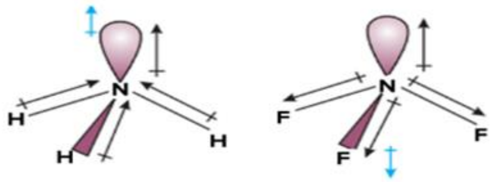
NAVODAYA VIDYALAYA SAMITI
TERM I EXAMINATION 2025-26
SUBJECT: CHEMISTRY (043)
MARKING SCHEME

	SECTION A	
1	c	1
2	c	1
3	c	1
4	d	1
5	a	1
6	b	1
7	c	1
8	c	1
9	c	1
10	b	1
11.	**a**	1
12.	a	1
13.	c	1
14.	d	1
15.	d	1
16.	b	1
	SECTION B	
17.	a) The law of multiple proportions states that if two elements combine to form more than one compound, then the masses of one element that combine with a fixed mass of the other element will always be in a ratio of small whole numbers. For example, carbon combines with oxygen to form carbon monoxide (CO) and carbon dioxide (CO_2).With a fixed mass of carbon, the masses of oxygen in CO and CO_2 are in a 1:2 ratio, demonstrating the law.	1 1
18.	a)Unbinilium(Ubn) b) The diagonal relationship describes the resemblance in chemical and physical properties between two elements positioned diagonally in the periodic table, typically the second-period element and the third-period element of the next group. For instance, Lithium (Li) resembles Magnesium (Mg), Beryllium (Be) resembles Aluminum (Al)	1 1
19.	i) Carbon. Across a period IE increases and with smaller size/effective nuclear charge being higher. C is smaller and binds valence electron more strongly than B,Alor Si. ii)Aluminium. Metallic character increases down a group and to the left of period, Al is largest so lowest IE among the four and is a true metal.	1 1
20.	a)The First Law of Thermodynamics, also known as the law of conservation of energy, states that energy can be neither created nor destroyed, but only converted from one form to another. Mathematically, it is expressed as $\Delta U = Q + W$ b) zero Expansion into vacuum is a free expansion, external pressure P_{ext}=0	1 1

W=-$\int P$ext = 0

21.



1

- In case of NH3 the orbital dipole due to the lone pair is in the same direction as the resultant dipole moment of the N–H bonds.
- But in the case of NF3, the orbital dipole is in the direction opposite to the resultant dipole moment of the three N–F bonds. 1

OR

$(\Delta H_1+\Delta H_2)/2$ = (493+424)/2=458.5 kJ/mol

SECTION C

22.

Elements	Percentage	Atomic mass	$\frac{\text{Percentage}}{\text{Atomic mass}}$	Relative ratio
H	4.07	1	4.07	2.016 = 2
C	24.27	12	2.02	1.0 ≈ 1
Cl	71.65	35.5	2.018	1.0 ≈ 1

Empirical formula = CH_2Cl 1

Molecular formula = n × Empirical formula

$$n = \frac{\text{molar mass}}{\text{Empirical formula mass}}$$

$$= \frac{98.96}{48.5} = 2.04 \approx 2$$

Molecular formula = 2 × CH_2Cl = $C_2H_4Cl_2$. 1

Empirical mass= 48.5 u 1

<table>
<tr><td>23.</td><td>

$$x_{NaOH} = \frac{n_{NaOH}}{n_{NaOH} + n_{H_2O}}$$

$$= \frac{\frac{W_{NaOH}}{M_{NaOH}}}{\frac{W_{NaOH}}{M_{NaOH}} + \frac{W_{H_2O}}{M_{H_2O}}} \qquad \mathbf{1}$$

$$= \frac{\frac{4}{40}}{\frac{4}{40} + \frac{36}{18}}$$

$$= \frac{\frac{1}{10}}{\frac{1}{10}+2} = \frac{\frac{1}{10}}{\frac{21}{10}} - \frac{1}{10} \times \frac{10}{21} - \frac{1}{21}$$

$$= 0.047 \qquad \mathbf{1}$$

$\because x_{NaOH} + x_{H_2O} = 1$
$\therefore x_{H_2O} = 1 - 0.047 = 0.953$
Mass of solution = 36 + 4 = 40 g
Volume of solution = Mass × specific gravity
= 40 × 1 = 40 ml

