DPP - Daily Practice Problems

Name : _____ Date : _____

Start Time : _____ End Time : _____

CHEMISTRY 29

SYLLABUS : Solid State-1 : Properties and Types of Solid, Crystallography and Lattice, Crystal Packing.

Max. Marks : 120 **Time : 60 min.**

GENERAL INSTRUCTIONS

- The Daily Practice Problem Sheet contains 30 MCQ's. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.
- You have to evaluate your Response Grids yourself with the help of solution booklet.
- Each correct answer will get you 4 marks and 1 mark shall be deduced for each incorrect answer. No mark will be given/ deducted if no bubble is filled. Keep a timer in front of you and stop immediately at the end of 60 min.
- The sheet follows a particular syllabus. Do not attempt the sheet before you have completed your preparation for that syllabus. Refer syllabus sheet in the starting of the book for the syllabus of all the DPP sheets.
- After completing the sheet check your answers with the solution booklet and complete the Result Grid. Finally spend time to analyse your performance and revise the areas which emerge out as weak in your evaluation.

DIRECTIONS (Q.1-Q.21) : There are 21 multiple choice questions. Each question has 4 choices (a), (b), (c) and (d), out of which ONLY ONE choice is correct.

Q.1 The three states of matter are solid, liquid and gas. Which of the following statement is/are true about them?
(a) Solids and liquids have viscosity as a common property
(b) The molecules in solid state do not have translational motion.
(c) Gases cannot be converted into solids without passing through the liquid phase
(d) Solids and liquids have vapour pressure as a common property

Q.2 The existence of a substance in more than one solid modification is known as
(a) polymorphism (b) isomorphism
(c) allotropy (d) enantiomorphism

Q.3 Dulong and Petit's law is valid only for
(a) metals
(b) non-metals
(c) gaseous elements
(d) solid elements

Q.4 Davy and Faraday prove that
(a) diamond is a form of carbon
(b) the bond lengths of carbon containing compounds are always equal
(c) the strength of graphite is minimum compared to platinum
(d) graphite is very hard

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

Space for Rough Work

Q.5 Which one of the following metal oxides is antiferromagnetic in nature?

(a) MnO_2 (b) TiO_2

(c) VO_2 (d) CrO_2

Q.6 Which of following is an example of ionic crystalline solid?

(a) Diamond (b) LiF

(c) Li (d) Silicon

Q.7 Which of the following statements about amorphous solids is incorrect?

(a) They melt over a range of temperature

(b) They are isotropic

(c) There is no orderly arrangement of particles

(d) They are rigid and incompressible

Q.8 Which solid will have the weakest intermolecular forces?

(a) Ice (b) Phosphorus

(c) Naphthalene (d) Sodium fluoride

Q.9 Tetragonal crystal system has the following unit cell dimensions

(a) $a = b = c$ and $\alpha = \beta \neq \gamma \neq 90^\circ$

(b) $a = b \neq c$ and $\alpha = \beta \neq \gamma \neq 90^\circ$

(c) $a \neq b \neq c$ and $\alpha = \beta \neq \gamma \neq 90^\circ$

(d) $a = b \neq c$ and $\alpha = \beta = 90^\circ, \gamma = 120^\circ$

Q.10 The three dimensional graph of lattice points which sets the pattern for the whole lattice is called

(a) Space lattice (b) Simple lattice

(c) Unit cell (d) Crystal lattice

Q.11 Crystal can be classified into ..... basic crystal lattices.

(a) 3 (b) 7

(c) 14 (d) 4

Q.12 The structure of TlCl is similar to CsCl. What would be the radius ratio in TlCl?

(a) 0.155 – 0.225 (b) 0.225 – 0.414

(c) 0.414 – 0.732 (d) 0.732 – 1.000

Q.13 Structure similar to zinc blende is found in

(a) AgCl (b) NaCl

(c) CuCl (d) TlCl

Q.14 The crystal system of a compound with unit cell dimensions $a = 0.387$, $b = 0.387$ and $c = 0.504$ nun and $\alpha = \beta = 90^\bullet$ and $\gamma = 120^\circ$ is

(a) cubic (b) hexagonal

(c) orthorhombic (d) rhombohedral

Q.15 If 'Z' is the number of atoms in the unit cell that represents the closest packing sequence ..... A B C A B C ....., the number of tetrahedral voids in the unit cell is equal to

(a) Z (b) 2 Z

(c) Z/2 (d) Z/4

Q.16 The arrangement ABCABCABC ..... is referred as

(a) octahedral close peking

(b) hexagonal close packing

(c) tetragonal packing

(d) cubic close packing

Q.17 An AB_2 type structure is found in

(a) NaCl (b) Al_2O_3

(c) CaF_2 (d) N_2O

Q.18 A solid is made of two elements X and Z. The atoms Z are in CCP arrangement while the atom X occupy all the tetrahedral sites. What is the formula of the compound?

