DPP - Daily Practice Problems

Chapter-wise Sheets

Date : | Start Time : | End Time :

CHEMISTRY CC21

SYLLABUS : p-Block Elements (Group 15, 16, 17 and 18)

Max. Marks : 180 **Marking Scheme :** + 4 for correct & (–1) for incorrect **Time : 60 min.**

INSTRUCTIONS : This Daily Practice Problem Sheet contains 45 MCQ's. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.

1. The brown ring test for NO_2^- and NO_3^- is due to the formation of complex ion with a formula
(a) $[Fe(H_2O)_6]^{2+}$ (b) $[Fe(NO)(CN)_5]^{2+}$
(c) $[Fe(H_2O)_5NO]^{2+}$ (d) $[Fe(H_2O)(NO)_5]^{2+}$

2. Which of the following shows nitrogen with its increasing order of oxidation number?
(a) $NO < N_2O < NO_2 < NO_3^- < NH_4^+$
(b) $NH_4^+ < N_2O < NO_2 < NO_3^- < NO$
(c) $NH_4^+ < N_2O < NO < NO_2 < NO_3^-$
(d) $NH_4^+ < NO < N_2O < NO_2 < NO_3^-$

3. Which one of the following is the correct decreasing order of boiling point?
(a) $H_2Te > H_2O > H_2Se > H_2S$
(b) $H_2O > H_2S > H_2Se > H_2Te$
(c) $H_2Te > H_2Se > H_2S > H_2O$
(d) $H_2O > H_2Te > H_2Se > H_2S$

4. The true statement for the acids of phosphorus. H_3PO_2, H_3PO_3, and H_3PO_4 is :
(a) the order of their acidity is $H_3PO_4 < H_3PO_3 <, H_3PO_2$
(b) all of them are reducing in nature
(c) all of them are tribasic acids
(d) the geometry of phosphorus is tetrahedral in all the three

5. The acid which forms two series of salts is
(a) H_3PO_4 (b) H_3PO_3 (c) H_3BO_3 (d) $H_3PO_2^-$

RESPONSE GRID	1. ⓐⓑⓒⓓ	2. ⓐⓑⓒⓓ	3. ⓐⓑⓒⓓ	4. ⓐⓑⓒⓓ	5. ⓐⓑⓒⓓ

Space for Rough Work

6. The nitrogen oxides that contain(s) N–N bond(s) is /are
(i) N_2O (ii) N_2O_3 (iii) N_2O_4 (iv) N_2O_5
(a) (i), (ii) (b) (ii), (iii), (iv)
(c) (iii), (iv) (d) (i), (ii) and (iii)

7. The geometry of ClO_3^- according to valence shell electron pair repulsion (VSEPR) theory will be
(a) planar triangle (b) pyramidal
(c) tetrahedral (d) square planar

8. It is possible to obtain oxygen from air by fractional distillation because
(a) oxygen is in a different group of the periodic table from nitrogen
(b) oxygen is more reactive than nitrogen
(c) oxygen has higher b.p. than nitrogen
(d) oxygen has a lower density than nitrogen

9. Which of the following is the most basic oxide?
(a) Sb_2O_3 (b) Bi_2O_3 (c) ScO_2 (d) Al_2O_3

10. Which compound is used in photography?
(a) Na_2SO_5 (b) $Na_2S_2O_8$
(c) $Na_2S_2O_6$ (d) $Na_2S_2O_3$

11. The oxyacid of phosphorous in which phosphorous has the lowest oxidation state is
(a) hypophosphorous acid
(b) orthophosphoric acid
(c) pyrophosphoric acid
(d) metaphosphoric acid

12. Which of the following statements is not valid for oxoacids of phosphorus?
(a) Orthophosphoric acid is used in the manufacture of triple superphosphate.
(b) Hypophosphorous acid is a diprotic acid.
(c) All oxoacids contain tetrahedral four coordinated phosphorus.
(d) All oxoacids contain atleast one P = O and one P — OH group.

