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ASSOCIATION OF CHEMISTRY TEACHERS
National Standard Examination in Chemistry – 2025
Date of Examination: November 23, 2025
Time: 11:30 AM to 1:30 PM
Question Paper Code: 34

Student's Roll No:											

Write the Question Paper Code (mentioned above) on YOUR OMR Answer Sheet (in the space provided), otherwise your Answer Sheet will NOT be evaluated. Note that the same Question Paper Code appears on each page of the Question Paper.

Instructions to Candidates:

1. Use of mobile phone, smart watch, and iPad during examination is STRICTLY PROHIBITED.
2. In addition to this Question Paper, you are given OMR Answer Sheet along with candidate's copy.
3. On the OMR sheet, make all the entries carefully in the space provided **ONLY** in **BLOCK CAPITALS** as well as by properly darkening the appropriate bubbles.
   Incomplete/ incorrect/ carelessly filled information may disqualify your candidature.
4. On the OMR Answer Sheet, use only **BLUE** or **BLACK BALL POINT PEN** for making entries and filling the bubbles.
5. Your **Eleven-digit roll number and date of birth** entered on the OMR Answer Sheet shall remain your login credentials means login id and password respectively for accessing your performance / result in National Standard Examination in Chemistry – 2025.
   Question paper has two parts. In part A-1 (Q. No.1 to 48) each question has four alternatives, out of which **only one** is correct. Choose the correct alternative and fill the appropriate bubble, as shown.

Q.No.12 (a) ● (c) (d)

   In part A-2 (Q. No. 49 to 60) each question has four alternatives out of which any number of alternative(s) (1, 2, 3, or 4) may be correct. You have to choose **all** correct alternative(s) and fill the appropriate bubble(s), as shown

Q.No.52 (a) ● (c) ●

7. Attempt all sixty questions. For **Part A-1,** each correct answer carries 3 marks whereas 1 mark will be deducted for each wrong answer. In **Part A-2,** you get 6 marks if all the correct alternatives are marked and no incorrect. No negative marks in this part.
8. Rough work may be done in the space provided. There are **16** printed pages in this question paper
9. Use of **Non-programmable scientific** calculator is allowed.
10. No candidate should leave the examination hall before the completion of the examination.
11. After submitting Answer Paper, take away the Question Paper & Candidate's copy of OMR sheet for your future reference.

Please DO NOT make any mark other than filling the appropriate bubbles properly in the space provided on the OMR Answer Sheet.

OMR Answer Sheets are evaluated using machine, hence CHANGE OF ENTRY IS NOT ALLOWED. Scratching or overwriting may result in a wrong score.

DO NOT WRITE ON THE BACK OF THE OMR ANSWER SHEET.

Instructions to Candidates (Continued) :
You may read the following instructions after submitting the Answer Sheet.

12. **Comments/Inquiries/Grievances regarding this Question Paper, if any, can be shared on the Inquiry/Grievance column on www.iapt.org.in on the specified format till Dec 1, 2025.**

13. **The answers/solutions to this Question Paper will be available on the website: www.iapt.org.in by Nov 29, 2025.** The score card may be downloaded after Dec 24, 2025

14. **CERTIFICATES and AWARDS:**
Following certificates are awarded by IAPT/ACT to students, successful in the National Standard Examination in Chemistry – 2025

   (i)   "CENTRE TOP 10 %"   To be downloaded from iapt.org.in after 30.01.26
   (ii) "STATE TOP 1 %"   Will be dispatched to the examinee
   (iii) "NATIONAL TOP 1 %" Will be dispatched to the examinee
   (iv) "GOLD MEDAL & MERIT CERTIFICATE" to all students who attend OCSC – 2026 at HBCSE Mumbai

   Certificate for centre toppers shall be uploaded on iapt.org.in

15. List of students (with centre number and roll number only) having a score equal and above **Minimum Admissible Score (MAS)** will be displayed on the website: **www.iapt.org.in** by **Dec 25, 2025. See the MAS clause** on the student's brochure on the web.

16. List of students eligible to appear for Indian National Chemistry Olympiad (INChO – 2026) shall be displayed on **www.iapt.org.in** by Dec 30, 2025.

