WEIRD CHEMIST

d-Block Elements

Alloys, Catalysis, Oxide Nature – SOLUTIONS

DPP – 05

Topic: Properties of TM **Questions:** 43 Questions **Exam:** NEET / JEE

Quick Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	2	10	2	19	2	28	2	37	1
2	1	11	4	20	4	29	1	38	3
3	4	12	1	21	1	30	1	39	2
4	4	13	4	22	1	31	4	40	1*
5	1	14	2†	23	2	32	2*	41	2
6	2	15	3	24	4	33	1	42	4
7	1	16	3	25	1	34	3	43	2
8	3	17	1	26	2	35	4		
9	2	18	1	27	4	36	3*		

**Q.36 repeats Q.27, Q.40 repeats Q.33 – identical stem/options, solved once and cross-referenced. Q.32 repeats Q.28's fact under "most acidic" phrasing.*

† Q.14: your source's Column-II is missing its own "e" entry (every option references "1–e") – see full note at the question.

▶ TYPE 1 : Alloy Formation

[F] Master Formulae

Hume–Rothery rules for good substitutional alloys (metals mixing smoothly into one lattice): atomic radii within about **15%** of each other, **similar** valence electron count, **similar** atomic volume, and the **same** crystal lattice structure – *similar*, not different, on every count. **Key compositions to lock in:** Brass = Cu+Zn; Bronze = Cu+Sn; Gun metal = Cu+Sn+Zn; German silver = Cu+Zn+Ni (no actual silver!); Nichrome = Ni+Cr; Cupronickel = Cu+Ni; Amalgam = Hg + another metal.

Q1. Which of the following metals is common in gun metal, monel metal and brass alloy?

(1) Zn (2) Cu (3) Ag (4) Fe

[E] Explanation

Gun metal = Cu+Sn+Zn. Monel metal = mostly Ni, with Cu (and traces of Fe/Mn). Brass = Cu+Zn. Cu is the only element present in *all three*; Zn is in two of them but absent from Monel.

[Ans] Answer

Option (2) Cu.

Q2. Gun metal contains

(1) Cu, Sn, Zn (2) Cu, Ni (3) Cu, Ni, Fe (4) Cu, Sn, P

[Ans] Answer

Option (1) Cu, Sn, Zn.

Q3. Which one alloy does not contain copper?

(1) Bronze (2) Brass (3) German silver (4) Mischmetal

[E] Explanation

Bronze, Brass, and German silver are all Cu-based (Cu+Sn, Cu+Zn, Cu+Zn+Ni respectively). Mischmetal is a mix of rare-earth metals (mostly Ce, La) with some Fe – no copper at all.

[Ans] Answer

Option (4) Mischmetal.

Q4. Which among the following alloy does not contain copper?

(1) Brass (2) Bronze (3) German Silver (4) Invar

[E] Explanation

Same idea as Q.3 with a different copper-free alloy as the answer: Invar is Fe(64%)+Ni(36%) – the special low-thermal-expansion alloy, no copper.

[Ans] Answer

Option (4) Invar.

Q5. Alloys are formed by atoms with metallic radii that are within about–(percent of each other)

(1) 15 (2) 50 (3) 30 (4) 75

[Ans] Answer

Option (1) 15.

Q6. Match the column

Column-I	Column-II
A. Nichrome	i. Cu + Al
B. Rolled gold	ii. Cu + Sn + Zn
C. Gun metal	iii. Cu + Sn
D. Bronze	iv. Ni + Fe + Cr

(1) A–iii; B–i; C–ii; D–iv

(2) A–iv; B–i; C–ii; D–iii

(3) A–iii; B–ii; C–i; D–iv

(4) A–iv; B–iii; C–ii; D–i

[E] Explanation

Nichrome = Ni+Cr (the table's "iv" also throws in Fe, common in commercial nichrome) → iv. Rolled gold = a thin gold layer bonded onto a Cu+Al base alloy → i. Gun metal = Cu+Sn+Zn → ii. Bronze = Cu+Sn → iii. So: A–iv, B–i, C–ii, D–iii.

[Ans] Answer

Option (2) A–iv; B–i; C–ii; D–iii.

