

NEET 2016 Phase 1 — Chemistry Question Paper with Solutions

41 Chemistry questions as set in the paper · answers checked by RankUp

NEET 2016 Phase 1 · Q46

1. Consider the molecules CH_4 , NH_3 and H_2O . Which of the given statements is false?

- (A) The H-C-H bond angle in CH_4 , the H-N-H bond angle in NH_3 , and the H-O-H bond angle in H_2O are all greater than 90° .
- (B) The H-O-H bond angle in H_2O is larger than the H-C-H bond angle in CH_4 .
- (C) The H-O-H bond angle in H_2O is smaller than the H-N-H bond angle in NH_3 .
- (D) The H-C-H bond angle in CH_4 is larger than the H-N-H bond angle in NH_3 .

NEET 2016 Phase 1 · Q47

2. In the reaction

$\text{H-C}\equiv\text{CH} \xrightarrow{(1) \text{NaNH}_2/\text{liq. NH}_3, (2) \text{CH}_3\text{CH}_2\text{Br}} \text{X} \xrightarrow{(1) \text{NaNH}_2/\text{liq. NH}_3, (2) \text{CH}_3\text{CH}_2\text{Br}} \text{Y}$

X and Y are:

- (A) X = 1-Butyne; Y = 3-Hexyne
- (B) X = 2-Butyne; Y = 3-Hexyne
- (C) X = 2-Butyne; Y = 2-Hexyne
- (D) X = 1-Butyne; Y = 2-Hexyne

NEET 2016 Phase 1 · Q48

3. Among the following, the correct order of acidity is:

- (A) $\text{HClO}_3 < \text{HClO}_4 < \text{HClO}_2 < \text{HClO}$
- (B) $\text{HClO} < \text{HClO}_2 < \text{HClO}_3 < \text{HClO}_4$
- (C) $\text{HClO}_2 < \text{HClO} < \text{HClO}_3 < \text{HClO}_4$
- (D) $\text{HClO}_4 < \text{HClO}_2 < \text{HClO} < \text{HClO}_3$

NEET 2016 Phase 1 · Q49

4. The rate of a first-order reaction is $0.04 \text{ mol l}^{-1} \text{ s}^{-1}$ at 10 seconds and $0.03 \text{ mol l}^{-1} \text{ s}^{-1}$ at 20 seconds after initiation of the reaction. The half-life period of the reaction is:

- (A) 24.1 s
- (B) 34.1 s
- (C) 44.1 s
- (D) 54.1 s

NEET 2016 Phase 1 · Q50

5. Which one of the following characteristics is associated with adsorption?

- (A) ΔG is negative but ΔH and ΔS are positive
- (B) ΔG , ΔH and ΔS all are negative
- (C) ΔG and ΔH are negative but ΔS is positive
- (D) ΔG and ΔS are negative but ΔH is positive

NEET 2016 Phase 1 · Q52

6. Which of the following statements is false?

- (A) Mg^{2+} ions form a complex with ATP.
- (B) Ca^{2+} ions are important in blood clotting.
- (C) Ca^{2+} ions are not important in maintaining the regular beating of the heart.
- (D) Mg^{2+} ions are important in the green parts of plants.

NEET 2016 Phase 1 · Q54

7. The correct statement regarding a carbonyl compound with a hydrogen atom on its alpha-carbon, is:

- (A) a carbonyl compound with a hydrogen atom on its alpha-carbon never equilibrates with its corresponding enol.
- (B) a carbonyl compound with a hydrogen atom on its alpha-carbon rapidly equilibrates with its corresponding enol and this process is known as aldehyde-ketone equilibration.
- (C) a carbonyl compound with a hydrogen atom on its alpha-carbon rapidly equilibrates with its corresponding enol and this process is known as carbonylation.
- (D) a carbonyl compound with a hydrogen atom on its alpha-carbon rapidly equilibrates with its corresponding enol and this process is known as keto-enol tautomerism.

NEET 2016 Phase 1 · Q55

8. MY and NY₃, two nearly insoluble salts, have the same K_{sp} values of 6.2×10^{-13} at room temperature. Which statement would be true in regard to MY and NY₃?

