S—S— bond is/are

I. $H_2S_2O_4$; II. $H_2S_2O_7$;

III. $H_2S_2O_6$; IV. $H_2S_2O_3$

Choose the correct option.

(a) I and III (b) II and IV (c) I and II (d) II and III

356. Hydrolysis of one mole of peroxodisulphuric acid will yield

(a) two moles of peroxomonosulphuric acid

(b) two moles of sulphuric acid

(c) one mole each of sulphuric acid, peroxomonosulphuric acid and hydrogen peroxide

(d) one mole of sulphuric acid and one mole of peroxomonosulphuric acid

357. Which of the following statements are correct?

I. Xenon fluorides are non-reactive.

II. Hydrolysis of XeF_6 is a redox reaction.

III. Only type of interactions between particles of noble gases are due to weak dispersion forces.

IV. Ionisation enthalpy of molecular oxygen is very close to that of xenon.

Choose the correct option.

(a) I and II (b) II and IV (c) III and IV (d) I and III

358. The reactions in which conc. H_2SO_4 is used as an oxidising agent are

I. $2HI + H_2SO_4 \longrightarrow I_2 + SO_2 + 2H_2O$

II. $NaCl + 2H_2SO_4 \longrightarrow NaHSO_4 + HCl$

III. $CaF_2 + H_2SO_4 \longrightarrow CaSO_4 + 2HF$

IV. $Cu + 2H_2SO_4 \longrightarrow CuSO_4 + SO_2 + 2H_2O$

Choose the correct option.

(a) I and II (b) II and III

(c) I and III (d) I and IV

359. Match the formulas of oxides given in Column I with the type of oxide given in Column II and mark the correct option. [NCERT Exemplar]

Column I	Column II
A. Pb_3O_4	1. Neutral oxide
B. N_2O	2. Acidic oxide
C. Mn_2O_7	3. Basic oxide
D. Bi_2O_3	4. Mixed oxide

Codes

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

360. Match the items of Columns I and II and choose the correct option from the codes given below. [NCERT Exemplar]

Column I	Column II
A. H_2SO_4	1. Highest electron gain enthalpy
B. CCl_3NO_2	2. Chalcogen
C. Cl_2	3. Tear gas
D. Sulphur	4. Storage batteries

Codes

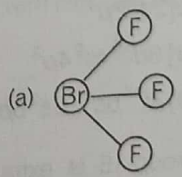
	A	B	C	D
(a)	4	3	1	2
(b)	3	4	1	2
(c)	4	1	2	3
(d)	2	1	3	4

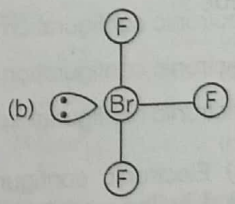
361. In BrF_3 the central atom Br has ...*A*... electrons in the valence shell. Here, *A* is

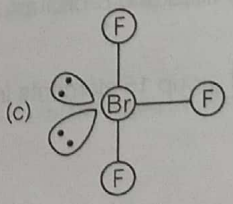
(a) six (b) seven

(c) eight (d) four

362. Structure of BrF_3 is

(a) 

(b) 

(c) 

(d) None of these

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