Q7. Which of the following rules to prepare alloys should be obeyed?

(1) Difference in atomic radii should be less than 15%.

(2) Valence electron configuration should not be equal.

(3) Atomic volume should not be the same.

(4) Crystal lattice structure should be different.

[E] Explanation

Options (2), (3), (4) all describe the *opposite* of the real Hume-Rothery rules – good alloying wants *similar* valence configuration, *similar* atomic volume, and the *same* crystal structure, not different ones. Only (1) states a genuine rule.

[!] Common Mistake

This question is really testing whether you can spot that (2)–(4) have each been quietly flipped from "similar" to "different" – read every word of a rule statement, not just its general shape.

[Ans] Answer

Option (1)

Q8. What is the difference in atomic radii of two metallic elements to prepare alloys?

(1) 20% (2) More than 15% (3) Less than 15% (4) 24.5%

[Ans] Answer

Option (3) Less than 15%.

Q9. Mn, Co, Cu metals are generally useful to prepare alloys because

(1) The difference in their atomic volume is more than 15%.
(2) The difference in their atomic volume is less than 2%.
(3) The difference in their atomic volume is 15%.
(4) The difference in their atomic volume is 2%.

[E] Explanation

These three sit unusually close together in atomic size – well inside the general 15% Hume-Rothery ceiling, in fact under 2%, which is exactly why they alloy with each other (and with their neighbours) so readily.

[Ans] Answer

Option (2)

Q10. Which alloy is used in preparation of coins?

(1) Brass (2) Bronze (3) German-Silver (4) Nichrome

[E] Explanation

Bronze (Cu+Sn) is the classic coinage/medal/statue alloy in standard reference tables – Brass leans toward utensils and cartridge cases, German silver toward cutlery/ornaments, Nichrome specifically toward heating elements.

[Ans] Answer

Option (2) Bronze.

Q11. Which of the following alloys is used to fill dental cavities?

(1) Sodium amalgam (2) Zinc chloride (3) Mercury (4) Mercury Amalgam

[E] Explanation

Dental filling material is specifically **mercury amalgam** (Hg alloyed with Ag/Sn/Cu) – not pure mercury alone, and not sodium amalgam (a reducing agent used in organic chemistry, unrelated to dentistry).

[Ans] Answer

Option (4) Mercury Amalgam.

Q12. Match column-A and column-B properly.

Column-A	Column-B
1. Brass	a. Ni(60%) Cr(40%)
2. Bronze	b. Cu(80%) Sn(20%)
3. Cupronickel	c. Cu(90%) Sn(10%)
4. Nichrom	d. Cu(70%) Zn(30%)
	e. Cu(75–85%) Ni(25–15%)

(1) 1–d; 2–c; 3–e; 4–a

(2) 1–d; 2–c; 3–e; 4–b

(3) 1–d; 2–e; 3–a; 4–b

(4) 1–e; 2–c; 3–a; 4–d

[E] Explanation

Brass = Cu+Zn → d (Cu70/Zn30). Bronze's standard reference composition is the higher-copper Cu90/Sn10 → c. Cupronickel = Cu+Ni in the Cu75–85%/Ni25–15% range → e. Nichrome = Ni+Cr → a (Ni60/Cr40). So: 1–d, 2–c, 3–e, 4–a.

[Ans] Answer

Option (1) 1–d; 2–c; 3–e; 4–a.

Q13. Where is amalgam alloy used?

(1) In electric heater

(2) In space research

(3) To make surgical appliances

(4) In filling tooth cavity

[Ans] Answer

Option (4) In filling tooth cavity.

Q14. Match Column-A and Column-B properly.

Column-A	Column-B
1. Stainless steel	a. In riveting
2. Bronze	b. In antique pieces
3. Nitinol	c. To make coins
4. German silver	d. To make surgical appliances

(1) 1–e; 2–d; 3–b; 4–c

(2) 1–e; 2–c; 3–b; 4–d

(3) 1–e; 2–c; 3–a; 4–b

(4) 1–e; 2–c; 3–a; 4–d

[E] Explanation

Flagging a source issue: every option maps Stainless steel (1) to ”e” – but Column-B as printed only goes up to ”d”; whatever ”e” actually says (most likely something like ”cutlery/kitchenware,” steel's most iconic use) is missing from your source. I can't verify that part directly, but it doesn't affect the graded choice among (1)–(4), since they all agree on it.