- (A) The molar solubilities of MY and NY₃ in water are identical.
- (B) The molar solubility of MY in water is less than that of NY₃.
- (C) The salts MY and NY₃ are more soluble in 0.5 M KY than in pure water.
- (D) The addition of the salt of KY to solution of MY and NY₃ will have no effect on their solubilities.

NEET 2016 Phase 1 · Q56

9. In a protein molecule various amino acids are linked together by:

- (A) α-glycosidic bond
- (B) β-glycosidic bond
- (C) peptide bond
- (D) dative bond

NEET 2016 Phase 1 · Q57

10. Natural rubber has:

- (A) All cis-configuration
- (B) All trans-configuration
- (C) Alternate cis- and trans-configuration
- (D) Random cis- and trans-configuration

NEET 2016 Phase 1 · Q58

**11. Match items of Column I with the items of Column II and assign the correct code:
Column I: (a) Cyanide process, (b) Froth floatation process, (c) Electrolytic reduction, (d) Zone refining**

Column II: (i) Ultrapure Ge, (ii) Dressing of ZnS, (iii) Extraction of Al, (iv) Extraction of Au, (v) Purification of Ni

- (A) Cyanide process – extraction of Au; froth floatation – dressing of ZnS; electrolytic reduction – extraction of Al; zone refining – ultrapure Ge
- (B) Cyanide process – dressing of ZnS; froth floatation – extraction of Al; electrolytic reduction – ultrapure Ge; zone refining – purification of Ni
- (C) Cyanide process – ultrapure Ge; froth floatation – dressing of ZnS; electrolytic reduction – extraction of Al; zone refining – extraction of Au
- (D) Cyanide process – extraction of Al; froth floatation – extraction of Au; electrolytic reduction – purification of Ni; zone refining – ultrapure Ge

NEET 2016 Phase 1 · Q59

12. Which one of the following statements is correct when SO₂ is passed through acidified K₂Cr₂O₇ solution?

- (A) The solution turns blue.
- (B) The solution is decolourized.
- (C) SO₂ is reduced.
- (D) Green Cr₂(SO₄)₃ is formed.

NEET 2016 Phase 1 · Q60

13. The electronic configurations of Eu (Atomic No. 63), Gd (Atomic No. 64) and Tb (Atomic No. 65) are:

- (A) $[\text{Xe}]4f^7 6s^2$, $[\text{Xe}]4f^8 6s^2$ and $[\text{Xe}]4f^8 5d^1 6s^2$
- (B) $[\text{Xe}]4f^6 5d^1 6s^2$, $[\text{Xe}]4f^7 5d^1 6s^2$ and $[\text{Xe}]4f^9 6s^2$
- (C) $[\text{Xe}]4f^6 5d^1 6s^2$, $[\text{Xe}]4f^7 5d^1 6s^2$ and $[\text{Xe}]4f^8 5d^1 6s^2$
- (D) $[\text{Xe}]4f^7 6s^2$, $[\text{Xe}]4f^7 5d^1 6s^2$ and $[\text{Xe}]4f^9 6s^2$

NEET 2016 Phase 1 · Q61

14. Two electrons occupying the same orbital are distinguished by:

- (A) Principal quantum number
- (B) Magnetic quantum number
- (C) Azimuthal quantum number
- (D) Spin quantum number

NEET 2016 Phase 1 · Q62

15. When copper is heated with conc. HNO_3 it produces:

- (A) $\text{Cu}(\text{NO}_3)_2$ and NO_2
- (B) $\text{Cu}(\text{NO}_3)_2$ and NO
- (C) $\text{Cu}(\text{NO}_3)_2$, NO and NO_2
- (D) $\text{Cu}(\text{NO}_3)_2$ and N_2O

NEET 2016 Phase 1 · Q63

16. Which of the following reagents would distinguish cis-cyclopenta-1,2-diol from the trans-isomer?

- (A) Acetone
- (B) Ozone
- (C) MnO_2
- (D) Aluminium isopropoxide

NEET 2016 Phase 1 · Q64

17. The correct thermodynamic conditions for the spontaneous reaction at all temperatures is:

- (A) $\Delta H < 0$ and $\Delta S = 0$
- (B) $\Delta H > 0$ and $\Delta S < 0$
- (C) $\Delta H < 0$ and $\Delta S > 0$
- (D) $\Delta H < 0$ and $\Delta S < 0$