Useful constants

Charge of electron, $e = 1.602 \times 10^{-19} C$

Mass of electron, $m_e = 9.1 \times 10^{-31} kg$

Planck's constant, $h = 6.63 \times 10^{-34} Js$

Speed of light, $c = 3.0 \times 10^8 ms^{-1}$

Avogadro constant, $N_A = 6.022 \times 10^{23} mol^{-1}$

Faraday constant $F = 96500\, C\, mol^{-1}$

Molar gas constant, $R = 0.082\, L\, atm\, mol^{-1}\, K^{-1}$

$= 8.314\, J\, mol^{-1}\, K^{-1}$

ASSOCIATION OF CHEMISTRY TEACHERS
NATIONAL STANDARD EXAMINATION IN CHEMISTRY
(NSEC - 2025)

Time: 120 minute

Max. Marks: 216

Attempt All Sixty Questions

A – 1
ONLY ONE OUT OF FOUR OPTIONS IS CORRECT. BUBBLE THE CORRECT OPTION.

1. The spin-only magnetic moment for $[Ni(H_2O)_6](ClO_4)_2$ should be
   - (a) 3.87
   - (b) 2.83
   - (c) 1.72
   - (d) 5.92

2. The correct order of Δ_o for the following given transition metal complexes is
   - (a) $Rh(CN)_6^{3-} > Rh(NH_3)_6^{3+} > RhCl_6^{3-}$
   - (b) $Rh(NH_3)_6^{3+} > RhCl_6^{3-} > Rh(CN)_6^{3-}$
   - (c) $RhCl_6^{3-} > Rh(CN)_6^{3-} > Rh(NH_3)_6^{3+}$
   - (d) $Rh(CN)_6^{3-} > RhCl_6^{3-} > Rh(NH_3)_6^{3+}$

3. The correct rank of bond order for O_2^+, O_2^-, CO and O_2^{2-} is
   - (a) 3, 1.5, 3, 1
   - (b) 2, 5, 1, 1
   - (c) 1.5, 2.5, 3, 2
   - (d) 2.5, 1.5, 3, 1

4. The correct basicity order in water for the following is
   - (a) $NMe_3 > NH_3 > NH_2NH_2 > NF_3$
   - (b) $NH_2OH > NH_3 > NF_3 > NMe_3$
   - (c) $NH_3 < NF_3 < NMe_3 < NH_2NH_2$
   - (d) $NMe_3 < NH_2OH < NH_3 < NF_3$

5. A 1.25 g Shelcal 500 tablet contains 1250 mg of $CaCO_3$. A student dissolved one tablet in water to make 1.0 L solution(X). 10.0 mL of solution(X) was titrated with 0.0198 M EDTA-MgEDTA mixture in the burette and found the $CaCO_3$ content matched the label claim. (Molar mass of $CaCO_3$ = 100.0 g/mol). The correct option is

   - (a) The burette reading is 6.31 mL and molarity of Shelcal solution is 0.125 M
   - (b) The burette reading is 10.00 mL and molarity of Shelcal solution is 0.0125 M
   - (c) The burette reading is 6.31 mL and molarity of Shelcal solution is 0.0125 M
   - (d) The burette reading is 10.00 mL and molarity of Shelcal solution is 0.125 M

6. When 10 mL of 0.01 M HCl was added to a mixture of 0.5 M NH_3 and 0.5 M NH_4Cl, the pH of the resultant solution will be (pK_b of NH_3 is 4.75)
   - (a) 9.07
   - (b) 9.75
   - (c) 9.25
   - (d) 8.75

7. The correct order of CO triple bond character in the given metal carbonyl complexes is
   - (a) $[Fe(CO)_4]^{-2} > [Co(CO)_4]^{-1} > [Mn(CO)_6]^+ > Ni(CO)_4$
   - (b) $Ni(CO)_4 > [Mn(CO)_6]^+ > [Co(CO)_4]^{-1} > [Fe(CO)_4]^{-2}$
   - (c) $[Mn(CO)_6]^+ > [Fe(CO)_4]^{-2} > [Co(CO)_4]^{-1} > Ni(CO)_4$
   - (d) $[Mn(CO)_6]^+ > Ni(CO)_4 > [Co(CO)_4]^{-1} > [Fe(CO)_4]^{-2}$

8. Consider the following statements for the square planar complex $[Pt(en)(NCS)_2]$. Identify the correct statements
   - I. It is thermodynamically more stable than $[Pt(NH_3)_2(NCS)_2]$
   - II. It can exhibit stereoisomerism.
   - III. It can exhibit structural isomerism.
   - IV. It is not easily soluble in polar solvents.