For the rest: Bronze → coins (c) is consistent with Q.10 and appears in three of the four options, so I'm treating that as solid. Nitinol (a nickel-titanium shape-memory alloy) is overwhelmingly associated with surgical/medical devices in real use, and German silver has a genuine historical citation as a surgical-instrument material predating modern stainless steel – between the remaining options, (2) is the one that keeps Bronze–coins while placing German silver at surgical appliances (d), which is the combination I can best justify chemically. ”Riveting” doesn't correspond cleanly to any of these decorative/specialty alloys, which makes me suspect it may be a transcription artifact from your source.

[!] Common Mistake

This whole question rests on an incompletely transcribed table – worth pulling up your original source PDF for this one specifically to confirm both the missing ”e” entry and the ”riveting” label before using it with students.

[Ans] Answer

Option (2) 1–e; 2–c; 3–b; 4–d *(lower confidence – see note above).*

Q15. German silver is alloy of

(1) Fe, Cr, Ni (2) Ag, Cu, Au (3) Cu, Zn, Ni (4) Cu, Zn, Sn

[E] Explanation

Despite the name, German silver contains no actual silver – it's Cu+Zn+Ni, valued for its silvery appearance.

[Ans] Answer

Option (3) Cu, Zn, Ni.

Q16. Which pair of elements can form an alloy?

(1) Zn and Pb (2) Fe and Hg (3) Fe and C (4) C and Pt

[E] Explanation

Zn and Pb are essentially immiscible in the solid state – a classic example of metals that *don't* alloy despite both being ordinary metals. Fe famously does *not* amalgamate with Hg (which is exactly why mercury is safely stored/transported in steel flasks). Fe and C, however, form the most important interstitial alloy of all: steel, with small carbon atoms occupying interstitial sites in the iron lattice.

[Ans] Answer

Option (3) Fe and C.

Q17. Percentage of gold in 14 carat gold is:

(1) 58 (2) 80 (3) 40 (4) 14

[E] Explanation

Pure gold = 24 carat. $\frac{14}{24} \times 100 \approx 58.3\%$.

[Ans] Answer

Option (1) 58.

Q18. Which alloy contains Cu, Sn and Zn:

(1) Gun metal (2) Solder (3) Type metal (4) German silver

[E] Explanation

Gun metal = Cu+Sn+Zn (Q.1/Q.2). Solder = Sn+Pb; Type metal = Pb+Sn+Sb; German silver = Cu+Zn+Ni (no Sn).

[Ans] Answer

Option (1) Gun metal.

▶ TYPE 2 : Catalytic Properties

[F] Master Formulae

Transition metals catalyse reactions because of two combined abilities: (a) **variable oxidation states**, letting the metal cycle between states and offer a lower-energy alternative reaction pathway, and (b) **complexing ability**, letting reactants bind at the metal centre so they're held together in the right orientation to react. **Name-to-process anchors:** V_2O_5 – $SO_2 \rightarrow SO_3$ (contact process); Fe – Haber's process ($N_2+H_2 \rightarrow NH_3$); Ni – vegetable oil hydrogenation; Pt – $NH_3 \rightarrow NO$ (Ostwald process); $TiCl_4+Al(CH_3)_3$ – Ziegler-Natta polymerisation of ethylene; $PdCl_2$ – oxidation of ethyne to ethanal.

Q19. Match the catalyst with the process [NEET-2019 (Odisha)]

Catalyst	Process
(i) V_2O_5	(a) The oxidation of ethyne to ethanal
(ii) $TiCl_4$ + $Al(CH_3)_3$	(b) Polymerisation of alkynes
(iii) $PdCl_2$	(c) Oxidation of SO_2 in the manufacture of H_2SO_4
(iv) Nickel complexes	(d) Polymerisation of ethylene

Which of the following is the correct option?