NEET 2016 Phase 1 · Q65

18. Lithium has a bcc structure. Its density is 530 kg m^{-3} and its atomic mass is 6.94 g mol^{-1} . Calculate the edge length of a unit cell of Lithium metal. ($N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$)

- (A) 154 pm
- (B) 352 pm
- (C) 527 pm
- (D) 264 pm

NEET 2016 Phase 1 · Q66

19. Which one of the following orders is correct for the bond dissociation enthalpy of halogen molecules?

- (A) $\text{I}_2 > \text{Br}_2 > \text{Cl}_2 > \text{F}_2$
- (B) $\text{Cl}_2 > \text{Br}_2 > \text{F}_2 > \text{I}_2$
- (C) $\text{Br}_2 > \text{I}_2 > \text{F}_2 > \text{Cl}_2$
- (D) $\text{F}_2 > \text{Cl}_2 > \text{Br}_2 > \text{I}_2$

20. Which of the following is an analgesic?

- (A) Novalgin
- (B) Penicillin
- (C) Streptomycin
- (D) Chloromycetin

21. Equal moles of hydrogen and oxygen gases are placed in a container with a pin-hole through which both can escape. What fraction of the oxygen escapes in the time required for one-half of the hydrogen to escape?

- (A) 1/8
- (B) 1/4
- (C) 3/8
- (D) 1/2

22. Consider the nitration of benzene using mixed conc. H_2SO_4 and HNO_3 . If a large amount of KHSO_4 is added to the mixture, the rate of nitration will be:

- (A) faster
- (B) slower
- (C) unchanged
- (D) doubled

23. Predict the correct order among the following:

- (A) lone pair - lone pair > lone pair - bond pair > bond pair - bond pair
- (B) lone pair - lone pair > bond pair - bond pair > lone pair - bond pair
- (C) bond pair - bond pair > lone pair - bond pair > lone pair - lone pair
- (D) lone pair - bond pair > bond pair - bond pair > lone pair - lone pair

24. Consider the following liquid - vapour equilibrium.

Liquid $\rightleftharpoons$ Vapour

Which of the following relations is correct?

- (A) $d \ln G/dT^2 = \Delta H_v/RT^2$
- (B) $d \ln P/dT = -\Delta H_v/RT$
- (C) $d \ln P/dT^2 = -\Delta H_v/T^2$
- (D) $d \ln P/dT = \Delta H_v/RT^2$

25. Match the compounds given in column I with the hybridisation and shape given in column II and mark the correct option.

Column I: (a) XeF_6 , (b) XeO_3 , (c) XeOF_4 , (d) XeF_4

Column II: (i) distorted octahedral, (ii) square planar, (iii) pyramidal, (iv) square pyramidal

- (A) XeF_6 - distorted octahedral; XeO_3 - pyramidal; XeOF_4 - square pyramidal; XeF_4 - square planar
- (B) XeF_6 - distorted octahedral; XeO_3 - square planar; XeOF_4 - square pyramidal; XeF_4 - pyramidal
- (C) XeF_6 - square pyramidal; XeO_3 - pyramidal; XeOF_4 - distorted octahedral; XeF_4 - square planar
- (D) XeF_6 - square pyramidal; XeO_3 - distorted octahedral; XeOF_4 - square planar; XeF_4 - pyramidal

26. Which of the following has longest C-O bond length? (Free C-O bond length in CO is 1.128 Å.)

- (A) $\text{Ni}(\text{CO})_4$
- (B) $[\text{Co}(\text{CO})_4]^-$
- (C) $[\text{Fe}(\text{CO})_4]^{2-}$
- (D) $[\text{Mn}(\text{CO})_6]^+$

NEET 2016 Phase 1 · Q75

27. The pressure of H_2 required to make the potential of H_2 -electrode zero in pure water at 298 K is:

- (A) 10^{-14} atm
- (B) 10^{-12} atm
- (C) 10^{-10} atm
- (D) 10^{-4} atm

NEET 2016 Phase 1 · Q76

28. The addition of a catalyst during a chemical reaction alters which of the following quantities?

- (A) Entropy
- (B) Internal energy
- (C) Enthalpy
- (D) Activation energy

NEET 2016 Phase 1 · Q77

29. The ionic radii of A^+ and B^- ions are 0.98×10^{-10} m and 1.81×10^{-10} m. The coordination number of each ion in AB is:

- (A) 6
- (B) 4
- (C) 8
- (D) 2

NEET 2016 Phase 1 · Q78

30. Which is the correct statement for the given acids?

- (A) Phosphinic acid is a diprotic acid while phosphonic acid is a monoprotic acid.
- (B) Phosphinic acid is a monoprotic acid while phosphonic acid is a diprotic acid.
- (C) Both are triprotic acids.
- (D) Both are diprotic acids.