13. Which one of the following reactions of xenon compounds is not feasible?
(a) $3XeF_4 + 6H_2O \longrightarrow 2Xe + XeO_3 + 12HF + 1.5O_2$
(b) $2XeF_2 + 2H_2O \longrightarrow 2Xe + 4HF + O_2$
(c) $XeF_6 + RbF \longrightarrow Rb[XeF_7]$
(d) $XeO_3 + 6HF \longrightarrow XeF_6 + 3H_2O$

14. The compound of sulphur that can be used as refrigerant is
(a) SO_2 (b) SO_3 (c) S_2Cl_2 (d) H_2SO_4

15. Which of the following on thermal decomposition gives oxygen gas ?
(a) Ag_2O (b) Pb_3O_4
(c) PbO_2 (d) All of these

16. Which of the following statements are correct?
(i) Arsenic and antimony are metalloids.
(ii) Phosphorus, arsenic and antimony are found mainly as sulphide minerals.
(iii) Covalent radii increases equally from N to Bi.
(iv) Elements of group 15 have extra stability and higher ionisation energy due to exactly half filled ns^2np^3 electronic configuration.
(v) In group 15 elements only nitrogen is gas whereas all others are solids.
(a) (i), (iv) and (v) (b) (ii), (iii) and (iv)
(c) (i), (ii) and (iii) (d) (ii), (iii) and (v)

17. The formation of $O_2^+[PtF_6]^-$ is the basis for the formation of xenon fluorides. This is because
(a) O_2 and Xe have comparable sizes
(b) both O_2 and Xe are gases
(c) O_2 and Xe have comparable ionisation energies
(d) Both (a) and (c)

RESPONSE GRID					
	6. ⓐⓑⓒⓓ	7. ⓐⓑⓒⓓ	8. ⓐⓑⓒⓓ	9. ⓐⓑⓒⓓ	10. ⓐⓑⓒⓓ
	11. ⓐⓑⓒⓓ	12. ⓐⓑⓒⓓ	13. ⓐⓑⓒⓓ	14. ⓐⓑⓒⓓ	15. ⓐⓑⓒⓓ
	16. ⓐⓑⓒⓓ	17. ⓐⓑⓒⓓ			

Space for Rough Work

18. Oxidation of thiosulphate by iodine gives
(a) tetrathionate ion (b) sulphide ion
(c) sulphate ion (d) sulphite ion

19. The hybridization in ICl_7 is
(a) sp^3d^3 (b) d^2sp^3 (c) sp^3d (d) sp^3

20. Match the columns.

	Column-I		Column-II
A.	Pb_3O_4	I.	Neutral oxide
B.	N_2O	II.	Acidic oxide
C.	Mn_2O_7	III.	Basic oxide
D.	Bi_2O_3	IV.	Mixed oxide

(a) A – I; B – II; C – III; D – IV
(b) A – IV; B – I; C – II; D – III
(c) A – III; B – II; C – IV; D – I
(d) A – IV; B – III; C – I; D – II

21. Which one of the following arrangements does not give the correct picture of the trends indicated against it?
(i) $F_2 > Cl_2 > Br_2 > I_2$: Oxidizing power
(ii) $F_2 > Cl_2 > Br_2 > I_2$: Electron gain enthalpy
(iii) $F_2 > Cl_2 > Br_2 > I_2$: Bond dissociation energy
(iv) $F_2 > Cl_2 > Br_2 > I_2$: Electronegativity.
(a) (ii) and (iv) (b) (i) and (iii)
(c) (ii)and(iii) (d) (ii), (iii)and(iv)

22. Which of the following is a saline oxide ?
(a) Na_2O_2 (b) BaO_2 (c) Na_2O (d) Fe_2O_3

23. Shape of $XeOF_4$ is
(a) octahedral (b) square pyramidal
(c) pyramidal (d) T-shaped

24. Which among the following is paramagnetic ?
(a) Cl_2O (b) ClO_2 (c) Cl_2O_7 (d) Cl_2O_6

25. The molecule having smallest bondangle is :
(a) NCl_3 (b) $AsCl_3$ (c) $SbCl_3$ (d) PCl_3

26. Which one of the following orders correctly represents the increasing acid strengths of the given acids?
(a) $HOClO < HOCl < HOClO_3 < HOClO_2$
(b) $HOClO_2 < HOClO_3 < HOClO < HOCl$
(c) $HOClO_3 < HOClO_2 < HOClO < HOCl$
(d) $HOCl < HOClO < HOClO_2 < HOClO_3$