   The correct option is
   - (a) I, II, IV
   - (b) II, III, IV
   - (c) I, III, IV
   - (d) I, II, III

39. Consider the given equilibrium reaction at 473 K
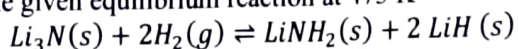
$$Li_3N(s) + 2H_2(g) \rightleftharpoons LiNH_2(s) + 2 LiH(s) \qquad \Delta H_{rxn}° = -200 \ kJ/mol$$

The number of moles of $H_2(g)$ present at equilibrium can be maximised by

	Temperature	Pressure
(a)	increasing	increasing
(b)	increasing	decreasing
(c)	decreasing	increasing
(d)	decreasing	decreasing

40. The following concentration vs time plot represents the conversion of $CH_3NC(g)$ to $CH_3CN(g)$. Which of the following statements (I to IV) is/are true?

    I.   The reaction is of zero order
    II. Unit of rate constant of this reaction is s^{-1}
    III. Unit of rate constant of the reaction is torr s^{-1}
    IV. Unit of rate of the reaction is torr s^{-1}

    (a) I only
    (b) I, II
    (c) III only
    (d) II, IV
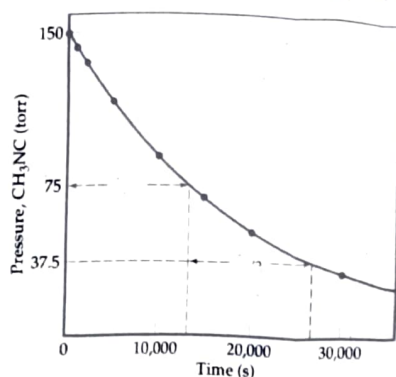
41. Consider the chemical reaction $A \rightarrow C + D$
The observations for kinetic study of the above unimolecular elementary reaction at 298 K are given in the table below:

Time (minute)	[A] (M)
0	0.35
10	0.035
t	0.00035

The value of time t (minute) is
    (a) 20   (b) 30   (c) 40   (d) 35

42. Propanoic acid (PA) is an organic acid. At 298 K, the pH of a 50.0 mL sample of 0.20 M of it is 3.0. The pH of solution formed by mixing 25.0 mL 0.2 M sodium propanoate solution with 25.0 mL 0.1 M propanoic acid will be:
    (a) 3.3   (b) 5.3   (c) 5.6   (d) 6.3

43. M is an alkaline earth metal. 1.0 M solution of MCl_2 is added dropwise to a solution that is 0.01 M each in fluoride, sulfite, and phosphate ions. The order of precipitation of corresponding salts is

Solid	Ksp
MSO_3	7×10^{-7}
MF_2	5×10^{-9}
$M_3(PO_4)_2$	1×10^{-25}

    (a) $M_3(PO_4)_2$, MF_2, MSO_3
    (c) MSO_3, MF_2, $M_3(PO_4)_2$
                           (b) $M_3(PO_4)_2$, MSO_3, MF_2
                           (d) MF_2, MSO_3, $M_3(PO_4)_2$

44. $CrCl_3.xNH_3$ can exist as an octahedral complex (P). 0.1 molal aqueous solution of this complex (P) shows a depression in freezing point of 0.558 °C. The molecular formula of the complex (P) is: (Given K_f for water = 1.86 K Kg mol^{-1}) (Assuming 100% ionization of the complex)

    (a) $[Cr(NH_3)_6]Cl_3$ (b) $[Cr(NH_3)_5Cl]Cl_2$ (c) $[Cr(NH_3)_4Cl_2]Cl$ (d) $[Cr(NH_3)_3Cl_3]$

45. Aspirin ($C_9H_8O_4$) is produced by the reaction between salicylic acid ($C_7H_6O_3$) and acetic anhydride ($C_4H_6O_3$) as per the reaction $C_7H_6O_3 + C_4H_6O_3 \rightarrow C_9H_8O_4 + C_2H_4O_2$

In the reaction of 155 g salicylic acid and 105 g acetic anhydride, assuming 80% conversion of the limiting reactant, the mass of aspirin formed is:

Given molar mass in g mol^{-1} salicylic acid = 138, acetic anhydride = 102 and aspirin = 180

    (a) 148 g   (b) 162 g   (c) 202 g   (d) 184 g

46. A voltaic cell is constructed as shown below
    $Ni(s)| Ni^{2+}(aq) \| Ag^+(aq) |Ag(s)$
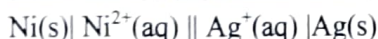
$E^\circ_{Ni2+(aq)/Ni(s)} = - 0.236$ V , $E^\circ_{Ag+(aq)/Ag(s)} = 0.799$ V. The initial concentration of Ag^+(aq) in the Ag^-(aq)/Ag(s) half-cell is 0.005 M and the corresponding cell voltage is +0.95 V at 298 K. Identify the correct option from the following