NEET 2016 Phase 1 · Q79

31. Fog is a colloidal solution of:

- (A) Liquid in gas
- (B) Gas in liquid
- (C) Solid in gas
- (D) Gas in gas

NEET 2016 Phase 1 · Q80

32. Which of the following statements about the composition of the vapour over an ideal 1 : 1 molar mixture of benzene and toluene is correct? Assume that the temperature is constant at 25°C. (Given, Vapour Pressure Data at 25°C, benzene = 12.8 kPa, toluene = 3.85 kPa)

- (A) The vapour will contain a higher percentage of benzene.
- (B) The vapour will contain a higher percentage of toluene.
- (C) The vapour will contain equal amounts of benzene and toluene.
- (D) Not enough information is given to make a prediction.

NEET 2016 Phase 1 · Q81

33. The correct statement regarding the comparison of staggered and eclipsed conformations of ethane, is:

- (A) The staggered conformation of ethane is less stable than eclipsed conformation, because staggered conformation has torsional strain.
- (B) The eclipsed conformation of ethane is more stable than staggered conformation, because eclipsed conformation has no torsional strain.
- (C) The eclipsed conformation of ethane is more stable than staggered conformation even though the eclipsed conformation has torsional strain.
- (D) The staggered conformation of ethane is more stable than eclipsed conformation, because staggered conformation has no torsional strain.

NEET 2016 Phase 1 · Q82

34. The reaction

**Cyclopentanol (C_5H_9-OH) $\xrightarrow{NaH}$ $C_5H_9-O^- Na^+$ $\xrightarrow{Me-I}$ C_5H_9-O-Me
can be classified as:**

- (A) Williamson ether synthesis reaction
- (B) Alcohol formation reaction
- (C) Dehydration reaction
- (D) Williamson alcohol synthesis reaction

NEET 2016 Phase 1 · Q83

35. The product formed by the reaction of an aldehyde with a primary amine is:

- (A) Schiff base
- (B) Ketone
- (C) Carboxylic acid
- (D) Aromatic acid

NEET 2016 Phase 1 · Q85

36. For the following reactions:

(a) $CH_3CH_2CH_2Br + KOH \rightarrow CH_3CH=CH_2 + KBr + H_2O$

(b) $(CH_3)_2CHBr + KOH \rightarrow (CH_3)_2CHOH + KBr$

(c) Cyclohexene + $Br_2 \rightarrow$ 1,2-dibromocyclohexane

Which of the following statements is correct?

- (A) (a) and (b) are elimination reactions and (c) is addition reaction.
- (B) (a) is elimination, (b) is substitution and (c) is addition reaction.
- (C) (a) is elimination, (b) and (c) are substitution reactions.
- (D) (a) is substitution, (b) and (c) are addition reactions.

NEET 2016 Phase 1 · Q86

37. At $100^\circ C$ the vapour pressure of a solution of 6.5 g of a solute in 100 g water is 732 mm. If $K_b = 0.52$, the boiling point of this solution will be:

- (A) $101^\circ C$
- (B) $100^\circ C$
- (C) $102^\circ C$
- (D) $103^\circ C$

NEET 2016 Phase 1 · Q87

38. The correct statement regarding RNA and DNA, respectively is:

- (A) The sugar component in RNA is arabinose and the sugar component in DNA is 2'-deoxyribose.
- (B) The sugar component in RNA is ribose and the sugar component in DNA is 2'-deoxyribose.
- (C) The sugar component in RNA is arabinose and the sugar component in DNA is ribose.
- (D) The sugar component in RNA is 2'-deoxyribose and the sugar component in DNA is arabinose.