(a) XZ (b) XZ_2

(c) X_2Z (d) X_2Z_3

Q.19 In the closest packed structrure of a metallic lattice, the number of nearest neighbours of a metallic atom is

(a) Twelve (b) Four

(c) Eight (d) Six

RESPONSE GRID					
	5. ⓐⓑⓒⓓ	6. ⓐⓑⓒⓓ	7. ⓐⓑⓒⓓ	8. ⓐⓑⓒⓓ	9. ⓐⓑⓒⓓ
	10. ⓐⓑⓒⓓ	11. ⓐⓑⓒⓓ	12. ⓐⓑⓒⓓ	13. ⓐⓑⓒⓓ	14. ⓐⓑⓒⓓ
	15. ⓐⓑⓒⓓ	16. ⓐⓑⓒⓓ	17. ⓐⓑⓒⓓ	18. ⓐⓑⓒⓓ	19. ⓐⓑⓒⓓ

Space for Rough Work

Q.20 In the rock salt structure, the number of formula units per unit cell is equal to

(a) 1 (b) 2 (c) 3 (d) 4

Q.21 Hexagonal close packing is found in which of the following crystal lattice ?

(a) Na (b) Mg

(c) Al (d) None of these

DIRECTIONS (Q.22-Q.24) : In the following questions, more than one of the answers given are correct. Select the correct answers and mark it according to the following codes:

Codes :

(a) 1, 2 and 3 are correct **(b)** 1 and 2 are correct

(c) 2 and 4 are correct **(d)** 1 and 3 are correct

Q.22 Which of the following are incorrect?

	Crystal system	Axial distance	Axial angles	Example
(1)	Cubic	$a \neq b = c$	$\alpha = \beta \neq \gamma = 90°$	Cu,KCl
(2)	Monoclinic	$a \neq b = c$	$\alpha = \beta = \gamma = 90°$	$PbCrO_2$, $PbCrO_4$
(3)	Triclinic	$a = b = c$	$\alpha \neq \beta = \gamma \neq 90°$	$K_2Cr_2O_7$, $CuSO_4,5H_2O$
(4)	Rhombohedral	$a = b = c$	$\alpha = \beta = \gamma \neq 90°$	$CaCO_3$, HgS

Q.23 Which of the following are the properties of solids?

(1) Solids have high density and low compressibility

(2) The diffusion of solids is very slow

(3) Solids have definite volume

(4) Solids are always crystalline in nature

Q.24 Which of the following statements are correct for ionic crystals?

(1) They possess low melting point and boiling point

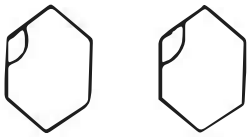
(2) All are electrolytes

(3) Exhibit directional properties of the bond

(4) Exhibit the property of isomorphism

DIRECTIONS (Q.25-Q.27) : Read the passage given below and answer the questions that follows :

It has been found that the angles between corresponding faces on various crystals of the same substance are constant. However, the shapes of crystals may differ because of the fact that the crystal faces are unequally developed. Here we have represented two crystals *A* and *B* in two dimensions which have different shapes but the angles between corresponding faces of them are same.



'A' *'B'*

The shape or the external form of a crystal depends upon the rate of deposition of atoms or ions on the different faces. During crystallization of sodium chloride, the crystals obtained by crystallization from aqueous solution are cubic while those obtained by crystallization from urea solution are octahedral.

Q.25 The angle of intersection between the corresponding faces in crystals "*A*" and "*B*" above will be

(a) same

(b) constant

(c) equal

(d) all these are correct

Q.26 The crystals of NaCl are found to be cubic when crystallisation is done from an aqueous solution of sodium chloride but have an octahedral shape if crystallized from urea solution. In view of the above observations, what about the law of constancy of interfacial angle is true?

(a) The law is still valid

(b) The law is not always valid

(c) It is an exception to the law

(d) None of these is correct

Q.27 For the cubic structure if edge lengths are equal (i.e. $a = b = c$) and internal angles are all 90° (i.e. $\alpha = \beta = \gamma = 90°$). What is the number of **Bravais** unit cells that fall into this **category** ?

(a) 1 (b) 2 (c) 3 (d) 4

RESPONSE GRID					
	20. ⓐⓑⓒⓓ	**21.** ⓐⓑⓒⓓ	**22.** ⓐⓑⓒⓓ	**23.** ⓐⓑⓒⓓ	**24.** ⓐⓑⓒⓓ
	25. ⓐⓑⓒⓓ	**26.** ⓐⓑⓒⓓ	**27.** ⓐⓑⓒⓓ		

Space for Rough Work

DIRECTIONS (Q. 28-Q.30) : Each of these questions contains two statements: Statement-1 (Assertion) and Statement-2 (Reason). Each of these questions has four alternative choices, only one of which is the correct answer. You have to select the correct choice.