(1) (i)-(c), (ii)-(a), (iii)-(d), (iv)-(b)

(2) (i)-(c), (ii)-(d), (iii)-(a), (iv)-(b)

(3) (i)-(a), (ii)-(b), (iii)-(c), (iv)-(d)

(4) (i)-(a), (ii)-(c), (iii)-(b), (iv)-(d)

[E] Explanation

Straight from the Master Formula anchors: V_2O_5 $\rightarrow$(c); the Ziegler-Natta pair $TiCl_4$+$Al(CH_3)_3$ $\rightarrow$(d), specifically for ethylene; $PdCl_2$ $\rightarrow$(a), the NCERT-cited ethyne-to-ethanal oxidation; Nickel complexes $\rightarrow$(b), polymerisation/oligomerisation of alkynes.

[Ans] Answer

Option (2) (i)-(c), (ii)-(d), (iii)-(a), (iv)-(b).

Q20. The catalytic activity of the transition metal and their compound is due to their

(1) Chemical reactivity

(2) Magnetic behaviour

(3) Filled d-orbitals

(4) Ability to adopt multiple oxidation state and their complexing ability

[Ans] Answer

Option (4)

Q21. Match the column

Metal	Use
A. Misch metal	i. Production of bullets
B. Ni	ii. Vegetable oil to vegetable ghee
C. Fe	iii. Haber's process
D. Pt	iv. Catalytic oxidation of NH_3

(1) A–i; B–ii; C–iii; D–iv

(2) A–ii; B–i; C–iii; D–iv

(3) A–i; B–ii; C–iv; D–iii

(4) A–ii; B–i; C–iv; D–iii

[E] Explanation

Misch metal (Ce/La-rich rare-earth alloy) $\rightarrow$ pyrophoric bullets/tracer ammunition and lighter flints (i). Ni $\rightarrow$ vegetable oil hydrogenation to ghee (ii, classic industrial use). Fe $\rightarrow$ Haber's process catalyst (iii). Pt $\rightarrow$ catalytic oxidation of NH_3 in the Ostwald process (iv).

[Ans] Answer

Option (1) A–i; B–ii; C–iii; D–iv.

Q22. Assertion: Transition metals are good catalyst.
Reason: V_2O_5 is used in the preparation of H_2SO_4 by contact process.

(1) Both Assertion and Reason are true, Reason gives correct explanation

(2) Both Assertion and Reason are true, it doesn't give correct explanation

(3) Assertion is correct but Reason is false

(4) Both Assertion and Reason are false

[E] Explanation

Both true, and the Reason is a genuine, correctly-cited real-world example directly supporting the Assertion.

[Ans] Answer

Option (1)

Q23. Which catalyst is used to prepare SO_3 from SO_2 in the contact process for production of H_2SO_4?

(1) NO (2) V_2O_5 (3) Fe (4) Ni

[Ans] Answer

Option (2) V_2O_5.

Q24. Which of the following statements is correct.

(1) Transition metals and their many compounds act as good catalyst

(2) The enthalpies of atomisation of the transition metals are high

(3) The transition metals generally form interstitial compounds with small atoms like C, B, H etc.

(4) All of these

[E] Explanation

All three are independently established, standard facts about transition metals – catalysis (this TYPE), high atomisation enthalpy (DPP-02), and interstitial compound formation with small atoms like C, B, H, N (classic examples: steel, TiC, borides, metal hydrides).

[Ans] Answer

Option (4) All of these.

Q25. Assertion: Transition metals are good catalysts.
Reason: V_2O_5 or Pt is used in the preparation of H_2SO_4 by contact process.

(1) If both Assertion & Reason are True & the Reason is a correct explanation of the Assertion.

(2) If both Assertion & Reason are True but Reason is not a correct explanation of the Assertion.

(3) If Assertion is True but the Reason is False.

(4) If both Assertion & Reason are False.

[E] Explanation

Both true: Pt was historically the original contact-process catalyst before being largely superseded industrially by the cheaper, more poison-resistant V_2O_5 – so citing "V_2O_5 or Pt" is accurate and directly supports the Assertion.