NEET 2016 Phase 1 · Q88

39. The correct statement regarding the basicity of arylamines is:

- (A) Arylamines are generally less basic than alkylamines because the nitrogen lone-pair electrons are delocalized by interaction with the aromatic ring π electron system.
- (B) Arylamines are generally more basic than alkylamines because the nitrogen lone-pair electrons are not delocalized by interaction with the aromatic ring π electron system.
- (C) Arylamines are generally more basic than alkylamines because of aryl group.
- (D) Arylamines are generally more basic than alkylamines, because the nitrogen atom in arylamines is sp -hybridized.

NEET 2016 Phase 1 · Q89

40. Which one given below is a non-reducing sugar?

- (A) Maltose
- (B) Lactose
- (C) Glucose
- (D) Sucrose

41. The pair of electron in the given carbanion, $\text{CH}_3\text{C}\equiv\text{C}^-$, is present in which of the following orbitals?

- (A) 2p
- (B) sp^3
- (C) sp^2
- (D) sp

Answer key and explanations

1. Answer: (B) The H-O-H bond angle in H_2O is larger than the H-C-H bond angle in CH_4 .

All three are sp^3 hybridised, with bond angles CH_4 $109.5^\circ > \text{NH}_3$ $107^\circ > \text{H}_2\text{O}$ 104.5° , because lone pairs repel bonding pairs more strongly. So the claim that water's angle exceeds methane's is false; all three angles are still above 90° .

2. Answer: (A) X = 1-Butyne; Y = 3-Hexyne

NaNH_2 removes the acidic terminal H of ethyne, and the acetylide is ethylated: $\text{HC}\equiv\text{C}-\text{CH}_2\text{CH}_3$ (1-butyne). Repeating on the remaining terminal H puts a second ethyl group on the other carbon: $\text{CH}_3\text{CH}_2\text{C}\equiv\text{CCH}_2\text{CH}_3$, 3-hexyne. 2-Butyne cannot form because the new group always attaches to the former terminal carbon.

3. Answer: (B) $\text{HClO} < \text{HClO}_2 < \text{HClO}_3 < \text{HClO}_4$

Acidity of chlorine oxoacids rises with the oxidation state of Cl (+1, +3, +5, +7): more oxygen atoms delocalise the negative charge of the conjugate base and stabilise it. Hence $\text{HClO} < \text{HClO}_2 < \text{HClO}_3 < \text{HClO}_4$, with perchloric acid the strongest.

4. Answer: (A) 24.1 s

For first order, rate $\propto$ concentration, so $0.04/0.03 = e^{(k \times 10)}$ and $k = \ln(4/3)/10 = 0.2877/10 \approx 0.0288 \text{ s}^{-1}$. $t_{1/2} = 0.693/0.0288 \approx 24.1 \text{ s}$. Using the 20 s mark as the time interval instead of the 10 s gap gives a much smaller k and longer half-lives.

5. Answer: (B) ΔG , ΔH and ΔS all are negative

Adsorption is spontaneous ($\Delta G < 0$). Adsorbate molecules lose freedom when held on the surface, so $\Delta S < 0$, and the process can be spontaneous only if it is exothermic ($\Delta H < 0$). A positive ΔS is the common trap.

6. Answer: (C) Ca^{2+} ions are not important in maintaining the regular beating of the heart.

Ca^{2+} ions are essential for muscle contraction and for maintaining the regular beating of the heart, so the statement denying this is false. Mg^{2+} does bind ATP in phosphate-transfer enzymes, Ca^{2+} is needed for blood clotting, and Mg^{2+} is the central ion of chlorophyll in green parts.

7. Answer: (D) a carbonyl compound with a hydrogen atom on its alpha-carbon rapidly equilibrates with its corresponding enol and this process is known as keto-enol tautomerism.

An α -hydrogen can shift to the carbonyl oxygen, giving an enol that is in rapid equilibrium with the keto form; this proton-shift isomerism is keto-enol tautomerism. Carbonylation means introducing a CO group, which is a different reaction altogether.

8. Answer: (B) The molar solubility of MY in water is less than that of NY_3 .

For MY, $K_{\text{sp}} = s^2$ so $s = \sqrt{6.2 \times 10^{-13}} \approx 7.9 \times 10^{-7} \text{ M}$. For NY_3 , $K_{\text{sp}} = 27s^4$, so $s = (6.2 \times 10^{-13}/27)^{1/4} \approx 3.9 \times 10^{-4} \text{ M}$, which is larger. Equal K_{sp} does not mean equal solubility when the formulas differ, and adding KY lowers both solubilities by the common ion effect.