(a) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.

(b) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.

(c) Statement -1 is False, Statement-2 is True.

(d) Statement -1 is True, Statement-2 is False.

Q.28 Statement -1 : In crystal lattice, the size of the cation is larger in a tetrahedral hole than in an octahedral hole.
Statement -2 : The cations occupy less space than anions in crystal packing.

Q.29 Statement -1 : Crystalline solids have short range order.
Statement-2 : Amorphous solids have no regular arrangement.

Q.30 Statement -1 : In any ionic solid (MX) with Schottky defects the number of positive and negative ions are same.
Statement -2 : Equal number of cation and anion vacancies are present.

RESPONSE GRID	28.ⓐⓑⓒⓓ	29.ⓐⓑⓒⓓ	30.ⓐⓑⓒⓓ

DAILY PRACTICE PROBLEM SHEET 29 - CHEMISTRY			
Total Questions	30	Total Marks	120
Attempted		Correct	
Incorrect		Net Score	
Cut-off Score	32	Qualifying Score	52
Success Gap = Net Score – Qualifying Score			
Net Score = (Correct × 4) – (Incorrect × 1)			

Space for Rough Work

DAILY PRACTICE PROBLEMS

CHEMISTRY SOLUTIONS

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(1) (b) Gases and liquids possess fluidity and hence they have viscosity as a common property. Molecules in the solid state do not have translational motion. Thus, statement (b) is the only true statement.

(2) (a) The existence of a substance in more than one crystalline form is known as polymorphism.

(3) (d) Dulong and Petit's law is valid for all solids except Be, C and Si.

(4) (a)

(5) (a)

(6) (b) LiF is an example of ionic crystal solid, in which constituent particles are positive (Li^+) and negative (F^-) ions.

(7) (d) They are comparatively soft and not very rigid.

(8) (a) Ice has the lowest melting point out of the given solids, hence it has the weakest intermolecular forces.

(9) (b) Tetragonal system has the unit cell dimension

$a = b \neq c$ and $\alpha = \beta \neq \gamma \neq 90°$

(10) (c) It is the definition of unit cell.

(11) (b)

(12) (d) Radius ratio in TlCl is 0.732 – 1.000 and co-ordination number is 8 and arrangement is body centred cubic.

(13) (c) Zinc blende (ZnS) has fcc structure.

(14) (b)

(15) (b) Number of tetrahedral voids in the unit cell

$= 2 \times$ number of atoms $= 2Z$.

(16) (d) It represents ccp arrangement.

(17) (c) AB_2 type of structure is present in CaF_2

$$\therefore \quad n = 8 \times \frac{1}{8} + \left(6 \times \frac{1}{2}\right) = 4.$$

(18) (c) Tetrahedral sites are double comparable to octahedral sites then ratio of X and Z respectively is 2 : 1. Thus the formula of the compound X_2Z.

(19) (a) Co-ordination number in HCP and CCP arrangements is 12 while in bcc arrangement it is 8.

(20) (d) In NaCl (rock salt) : Number of Na^+ ions = 12 (at edge centers) $\times \frac{1}{4}$ + 1 (at body centre) $\times$ 1 = 4. Number of Cl^- ions = 8 (at corners) $\times \frac{1}{8}$ + 6 (at face centre) $\times \frac{1}{2}$ = 4 . Thus 4 formula units per unit cell.

(21) (b) Co-ordination number in HCP = 12

Co-ordination number in Mg is also = 12

(22) (a) Rhombohedral crystal system

$a = b = c$, $\alpha = \beta = \gamma \neq 90°$

ex – Na_2CO_3, $CaSO_4$, $CaCO_3$, HgS

Thus (1), (2) and (3) are incorrect.

(23) (a) As solids are also non-crystalline in nature, thus statement (1), (2) and (3) are the correct statements.

(24) (c) Ionic crystals possess high melting and boiling points and they also exhibit non-directional properties of the bond.

(25) (d) The angle of intersection between corresponding faces in crystals "*A*" and "*B*" will be same. Thus it will be constant and it will be equal as both "*A*" and "*B*" represent crystal structure of the same substance.

(26) (a) The law is still valid because the external form depends upon rate of deposition of atoms or ions on different faces.

(27) (c) There are three types of unit cells that fall in this category (i.e. cubic).

(28) (c) Tetrahedral holes are smaller in size than octahedral holes. Cations usually occupy less space than anions. Thus, statement-2 is correct and statement-1 is incorrect.

(29) (c) Crystalline solids have regular arrangement of constituent particles and are anisotropic whereas amorphous solids have no regular arrangement and are isotropic. Thus statement-2 is correct and statement-1 is incorrect.

(30) (a) Schottky defect is due to missing of equal number of cations and anions.