    (a) Initial $[Ni^{2+}]$(aq) = 0.019 M; it will increase with time
    (b) Initial $[Ni^{2+}]$(aq) = 0.120 M; it will increase with time
    (c) Initial $[Ni^{2+}]$(aq) = 0.019 M; it will decrease with time
    (d) Initial $[Ni^{2+}]$(aq) = 0.120 M; it will decrease with time

47. The photon with the longest wavelength required for the electronic transition in an atom of hydrogen is:
    (a) $n = 1 \rightarrow n = 3$ (b) $n = 2 \rightarrow n = 6$ (c) $n = 3 \rightarrow n = 1$ (d) $n = 1 \rightarrow n = 6$

48. Consider two reactions A and B for which the variation of RT ln K with temperature is given in the plots below. If the enthalpy change for the reactions are –25 kJ/mol and 20 kJ/mol, respectively for A and B, the correct statement is:
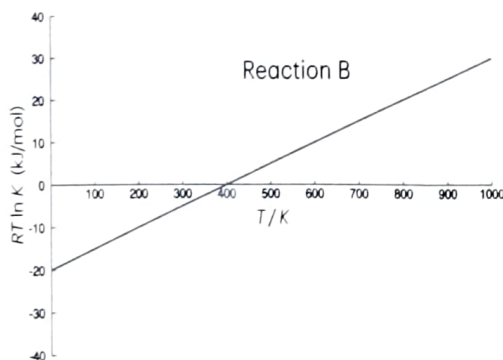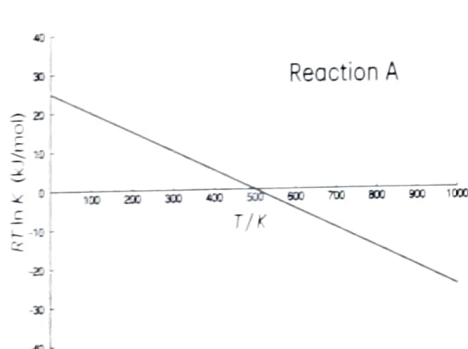

    (a) The equilibrium constant for Reaction B decreases as temperature increases.
    (b) The entropy change for Reaction A is 50 kJ/mol.
    (c) Reaction A remains spontaneous only at temperatures less than 500K
    (d) At 400 K, reaction B changes from exothermic to endothermic reaction.

A – 2
ANY NUMBER OF OPTIONS (4, 3, 2 or 1) MAY BE CORRECT
MARKS WILL BE AWARDED ONLY IF ALL THE CORRECT OPTIONS ARE BUBBLED AND NO INCORRECT.
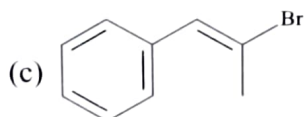
49. The following reaction was performed.
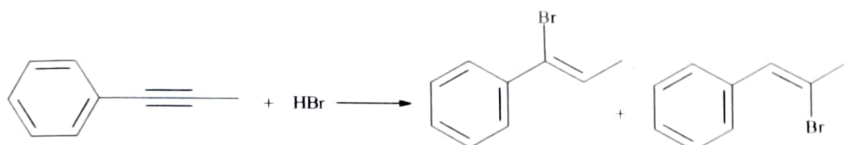
However, on investigation it was discovered that there were additional product(s) in the reaction mixture. The additional product(s) is/are
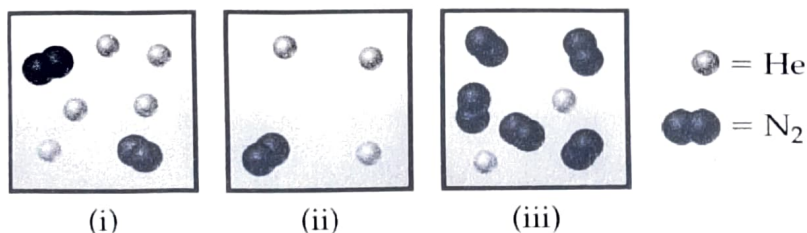
(a)
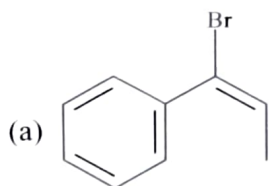
(b) a vicinal dibromide

(c)