9. Answer: (C) peptide bond

Amino acids join through the $-\text{CO}-\text{NH}-$ amide linkage formed between the carboxyl group of one and the amino group of the next; this is the peptide bond. Glycosidic bonds link monosaccharides in carbohydrates, not amino acids.

10. Answer: (A) All cis-configuration

Natural rubber is cis-1,4-polyisoprene, in which every double bond has the cis configuration; this gives the coiled, elastic chains. The all-trans polymer is gutta-percha, which is hard and non-elastic.

11. Answer: (A) Cyanide process - extraction of Au; froth floatation - dressing of ZnS; electrolytic reduction - extraction of Al; zone refining - ultrapure Ge

Gold is leached with cyanide, sulphide ores such as ZnS are concentrated by froth floatation, aluminium is obtained by electrolytic reduction of alumina, and zone refining gives ultrapure semiconductors such as germanium. Nickel is purified by the Mond (carbonyl) process, not zone refining.

12. Answer: (D) Green $\text{Cr}_2(\text{SO}_4)_3$ is formed.

SO_2 acts as a reducing agent: it is oxidised to sulphate while orange dichromate (Cr^{+6}) is reduced to Cr^{3+} , giving green $\text{Cr}_2(\text{SO}_4)_3$. The solution turns green rather than colourless, and SO_2 is oxidised, not reduced.

13. Answer: (D) $[\text{Xe}]4f^76s^2$, $[\text{Xe}]4f^75d^16s^2$ and $[\text{Xe}]4f^96s^2$

Eu (63) has a half-filled $4f^7$ shell: $[\text{Xe}]4f^76s^2$. In Gd (64) the extra electron goes to 5d to keep the stable $4f^7$: $[\text{Xe}]4f^75d^16s^2$. Tb (65) has $[\text{Xe}]4f^96s^2$. Writing Gd as $4f^96s^2$ ignores the extra stability of the half-filled f subshell.

14. Answer: (D) Spin quantum number

Electrons in the same orbital share n, l and m; by the Pauli exclusion principle they must differ in spin quantum number ($+\frac{1}{2}$ and $-\frac{1}{2}$). The other three quantum numbers define the orbital itself and are therefore identical.

15. Answer: (A) $\text{Cu}(\text{NO}_3)_2$ and NO_2

$\text{Cu} + 4\text{HNO}_3(\text{conc.}) \rightarrow \text{Cu}(\text{NO}_3)_2 + 2\text{NO}_2 + 2\text{H}_2\text{O}$. Concentrated nitric acid is reduced only to NO_2 ; NO is the product with dilute nitric acid.

16. Answer: (A) Acetone

In the cis-1,2-diol both OH groups are on the same face of the ring, so acetone can bridge them to form a five-membered cyclic ketal (acetoneide); the trans-diol cannot reach both groups. Ozone acts on C=C bonds, which neither diol has.

17. Answer: (C) $\Delta H < 0$ and $\Delta S > 0$

$\Delta G = \Delta H - T\Delta S$. With $\Delta H < 0$ and $\Delta S > 0$, both terms make ΔG negative at every temperature. If $\Delta S < 0$, the $-T\Delta S$ term becomes positive and the reaction stops being spontaneous at high temperature.

18. Answer: (B) 352 pm

For bcc, $Z = 2$. $a^3 = ZM/(\rho N_A) = (2 \times 6.94 \times 10^{-3})/(530 \times 6.02 \times 10^{23}) \approx 4.35 \times 10^{-29} \text{ m}^3$, so $a \approx 3.52 \times 10^{-10} \text{ m} = 352 \text{ pm}$. Using $Z = 1$ gives about 279 pm, and forgetting to convert g to kg throws the answer off by a factor of 10.