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

28. A certain compound (X) when treated with copper sulphate solution yields a brown precipitate. On adding hypo solution, the precipitate turns white. The compound is
(a) K_2CO_3 (b) KI (c) KBr (d) K_3PO_4

29. Which of the following species is not a pseudo halide
(a) CNO^- (b) $RCOO^-$ (c) OCN^- (d) NNN^-

30. Which of the following is used to produce and sustain powerful superconducting magnets to form an essential part of NMR spectrometer ?
(a) Ar (b) Ne (c) Rn (d) He

31. The product obtained as a result of a reaction of nitrogen with CaC_2 is
(a) $Ca(CN)_2$ (b) CaCN (c) $CaCN_3$ (d) Ca_2CN

32. Which of the following noble gases has the highest negative electron gain enthalpy value?
(a) Helium (b) Krypton
(c) Argon (d) Neon

RESPONSE GRID					
	18. ⓐⓑⓒⓓ	19. ⓐⓑⓒⓓ	20. ⓐⓑⓒⓓ	21. ⓐⓑⓒⓓ	22. ⓐⓑⓒⓓ
	23. ⓐⓑⓒⓓ	24. ⓐⓑⓒⓓ	25. ⓐⓑⓒⓓ	26. ⓐⓑⓒⓓ	27. ⓐⓑⓒⓓ
	28. ⓐⓑⓒⓓ	29. ⓐⓑⓒⓓ	30. ⓐⓑⓒⓓ	31. ⓐⓑⓒⓓ	32. ⓐⓑⓒⓓ

Space for Rough Work

33. Gaseous HCl is a poor conductor of electricity while its aqueous solution is a good conductor this is because
(a) H_2O is a good conductor of electricity
(b) a gas cannot conduct electricity but a liquid can
(c) HCl gas does not obey Ohm's law, whereas the solution does
(d) HCl ionises in aqueous solution

34. Density of nitrogen gas prepared from air is slightly greater than that of nitrogen prepared by chemical reaction from a compound of nitrogen due to the presence of
(a) argon
(b) carbon dioxide
(c) some N_3 molecules analogous to O_3
(d) greater amount of N_2 molecules derived from N-15 isotope

35. The correct order of acidic strength is
(a) $Cl_2O_7 > SO_2 > P_4O_{10}$
(b) $CO_2 > N_2O_5 > SO_3$
(c) $Na_2O > MgO > Al_2O_3$
(d) $K_2O > CaO > MgO$

36. Sulphur trioxide can be obtained by which of the following reaction :

(a) $CaSO_4 + C \xrightarrow{\Delta}$ (b) $Fe_2(SO_4)_3 \xrightarrow{\Delta}$

(c) $S + H_2SO_4 \xrightarrow{\Delta}$ (d) $H_2SO_4 + PCl_5 \xrightarrow{\Delta}$

37. The correct order of increasing bond angles in the following species are :

(a) $Cl_2O < ClO_2 < ClO_2^-$

(b) $ClO_2 < Cl_2O < ClO_2^-$

(c) $Cl_2O < ClO_2^- < ClO_2$

(d) $ClO_2^- < Cl_2O < ClO_2$

38. Which one of the following oxides of chlorine is obtained by passing dry chlorine over silver chlorate at 90°C ?
(a) Cl_2O (b) ClO_3 (c) ClO_2 (d) ClO_4

39. The shape of XeO_2F_2 molecule is
(a) trigonal bipyramidal (b) square planar
(c) tetrahedral (d) see-saw

40. Number of lone pairs of electrons on Xe atoms XeF_2, XeF_4 and XeF_6 molecules are respectively
(a) 3, 2 and 1 (b) 4, 3 and 2
(c) 2, 3 and 1 (d) 3, 2 and 0

41. Match the interhalogen compounds of column-I with the geometry in column II and assign the correct code.

Column-I		Column-II
A.	XX'	I. T-shape
B.	XX'_3	II. Pentagonal bipyramidal
C.	XX'_5	III. Linear
D.	XX'_7	IV. Square-pyramidal
		V. Tetrahedral

(a) A – III; B – I; C – IV; D – II
(b) A – V; B – IV; C – III; D – II
(c) A – IV; B – III; C – II; D – I
(d) A – III; B – IV; C – I; D – II