(d) a geminal dibromide

50. Three different gaseous mixtures (i), (ii) and (iii) of helium and nitrogen are placed in boxes of equal volume as shown below:


(i) (ii) (iii)

The true statement(s) from the following is/are
   (a) Box (ii) has the lowest pressure
   (b) Box (ii) has the lowest partial pressure of helium
   (c) Box (ii) has the lowest density
   (d) Pressure of box (iii) is less than pressure of box (i)

51. Identify the isotonic solution(s) from the following mixtures of aqueous solutions at 298 K. (Assume complete dissociation of the electrolytes in water)
   (a) 100 mL 0.5 M glucose solution and 110 mL 0.2 M $CuSO_4$ solution
   (b) 200 mL 0.5 M acetamide solution and 300 mL 0.1 M NaCl solution
   (c) 400mL 0.1 M $BaCl_2$ solution and 100 mL 0.2 M KCl solution
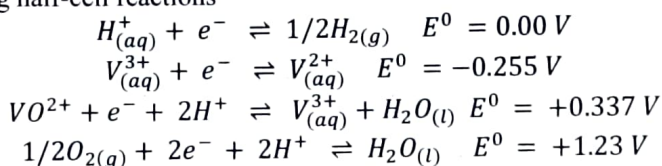   (d) 200mL 0.13 M $CaCl_2$ solution and 200mL 0.125 M HCl solution

52. Alkyl lithium compounds are of interest in organic synthesis as efficient alkylating agents. Consider the following two reactions

   (i) $C_4H_9Li + C_6H_6 \rightarrow C_6H_5Li + C_4H_{10}$
   (ii) $C_5H_5Li + C_6H_6 \rightarrow C_6H_5Li + C_5H_6$
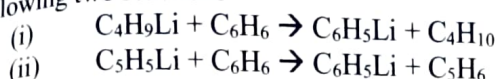
The CORRECT statement(s) for the above two reactions is/are:
   (a) Reaction (i) will proceed because the more acidic hydrocarbon will react with the Li-derivative of less acidic hydrocarbon to liberate less acidic hydrocarbon.
   (b) Reaction (ii) will proceed because the less acidic hydrocarbon will react with the Li-derivative of more acidic hydrocarbon to liberate more acidic hydrocarbon.
   (c) Both the reactions will proceed because the more acidic hydrocarbon will react with the Li-derivative of more acidic hydrocarbon to liberate less acidic hydrocarbon.
   (d) Both the reactions proceed because the less acidic hydrocarbon will react with the Li-derivative of more acidic hydrocarbon to liberate less acidic hydrocarbon.

53. A mixture gave light yellow precipitate with silver nitrate which did not dissolve completely with ammonia solution. It gave positive chromyl chloride test. When organic layer test was performed with addition of excess of concentrated nitric acid, a violet coloured organic layer first formed which then changed to orange colour. Brown ring test was positive but brown coloured gas was not intensified on heating the mixture with copper turnings and concentrated sulphuric acid. Which of the anions were present?
   (a) Chloride, bromide, iodide
   (b) Chloride, nitrate, iodide
   (c) Fluoride, nitrate, bromide
   (d) Chloride, iodide, nitrite

54. Consider the following half-cell reactions
$$H^+_{(aq)} + e^- \rightleftharpoons 1/2 H_{2(g)} \quad E^0 = 0.00 \ V$$
$$V^{3+}_{(aq)} + e^- \rightleftharpoons V^{2+}_{(aq)} \quad E^0 = -0.255 \ V$$
$$VO^{2+} + e^- + 2H^+ \rightleftharpoons V^{3+}_{(aq)} + H_2O_{(l)} \quad E^0 = +0.337 \ V$$
$$1/2 O_{2(g)} + 2e^- + 2H^+ \rightleftharpoons H_2O_{(l)} \quad E^0 = +1.23 \ V$$

   Using above equations, the correct statement(s) is/are
   (a) Oxidation of $V^{2+}_{(aq)}$ to $V^{3+}_{(aq)}$ by H^+ is a spontaneous reaction.
   (b) Oxidation of $V^{3+}_{(aq)}$ to $V^{4+}_{(aq)}$ by H^+ is a nonspontaneous reaction.
   (c) H^+ is a better oxidizing agent than O_2.
   (d) O_2 will be able to oxidize $V^{2+}_{(aq)}$ to $V^{3+}_{(aq)}$.