19. Answer: (B) $\text{Cl}_2 > \text{Br}_2 > \text{F}_2 > \text{I}_2$

Bond enthalpy generally falls down the group ($\text{Cl}_2 > \text{Br}_2 > \text{I}_2$), but F_2 is anomalously weak because lone pairs on the two small fluorine atoms repel each other strongly. The actual order is Cl_2 (242) $>$ Br_2 (192) $>$ F_2 (158) $>$ I_2 (151 kJ/mol), so the simple $\text{F}_2 > \text{Cl}_2 > \text{Br}_2 > \text{I}_2$ trend is wrong.

20. Answer: (A) Novalgin

Novalgin is a non-narcotic analgesic used to relieve pain. Penicillin, streptomycin and chloromycetin are antibiotics that act against bacteria and do not relieve pain.

21. Answer: (A) 1/8

By Graham's law rate $\propto 1/\sqrt{M}$, so $r(\text{H}_2)/r(\text{O}_2) = \sqrt{(32/2)} = 4$. In the time half the hydrogen escapes, oxygen escapes one-quarter as much, i.e. $\frac{1}{2} \times \frac{1}{4} = 1/8$ of its amount. 1/4 is the rate ratio itself, not the fraction escaped.

22. Answer: (B) slower

The electrophile NO_2^+ forms when H_2SO_4 protonates HNO_3 : $\text{HNO}_3 + 2\text{H}_2\text{SO}_4 \rightleftharpoons \text{NO}_2^+ + \text{H}_3\text{O}^+ + 2\text{HSO}_4^-$. Adding a lot of HSO_4^- (from KHSO_4) suppresses the ionisation of H_2SO_4 by the common ion effect, so less NO_2^+ forms and nitration slows down.

23. Answer: (A) lone pair - lone pair $>$ lone pair - bond pair $>$ bond pair - bond pair

According to VSEPR theory, lone pairs are held only by one nucleus and spread out more, so they repel most strongly. The repulsion order is lone pair-lone pair $>$ lone pair-bond pair $>$ bond pair-bond pair, which is why lone pairs compress bond angles in NH_3 and H_2O .

24. Answer: (D) $d \ln P/dT = \Delta H_v/RT^2$

For liquid $\rightleftharpoons$ vapour, the vapour pressure P plays the role of the equilibrium constant, and the van't Hoff (Clausius-Clapeyron) equation gives $d \ln P/dT = \Delta H_v/RT^2$. The sign is positive because vapour pressure rises with temperature for an endothermic vaporisation, and the derivative is with respect to T, not T^2 .

25. Answer: (A) XeF₆ - distorted octahedral; XeO₃ - pyramidal; XeOF₄ - square pyramidal; XeF₄ - square planar

XeF₆ (sp³d³, 6 bond pairs + 1 lone pair) is distorted octahedral; XeO₃ (sp³, 3 bond pairs + 1 lone pair) is pyramidal; XeOF₄ (sp³d², 5 bond pairs + 1 lone pair) is square pyramidal; XeF₄ (sp³d², 4 bond pairs + 2 lone pairs) is square planar. A square planar XeO₃ is impossible because its lone pair makes it pyramidal.

26. Answer: (C) [Fe(CO)₄]²⁻

These carbonyls are isoelectronic, but the more negative the metal centre, the more electron density it back-donates into the π* orbitals of CO, weakening and lengthening the C–O bond. [Fe(CO)₄]²⁻ carries the highest negative charge, so it has the longest C–O bond, while the cationic [Mn(CO)₆]⁺ has the shortest.

27. Answer: (A) 10⁻¹⁴ atm

For 2H⁺ + 2e⁻ → H₂, E = 0 – (0.059/2) log(p_{H₂}/[H⁺]²). In pure water [H⁺] = 10⁻⁷ M, so E = 0 requires p_{H₂} = [H⁺]² = 10⁻¹⁴ atm. Using [H⁺] instead of [H⁺]² would give 10⁻⁷ atm, which is not even offered.

28. Answer: (D) Activation energy

A catalyst provides an alternative pathway with a lower activation energy, which speeds up the reaction. Entropy, internal energy and enthalpy are state functions that depend only on the initial and final states, so a catalyst cannot change them.

29. Answer: (A) 6

Radius ratio r⁺/r⁻ = 0.98/1.81 ≈ 0.54, which lies in the range 0.414–0.732 for octahedral holes, so each ion has coordination number 6 (NaCl type). A coordination number of 8 needs a ratio above 0.732.