42. The crystals of ferrous sulphate on heating give :

(a) $FeO + SO_2 + H_2O$

(b) $FeO + SO_3 + H_2SO_4 + H_2O$

(c) $Fe_2O_3 + SO_2 + H_2SO_4 + H_2O$

(d) $Fe_2O_3 + H_2SO_4 + H_2O$

43. One mole of fluorine is reacted with two moles of hot and concentrated KOH. The products formed are KF, H_2O and O_2. The molar ratio of KF, H_2O and O_2 respectively is
(a) 1 : 1 : 2 (b) 2 : 1 : 0.5
(c) 1 : 2 : 1 (d) 2 : 1 : 2

44. A greenish yellow gas reacts with an alkali metal hydroxide to form a halate which can be used in fire works safety matches. The gas and halate respectively are
(a) $Br_2, KBrO_3$ (b) $Cl_2, KClO_3$
(c) $I_2, NaIO_3$ (d) $Cl_2, NaClO_3$

45. Yellow ammonium sulphide is
(a) $(NH_4)_2S_8$ (b) $(NH_4)_2S$
(c) $(NH_4)_2S_x$ (d) $(NH_4)_2S_4$

RESPONSE GRID					
	33. (a)(b)(c)(d)	34. (a)(b)(c)(d)	35. (a)(b)(c)(d)	36. (a)(b)(c)(d)	37. (a)(b)(c)(d)
	38. (a)(b)(c)(d)	39. (a)(b)(c)(d)	40. (a)(b)(c)(d)	41. (a)(b)(c)(d)	42. (a)(b)(c)(d)
	43. (a)(b)(c)(d)	44. (a)(b)(c)(d)	45. (a)(b)(c)(d)		

Space for Rough Work

1. **(c)** $[Fe(H_2O)_5NO]^{2+}$ ion is formed.

2. **(c)**

Compound	O.S. of N
N_2O	+1
NO	+2
NO_2	+4
NO_3^-	+5
NH_4^+	−3

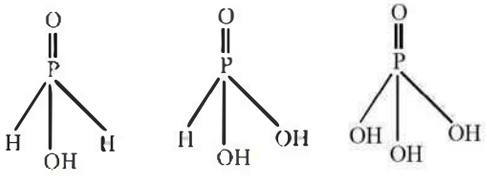
Therefore increasing order of oxidation state of N is:

$NH_4^+ < N_2O < NO < NO_2 < NO_3^-$.

3. **(d)** Among the hydrides of group 16 elements, boiling point of H_2O is higher than H_2S (difference in boiling points of H_2O and H_2S is around 200°C) because of strong intermolecular hydrogen bonding. After the decrease in boiling point from H_2O to H_2S, from H_2S to H_2Te, it increases due to increase in size of the atoms from S to Te which increases the magnitude of van der Waal's forces among the molecules. So, the correct order of boiling points is

$H_2O > H_2Te > H_2Se > H_2S$

4. **(d)** (i) The geometry of phosphorus is tetrahedral in all the three.



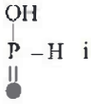
H_3PO_2 H_3PO_3 H_3PO_4

(ii) The acidity increases with increase in oxidation number of central atom

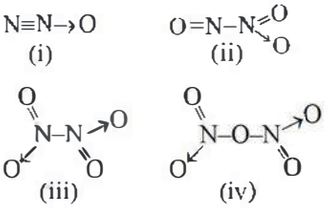
$\overset{+1}{H_3PO_2} < \overset{+3}{H_3PO_3} < \overset{+5}{H_3PO_4}$

(iii) H_3PO_4 is not reducing.

(iv) H_3PO_3 is diabasic, while H_3PO_2 is monobasic.

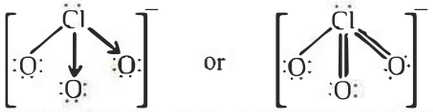
5. **(b)**  it can form two series of salts by replacement of H attached to oxygen

6. **(d)**



(i) (ii) (iii) (iv)

7. **(b)** Hybridisation is sp^3 and shape pyramidal

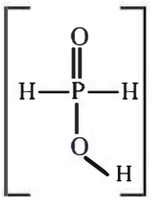


8. **(c)** Air is liquified by making use of the joule-Thomson effect (cooling by expansion of the gas). Water vapour and CO_2 are removed by solidification. The remaining constituents of liquid air i.e., liquid oxygen and liquid nitrogen are separated by means of fractional distillation (b.p. of $O_2 = -183°C$: b.P. of $N_2 = -195.8°C$).