[Ans] Answer

Option (1)

▶ TYPE 3 : Nature of Oxide

[F] Master Formulae

Two axes control everything in this TYPE:

- **Rising oxidation state** $\Rightarrow$ **rising acidity** for the SAME metal: low state (basic) $\rightarrow$ mid state (amphoteric) $\rightarrow$ high state (acidic). Cr: CrO(+2, basic) $\rightarrow$ Cr_2O_3(+3, amphoteric) $\rightarrow$ CrO_3(+6, acidic). Mn: MnO(+2, basic) $\rightarrow$ Mn_2O_3(+3) $\rightarrow$ MnO_2(+4, amphoteric) $\rightarrow$ Mn_2O_7(+7, strongly acidic, a covalent green oil).
- **Moving right across a period at the SAME (+2) oxidation state, basicity falls**: TiO $>$ VO $>$ CrO $>$ FeO.
- **Sc is the one 3d metal with no MO oxide at all** (its only state is +3, so no ScO exists).

Q26. Which of the following pairs of oxides are of basic nature?

(1) MnO, Cr_2O_3

(2) MnO, CrO

(3) CrO, Mn_2O_7

(4) CrO_3, Mn_2O_7

[E] Explanation

Both members of the pair need to be genuinely, purely basic. MnO(+2) and CrO(+2) both qualify. Cr_2O_3 is amphoteric (not purely basic), and Mn_2O_7/CrO_3 are both strongly acidic – ruling out the other three options.

[Ans] Answer

Option (2) MnO, CrO.

Q27. The basic character of the transition metal monoxides follows the order (Atomic nos. Ti $= 22$, V $= 23$, Cr $= 24$, Fe $= 26$)

(1) VO $>$ CrO $>$ TiO $>$ FeO

(2) CrO $>$ VO $>$ FeO $>$ TiO

(3) TiO $>$ FeO $>$ VO $>$ CrO

(4) TiO $>$ VO $>$ CrO $>$ FeO

[E] Explanation

Direct statement of the "same oxidation state, across a period" rule – basicity falls smoothly as Z rises: Ti→V→Cr→Fe.

[Ans] Answer

Option (4) TiO $>$ VO $>$ CrO $>$ FeO.

Q28. Which oxide of manganese is acidic in nature?

(1) MnO (2) Mn_2O_7 (3) Mn_2O_3 (4) MnO_2

[E] Explanation

Mn_2O_7 (+7) is unambiguously the acidic one – MnO is basic, Mn_2O_3 leans basic, and MnO_2 is generally classed as amphoteric rather than simply "acidic."

[Ans] Answer

Option (2) Mn_2O_7.

Q29. Which of the following statement is correct for $3d$-transition elements?

(1) All the metals except Sc form 'MO' oxide

(2) All the metals except Zn form 'MO' oxide

(3) All the metals except Zn and Sc form 'MO' oxide

(4) All the metals except Mn form 'MO' oxide

[E] Explanation

Every 3d metal from Ti through Zn has a genuine $+2$ oxide (TiO, VO, CrO, MnO, FeO, CoO, NiO, CuO, ZnO all exist – ZnO is extremely common, since $+2$ is Zn's *only* state). Sc is the sole exception: its only accessible oxidation state is $+3$, so ScO simply doesn't exist.

[!] Common Mistake

Zn is a tempting "exception" to reach for since it's the other odd-one-out element in this chapter – but Zn's fixed oxidation state *is* $+2$, so ZnO exists just fine. Sc is the one that's actually excluded here.

[Ans] Answer

Option (1) All the metals except Sc form 'MO' oxide.

Q30. Which of the following oxides is ionic?

(1) MnO (2) Mn_2O_7 (3) CrO_3 (4) P_2O_5

[E] Explanation

Ionic character tracks with *low* oxidation state / low charge on the metal (less polarisation of the shared electron density). MnO $(+2)$ is a simple rock-salt-structured ionic solid. Mn_2O_7 and CrO_3 are both highly covalent (Mn_2O_7 is even a molecular liquid), and P_2O_5 is a nonmetal oxide – always covalent.

[Ans] Answer

Option (1) MnO.

Q31. Which statement is true:

Statement (ii) as transcribed from the source gives VO_4^+ as the acid-medium product; the standard textbook species is the dioxovanadium(V) cation VO_2^+. Kept as written in your notes – worth double-checking against your source.