30. Answer: (B) Phosphinic acid is a monoprotic acid while phosphonic acid is a diprotic acid.

Phosphinic (hypophosphorous) acid H₃PO₂ has one P–OH and two P–H bonds, so it is monoprotic; phosphonic (phosphorous) acid H₃PO₃ has two P–OH and one P–H, so it is diprotic. Hydrogens bonded directly to phosphorus are not ionisable, which is why neither is triprotic.

31. Answer: (A) Liquid in gas

Fog consists of tiny water droplets dispersed in air, so the dispersed phase is a liquid and the dispersion medium is a gas (an aerosol of liquid). Solid in gas describes smoke, and gas in liquid describes foam.

32. Answer: (A) The vapour will contain a higher percentage of benzene.

For the 1:1 mixture, partial pressures are 0.5 × 12.8 = 6.4 kPa (benzene) and 0.5 × 3.85 ≈ 1.93 kPa (toluene), so benzene's mole fraction in the vapour is 6.4/8.33 ≈ 0.77. The more volatile component is enriched in the vapour; equal liquid amounts do not give equal vapour amounts.

33. Answer: (D) The staggered conformation of ethane is more stable than eclipsed conformation, because staggered conformation has no torsional strain.

In the staggered form the C–H bonds on adjacent carbons are as far apart as possible, so there is minimum repulsion and no torsional strain, making it the more stable conformation. The eclipsed form has the bonds aligned, which creates torsional strain and makes it less stable.

34. Answer: (A) Williamson ether synthesis reaction

NaH converts cyclopentanol into its sodium alkoxide, which then displaces iodide from methyl iodide by an S_N2 reaction to give methoxycyclopentane, an ether. Forming an ether from an alkoxide and an alkyl halide is the Williamson ether synthesis; no alcohol is formed and no water is eliminated.

35. Answer: (A) Schiff base

A primary amine adds to the carbonyl group and then loses water to form an imine, R–CH=N–R', known as a Schiff base. The reaction is a condensation, not an oxidation, so no acid or ketone is formed.

36. Answer: (B) (a) is elimination, (b) is substitution and (c) is addition reaction.

In (a) HBr is removed to form an alkene (elimination); in (b) –OH replaces –Br on the same carbon (substitution); in (c) Br₂ adds across the C=C double bond (addition). Calling the second reaction an elimination is wrong because no double bond is formed.

37. Answer: (A) 101°C

Relative lowering: (760 – 732)/732 = n₂/n₁ (Raoult's law form), with n₁ = 100/18 = 5.56 mol, so n₂ ≈ 0.0383 × 5.56 ≈ 0.213 mol. Molality = 0.213/0.1 ≈ 2.13 m and ΔT_b = 0.52 × 2.13 ≈ 1.1 K, so the boiling point is about 101°C. 100°C would ignore the elevation altogether.

38. Answer: (B) The sugar component in RNA is ribose and the sugar component in DNA is 2'-deoxyribose.

RNA contains β -D-ribose, while DNA contains β -D-2-deoxyribose, which lacks the oxygen at C-2'. Arabinose is not a nucleic acid sugar.

39. Answer: (A) Arylamines are generally less basic than alkylamines because the nitrogen lone-pair electrons are delocalized by interaction with the aromatic ring π electron system.

In aniline the nitrogen lone pair is delocalised into the benzene ring by resonance, so it is less available to accept a proton; arylamines are therefore weaker bases than alkylamines, whose alkyl groups push electron density onto nitrogen. The nitrogen in arylamines is not sp-hybridised.

40. Answer: (D) Sucrose

In sucrose the glycosidic link joins C1 of glucose to C2 of fructose, so both anomeric carbons are tied up and there is no free hemiacetal group to reduce Tollens' or Fehling's reagent. Maltose and lactose keep one free anomeric carbon, and glucose is a free aldose, so all three are reducing sugars.

41. Answer: (D) sp

The negatively charged carbon is triple-bonded, so it is sp hybridised; its lone pair occupies the remaining sp orbital, pointing away from the triple bond. The two unhybridised 2p orbitals are used for the π bonds, so the lone pair is not in a p orbital.

Questions as set in the AIPMT/NEET papers conducted by CBSE and NTA. Answers checked and explanations written by the RankUp team. RankUp is not affiliated with CBSE or NTA.