

BINDURA UNIVERSITY OF SCIENCE EDUCATION  
SCIENCE AND MATHEMATICS EDUCATION DEPARTMENT

DC002/ DCH004: INORGANIC CHEMISTRY

Time:

2Hours

ANSWER QUESTION 1 AND FOUR (4) OTHER QUESTIONS TWO (2) FROM EACH OF THE SECTIONS "A" AND "B". EACH QUESTION CARRIES 20 MARKS

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1. (a) Define
- (i) Electron shielding.
  - (ii) Electropositivity.
  - (iii) Effective nuclear charge
  - (iv) Ionic radius. [4 × 2 marks]
- (b) State and explain how:
- (i) Reducing power of group I metals varies down the group. [4 marks]
  - (ii) Oxidising power of group VII elements varies down the Group. [4 marks]
- (c) Give the properties that make d-block elements good construction materials. [4 marks]

SECTION A: ANSWER TWO QUESTIONS FROM THIS SECTION

2. Group II metals behave differently in their reactions with H<sub>2</sub>O and in air.
- (a) Describe the reactions of group II elements with water giving balanced reactions for all the reactions that take place. [10 marks]
  - (b) Outline the reactions of the elements with air. [10 marks]
3. (a) Discuss the trends of Group 6 hydrides under the following sub-headings:
- (i) Reducing character. [3 marks]
  - (ii) Thermal stability. [3 marks]
- (b) Oxygen can be prepared from heating some metallic oxides. Illustrate this with an equation. [2 marks]
- (c) Outline the manufacture of Sulphuric acid in the Contact process. [12 marks]

4. (a) Part of the periodic table is shown below.

			B		N	O	F	Ne
Na						S	Cl	
K	Ca	Cu						
Cs				Pb				Rn

From the elements shown in the table, identify one which:

- (i) Has the lowest first ionisation energy.
  - (ii) Has the highest first ionisation energy.
  - (iii) Has a hydride that forms the strongest hydrogen bonds.
  - (iv) Has a nitrate of formula  $X(\text{NO}_3)_2$  that gives a brown gas when heated.
  - (v) Has a trifluoride with molecules of trigonal shape. [5 marks]
- (b) The six elements in the third period from sodium to sulphur show a change in properties based on structure and bonding. State and explain the change in:
- (i) metallic character. [3 marks]
  - (ii) melting point. [3 marks]
  - (iii) electrical conductivity. [3 marks]
- (c) Choose one metallic and one non-metallic element from these six and for each chosen element describe what you would observe when:
- (i) The element reacts with oxygen. [2 marks]
  - (ii) The oxide reacts with water containing universal indicator. [4 marks]

**SECTION B: ANSWER ANY TWO QUESTIONS FROM THIS SECTION**

6. (a) Outline the differences between:
- (i) Elemental silicon and carbon. [8 marks]
  - (i) Oxides of silicon and carbon [10 marks]
- (b) Describe the variation in group 4 elements' catenation ability. [2 marks]
5. Hydrogen can be classified as Group 1, 4 and 7. Outline the chemistry of hydrogen that makes it typical and unlike Group 1, 4 and 7 elements. [20 marks]

7. (a) Explain the following:
- (i) Transition metals are used as catalysts. [3 marks]
  - (ii) Transition metal ions form colored compounds in solution. [3 marks]
  - (iv) Transition metals are better electrical conductors than s block metals. [3 marks]
  - (v) Melting points of transition metals are higher than the melting points the s block metals. [3 marks]
- (b) Copy and complete the following table.

d-block element	Catalyst formula	Reaction catalyzed
V		
Fe		
Ni		
Pt		

[8 marks]

END OF PAPER

## PERIODIC TABLE OF ELEMENTS

Alkali metals																		Noble gases	
1A																		↓	
Alkaline earth metals																		8A	
1	2																	18	2
H	He																	4.003	
1.008																			
3	4																	10	
Li	Be																	20.18	
6.941	9.012																		
11	12	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		
Na	Mg											Al	Si	P	S	Cl	Ar		
22.99	24.31											26.98	28.09	30.97	32.07	35.45	39.95		
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36		
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr		
39.10	40.08	44.96	47.88	50.94	52.00	54.94	55.85	58.93	58.69	63.55	65.38	69.72	72.59	74.92	78.96	79.90	83.80		
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54		
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe		
85.47	87.62	88.91	91.22	92.91	95.94	(98)	101.1	102.9	106.4	107.9	112.4	114.8	118.7	121.8	127.6	126.9	131.3		
55	56	57	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86		
Cs	Ba	La*	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn		
132.9	137.3	138.9	178.5	180.9	183.9	186.2	190.2	192.2	195.1	197.0	200.6	204.4	207.2	209.0	(209)	(210)	(222)		
87	88	89	104	105	106	107	108	109	110	111	112								
Fr	Ra	Ac**	Rf	Db	Sg	Bh	Hs	Mt	Uun	Uuu	Uub								
(223)	226	(227)																	

metals

nonmetals

\* Lanthanides

\*\* Actinides

58	59	60	61	62	63	64	65	66	67	68	69	70	71
Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
140.1	140.9	144.2	(145)	150.4	152.0	157.3	158.9	162.5	164.9	167.3	168.9	173.0	175.0
90	91	92	93	94	95	96	97	98	99	100	101	102	103
Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr
232.0	(231)	238.0	(237)	(244)	(243)	(247)	(247)	(251)	(252)	(257)	(258)	(259)	(260)