(i) CrO is basic and Cr_2O_3 is amphoteric.
(ii) V_2O_5 reacts with alkalies as well as acids to give VO_4^{3-} & VO_4^+ respectively.
(iii) V_2O_4 dissolved in acid to give VO^{2+} salts

(1) i and ii (2) ii and iii (3) only iii (4) all are true

[E] Explanation

(i) is correct (matches the Master Formula: CrO basic, Cr_2O_3 amphoteric). (ii) is conceptually correct – V_2O_5 genuinely is amphoteric, reacting with base to give vanadate (VO_4^{3-}) and with acid to give the dioxovanadium(V) cation (correctly VO_2^+, not the "VO_4^+" as transcribed – see the flagged note above). (iii) is correct – V_2O_4 (V's $+4$ oxide) dissolving in acid to give the blue vanadyl(IV) ion VO^{2+} is a standard, well-documented fact. Treating (ii) at the level of the concept it's testing (V_2O_5's amphoteric behaviour) rather than the likely typo, all three statements hold.

[Ans] Answer

Option (4) All are true.

Q32. Which oxide of manganese is most acidic in nature?

(1) MnO (2) Mn_2O_7 (3) Mn_2O_3 (4) MnO_2

[E] Explanation

Same underlying fact as Q.28, just phrased with "most" – Mn_2O_7 remains the clear answer either way.

[Ans] Answer

Option (2) Mn_2O_7 – see Q.28.

Q33. Which of the following is an amphoteric oxide? Mn_2O_7, CrO_3, Cr_2O_3, CrO, V_2O_5, V_2O_4

(1) V_2O_5, Cr_2O_3 (2) Mn_2O_7, CrO_3 (3) CrO, V_2O_5 (4) V_2O_5, V_2O_4

[E] Explanation

Cr_2O_3 (+3) is the textbook amphoteric Cr oxide, and V_2O_5 is genuinely amphoteric too (Q.31 – reacts with both acid and base). Mn_2O_7/CrO_3 are acidic; CrO is basic; V_2O_4's established behaviour (Q.31) is specifically with acid, not confirmed amphoteric.

[Ans] Answer

Option (1) V_2O_5, Cr_2O_3.

Q34. Which one of the following is an amphoteric oxide?

(i) Mn_2O_7
(ii) CrO
(iii) MnO_2
(iv) Cr_2O_3

(1) i and ii (2) ii, iii and iv (3) iii and iv (4) i and iv

[E] Explanation

Mn_2O_7 is acidic and CrO is basic – neither is amphoteric. MnO_2 (+4) and Cr_2O_3 (+3) are both genuinely amphoteric.

[Ans] Answer

Option (3) iii and iv.

Q35. Arrange the following in increasing order of acidic character: Mn_2O_7(A), Mn_2O_3(B), MnO(C)

(1) C, A, B (2) A, C, B (3) B, A, C (4) C, B, A

[E] Explanation

Acidity rises with oxidation state: MnO(+2, least acidic) $<$ Mn_2O_3(+3) $<$ Mn_2O_7(+7, most acidic). Increasing order: C, B, A.

[Ans] Answer

Option (4) C, B, A.

Q36. The basic character of the transition metal monoxides follows the order:–

(1) $CrO > VO > FeO > TiO$

(2) $TiO > FeO > VO > CrO$

(3) $TiO > VO > CrO > FeO$

(4) $VO > CrO > TiO > FeO$

[E] Explanation

This is Q.27 again – same four candidate orderings, options reshuffled. Correct order remains $TiO > VO > CrO > FeO$, now listed as option (3).

[Ans] Answer

Option (3) $TiO > VO > CrO > FeO$ – see Q.27.

Q37. Which of the following is an acidic oxide?

(1) Mn_2O_7 (2) Mn_3O_4 (3) MnO (4) Mn_2O_3

[E] Explanation

Mn_3O_4 is a mixed-valence oxide (effectively $MnO{\cdot}Mn_2O_3$) and leans basic/mixed, not acidic. Mn_2O_7 remains the clean acidic choice.

[Ans] Answer

Option (1) Mn_2O_7.

Q38. Which is not amphoteric?