9. **(b)** More the oxidation state of the central atom (metal) more is its acidity. Hence SeO_2 (O. S. of Se = +4) is acidic. Further for a given O.S., the basic character of the oxides increases with the increasing size of the central atom. Thus Al_2O_3 and Sb_2O_3 are amphoteric and Bi_2O_3 is basic.

10. **(d)**

11. **(a)** Hypophosphorous acid is H_3PO_2 in which O.S. of P is +1.

12. **(b)**  Hypophosphorous acid (H_3PO_2) is a monobasic acid. i.e., it has only one ionisable hydrogen atom or one OH is present.

13. **(d)** The products of the concerned reaction react each other forming back the reactants.

$XeF_6 + 3H_2O \longrightarrow XeO_3 + 6HF$.

14. **(a)** Due to large enthalpy of vaporisation SO_2 can be used as refrigerant.

15. **(d)**

$2Ag_2O(s) \rightarrow 4Ag(s) + O_2(g)$

$2Pb_3O_4(s) \rightarrow 6PbO(s) + O_2(g)$

$2PbO_2(s) \rightarrow 2PbO(s) + O_2(g)$

16. **(a)** Phosphorus occurs in minerals of the apatite family, $Ca_9(PO_4)_6$, CaX_2 (X = F, Cl or OH) which are main components of phosphate rocks whereas arsenic and antimony are found as sulphide minerals. The increase in covalent radii from N to P is greater in comparison to increase from As to Bi.

17. **(d)** (i) The first ionization energy of xenon (1, 170 kJ mol^{-1}) is quite close to that of dioxygen (1,180 kJ mol^{-1}).

(ii) The molecular diameters of xenon and dioxygen are almost identical.

Based on the above similarities Barlett (who prepared $O_2^+[PtF_6]^-$ compound) suggested that since oxygen combines with PtF_6, so xenon should also form similar compound with PtF_6.

18. **(a)** $2S_2O_3^{2-} + I_2 \rightarrow \underset{\text{Tetrathionate}}{S_4O_6^{2-}} + 2I^-$

19. **(a)** ICl_7. The hybridisation is $\frac{1}{2}(7+7+0-0) = 7\ (sp^3d^3)$

20. **(b)**

21. **(c)** From the given options we find option (i) is correct. The oxidising power of halogens follow the order $F_2 > Cl_2 > Br_2 > I_2$. Option (ii) is incorrect because it in not the correct order of electron gain enthalpy of halogens.
The correct order is $Cl_2 > F_2 > Br_2 > I_2$. The low value of F_2 than Cl_2 is due to its small size.
Option (iii) is incorrect. The correct order of bond dissociation energies of halogens is
$Cl_2 > Br_2 > F_2 > I_2$.
Option (iv) is correct. It is the correct order of electronegativity values of halogens. Thus option (ii) and (iii) are incorrect.

22. **(c)** Oxides which are more ionic in nature (salt - like) are known as saline oxides e.g. oxides of alkali metals.

23. **(b)** $XeOF_4$ square pyramidal.

24. **(b)** ClO_2 contains 7 + 12 i.e. 19 electrons (valence) which is an odd number, i.e. there is (are) free electron(s). Hence it is paramagnetic in nature.

25. **(c)** All the members form volatile halides of the type AX_3. All halides are pyramidal in shape. The bond angle decreases on moving down the group due to decrease in bond pair-bond pair repulsion.

NCl_3	PCl_3	$AsCl_3$	$SbCl_3$
107°	109.5°	98°	97.2°

26. **(d)** $\underset{+1}{HOCl} < \underset{+3}{HOClO} < \underset{+5}{HOClO_2} < \underset{+7}{HOClO_3}$
In case of oxyacids of similar element as the oxidation number of the central atom increases, strength of acid also increases.

27. **(a)** As size increases, van der Waal's forces of attraction between noble gas atoms also increases. Consequently, ease of their liquefaction increases.