55. The suitable combinations of physico-chemical methods that can be used to assign the correct formula to the compound $CoCl_3.4NH_3$ are

   (a) Addition of Ag^+ ions
   (b) Electrical conductance of aqueous solution
   (c) Depression in freezing point
   (d) Thermal decomposition of the complex under controlled conditions

56. Two open beakers A and B are kept inside a sealed box. Initially, beaker A contains 30 mL of 0.050 M glucose solution and beaker B contains 30 mL of 0.035 M fructose solution. Enough time was given to ensure that the water vapour in the system is in equilibrium. Under the equilibrium conditions, Assume density of solution to be 1 gm/cm^3

   (a) Volume of solution in A decreased to 25 mL
   (b) Volume of solution in B decreased to 25 mL
   (c) Volume of solution in A increased to 35 mL
   (d) Volume of solution in B increased to 35 mL

57. Given below is the structure of a compound **X**. Identify the correct statement(s) from below.
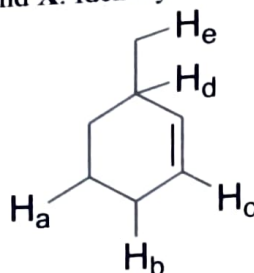
X

    (a) Compound X has two vinylic protons, and two allylic protons.
    (b) Compound X (9.6 gram) will react with excess of bromine to give a dibromide (25.6 gram).
    (c) The carbon radical that generated by cleavage of C-H_d bond will be more stable than that generated by cleavage of C-H_b bond.
    (d) Compound X on ozonolysis followed by treatment with Zn/H_2O will give a dial.

58. Which of the following statement(s) is/are incorrect for sugars?

    (a) If a disaccharide is dextrorotatory, it means both its monosaccharides will also be essentially dextrorotatory.
    (b) The designations (+) and (−) can also be referred to as D- and L- respectively
    (c) The predominant hemiacetal form of glucose is formed by bond formation between C_1 and C_6
    (d) All nucleic acids contain 2-deoxy-D-ribose as the aldopentose

59. When the following reaction was performed, the product obtained gave a bright orange red precipitate with 2, 4-dinitrophenylhydrazine and does not react with saturated solution of $NaHCO_3$.
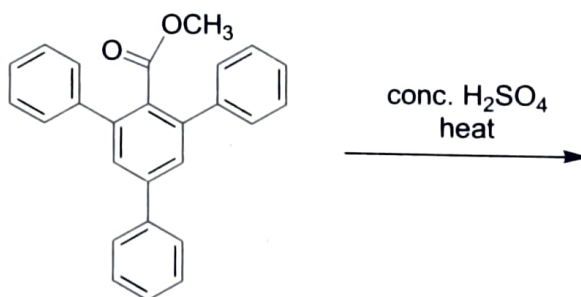
This implies:
    (a) hydrolysis has taken place
    (b) intramolecular Friedal Crafts reaction has been favoured
    (c) intermolecular Friedal Crafts reaction has taken place
    (d) the product has a carbonyl functional group

60. Three cylinders connected with valves are shown in the diagram. All the cylinders are at same temperature. Which of the following statement(s) is/are true once the valves are opened and the system is allowed to reach equilibrium?

Cylinder 1
Ne
$V = 1 L$
$P = 2$ atm

Cylinder 2
Xe
$V = 0.5 L$
$P = 2$ atm

Cylinder 3
Ar
$V = 0.5 L$
$P = 1$ atm
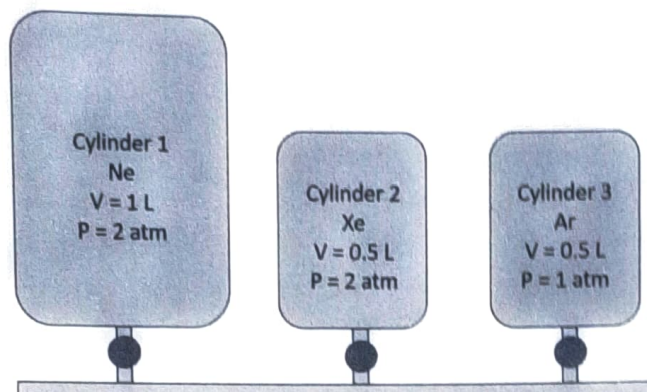
NOTE: Volume of connecting tubes may be neglected.

(a) Total pressure of the system will be 1.75 atm
(b) The partial pressure of Ne in cylinder 1 will be higher than that in cylinder 2 and 3
(c) The correct order of partial pressures will be $p(Ne) > p(Xe) > p(Ar)$
(d) Number of moles of gas in cylinder 2 will be lower than its initial value.