(1) Al^{3+} (2) Cr^{3+} (3) Fe^{2+} (4) Zn^{2+}

[E] Explanation

$Al(OH)_3$, $Cr(OH)_3$, and $Zn(OH)_2$ are all classic amphoteric hydroxides (dissolve in both acid and excess base). $Fe(OH)_2$, by contrast, is simply basic – it does not dissolve in excess NaOH the way the other three do.

[Ans] Answer

Option (3) Fe^{2+}.

Q39. Which of the following oxides of chromium is amphoteric in nature:–

(1) CrO (2) Cr_2O_3 (3) CrO_3 (4) CrO_5

[Ans] Answer

Option (2) Cr_2O_3.

Q40. Which of the following is an amphoteric oxide? Mn_2O_7, CrO_3, Cr_2O_3, CrO, V_2O_5, V_2O_4:–

(1) V_2O_5, Cr_2O_3 (2) Mn_2O_7, CrO_3 (3) CrO, V_2O_5 (4) V_2O_5, V_2O_4

This question is an exact repeat of Q.33 in this paper – identical stem and options.

[Ans] Answer

Option (1) V_2O_5, Cr_2O_3 – see Q.33.

Q41. Which of the following have maximum and minimum ionic character out of MnO, MnF_2, MnO_2, Mn_2O_7?

(1) MnO, Mn_2O_7 respectively
(2) MnF_2, Mn_2O_7 respectively
(3) MnO_2, MnO respectively
(4) Mn_2O_7, MnO respectively

[E] Explanation

Mn_2O_7 (+7) is unambiguously the least ionic – it's a covalent, molecular liquid (ruling out option 4 immediately, which has it backwards). Comparing MnO and MnF_2 (both Mn^{2+}, same metal charge): fluoride, being monovalent and less polarisable, typically gives *more* ionic character than oxide (divalent O^{2-}) at a matched cation charge – so MnF_2 edges out MnO for maximum ionic character.

[Ans] Answer

Option (2) MnF_2 (maximum), Mn_2O_7 (minimum).

Q42. Among the oxides Mn_2O_7(I), V_2O_3(II), V_2O_5(III), CrO(IV) and Cr_2O_3(V) the basic oxides are.

(1) I and II (2) II and III (3) III and IV (4) II and IV

[E] Explanation

Mn_2O_7(I) is acidic; V_2O_5(III) is amphoteric (Q.31); Cr_2O_3(V) is amphoteric. That leaves V_2O_3(II, a low/+3 oxidation state early-metal oxide – basic, consistent with the periodic trend of decreasing basicity left-to-right) and CrO(IV, +2, established basic) as the genuinely basic pair.

[Ans] Answer

Option (4) II and IV.

Q43. Match the column

	Column-I	Column-II
(A)	Metal of the $3d$-series which does not form MO type oxide.	(p) Manganese
(B)	Metal of the $3d$-series which forms most covalent oxide	(q) Vanadium
(C)	Metal of the $3d$-series which forms the amphoteric oxide.	(r) Scandium

(1) A – p; B – r; C – q
(2) A – r; B – p; C – q
(3) A – r; B – q; C – p
(4) A – q; B – q; C – r

[E] Explanation

(A) No MO oxide $\rightarrow$ Scandium (only $+3$ state, Q.29) $\rightarrow$ r. (B) Most covalent oxide $\rightarrow$ Manganese (Mn_2O_7, the covalent green oil, the most extreme/covalent oxide in the whole 3d row) $\rightarrow$ p. (C) Amphoteric oxide $\rightarrow$ since Chromium isn't offered as an option here, this points to Vanadium (V_2O_5, established amphoteric in Q.31/Q.33) $\rightarrow$ q. So: A–r, B–p, C–q.

[!] Common Mistake

Don't reach for Chromium here just because Cr_2O_3 is the more famous amphoteric example – it simply isn't one of the three answer choices (p, q, r) offered for this particular question, so the intended answer has to be Vanadium instead.

[Ans] Answer

Option (2) A–r; B–p; C–q.

Alloys are about matching sizes, catalysis is about flexible oxidation states,
and oxide character is just a mirror of how much charge is sitting on the metal.

– Your Weird Chemist