28. **(b)** KI reacts with $CuSO_4$ solution to produce cuprous iodide (white precipitate) and I_2 (which gives brown colour). Iodine reacts with hypo ($Na_2S_2O_3.5H_2O$) solution. Decolourisaiton of solution shows the appearance of white precipitate.

$$2CuSO_4 + 4KI \rightarrow 2K_2SO_4 + \underset{\substack{\text{Cuprous iodide}\\\text{(White ppt.)}}}{2CuI} + \underset{\substack{\text{(Brown colour}\\\text{in solution)}}}{I_2}$$

$$2Na_2S_2O_3 + I_2 \longrightarrow \underset{\substack{\text{Sod. tetra}\\\text{thionate}\\\text{(colourless)}}}{Na_2S_4O_6} + 2NaI$$

29. **(b)** $RCOO^-$ is not pseudo halide.

30. **(d)**

31. **(a)** (Bonus)
$CaC_2 + N_2 \rightarrow Ca(CN)_2 + C$

32. **(d)** Electron gain enthalpy for noble gases is positive and it becomes less positive with increase in size of atom. Value of electron gain enthalpy
He– 48 kJmol^{-1}, Ne– 116 kJmol^{-1}
Ar, Kr – 96 kJ mol^{-1}, Xe – 77 kJ mol^{-1}
Hence, Ne has highest negative electron gain enthalpy.

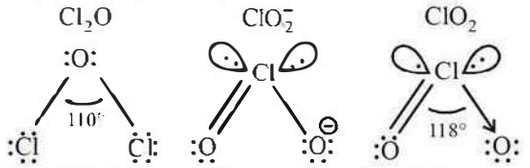
33. **(d)** In gaseous state the HCl is covalent in nature while in aqueous solution it ionises to give H^+ and Cl^- ions.

34. **(a)** Air contains about 1% inert gases, mainly Ar (At.wt = 40). The atomic wt. of N_2 is 28.

35. **(a)** Non-metallic oxides are acidic and acidic character decreases with decreasing non-metallic character.

36. **(b)** $Fe_2(SO_4)_3 \xrightarrow{\Delta} Fe_2O_3 + SO_3$

37. **(c)** The correct order of increasing bond angle is
$Cl_2O < ClO_2^- < ClO_2$

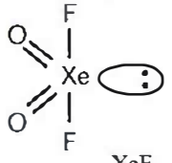


* In ClO_2^- there are 2 lone pairs of electrons present on the central chlorine atom. Therefore the bond angle in ClO_2^- is less than 118° which is the bond angle in ClO_2 which has less number of electrons on central chlorine atom.

38. **(c)** Pure ClO_2 is obtained bypassing dry Cl_2 over $AgClO_3$ at 90°C.

$$2AgClO_3 + Cl_2(dry) \xrightarrow{90°C} 2AgCl + 2ClO_2 + O_2$$

39. **(d)** XeO_2F_2 has trigonal bipyramidal geometry, but due to presence of lone pair of electrons on equitorial position, its actual shape is *see-saw*.



40. **(a)**

	XeF_2	XeF_4	XeF_6
Valence electrons of Xe	8	8	8
Electrons involved in bond formation	2	4	6
Lone pairs left	3	2	1

41. **(a)** $XX' \rightarrow$ Linear (e.g. ClF, BrF)
$XX_3' \rightarrow$ T-Shape (e.g. ClF_3, BrF_3)
$XX_5' \rightarrow$ Square pyramidal (e.g. BrF_5 IF_5)
$XX_7' \rightarrow$ Pentagonal bipyramidal (e.g. IF_7)

42. **(c)** $FeSO_4.7H_2O \rightarrow FeSO_4 + 7H_2O$

$$2FeSO_4 \xrightarrow{\Delta} Fe_2O_3 + SO_2 + SO_3$$

43. **(b)** $2F_2 + 4KOH \rightarrow 4KF + O_2 + 2H_2O$ for 1 mole of F_2 the molar ratio.

F_2	KOH	KF	O_2	H_2O
1	2	2	$\frac{1}{2}$	1

44. **(b)** $3Cl_2 + 6KOH \rightarrow KClO_3 + 5KCl + 3H_2O$
$KClO_3$ is used in fire works and safety matches and Cl_2 is greenish yellow gas.

45. **(c)** Yellow ammonium sulphide is $(NH_4)_2S_x$.