$$M = \frac{W_B}{M_B} \times \frac{1000}{\text{Volume of solution in ml}}$$

$$= \frac{4}{40} \times \frac{1000}{40}$$

$$= 2.5\ M \qquad \mathbf{1}$$

Or

a) 10^{-12} b) 10^{-9} c) 10^{-6} d) 10^{-1} e) 10^{12} f) 10^{6}
</td><td>1

1

1

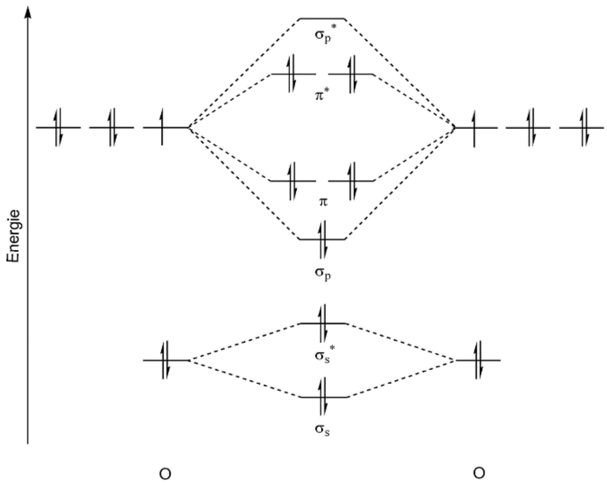
½ for each</td></tr>
<tr><td>24.</td><td>

Element Unpaired Electrons
(a) P 3
(b) Si 2
(c) Cr 6
(d) Fe 4
(e) Kr 0
(f) Cl 1
</td><td>½
½
½
½
½
½</td></tr>
<tr><td>25.</td><td>

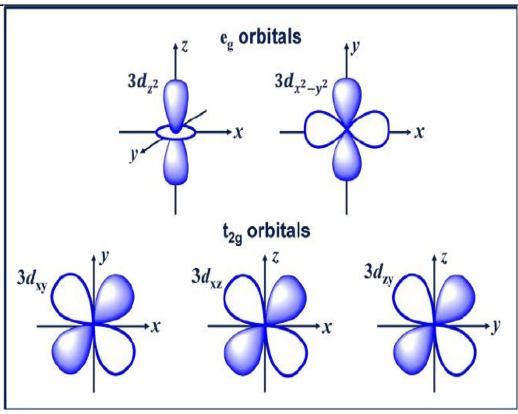
a)
λ=h/mv

- λ = wavelength of the particle
- h = Planck’s constant (6.626×10^{-34} J·s)
- m = mass of the particle
- v = velocity of the particle
</td><td>1</td></tr>
</table>

	b) p=mv $p=(4.0026\times10^{-27}\ \text{kg})\times(2.0\times10^{3}\ \text{m s}-1)$. • The momentum is calculated as: $p=8.0052\times10^{-24}$ kg m s^{-1} now, $\lambda=h/p$. • Substituting the values: λ=6.626×10-34 J s/8.0052×10-24 kg m s^{-1}= 8.27×10^{-11} m **Or** **a)** **i)** Threshold Frequency (ν_0): Threshold frequency is the minimum frequency of incident light required to eject electrons from the surface of a material (usually a metal) in the photoelectric effect. ii) **Work Function (ϕ):** The work function is the **minimum energy required** to **remove an electron** from the surface of a material. Work function $(W_0) = h\nu_0$ $\therefore \quad \nu_0 = \frac{W_0}{h}$ ...(1) $W_0 = 1.9\ \text{eV} = 1.9 \times 1.602 \times 10^{-19}\text{J}$ $[\because 1\text{eV} = 1.602 \times 10^{-19}\text{J}]$ $h = 6.626 \times 10^{-34}\text{Js}$ Substituting the values in eq. (1), we have $\nu_0 = \frac{1.91 \times 1.602 \times 10^{-19}\text{J}}{6.626 \times 10^{-34}\text{Js}} = 4.59 \times 10^{14}\text{s}^{-1}$ $\text{Also, } \lambda_0 = \frac{c}{\nu_0} = \frac{3.0 \times 10^{8}\text{ms}^{-1}}{4.59 \times 10^{14}\text{s}^{-1}}$ $= 6.54 \times 10^{-7}\text{m} = 654 \times 10^{-9}\text{m}$ $= 654\ \text{nm}$	1 1 1 1 1
26.	i) Increases down the group	1

	ii) Cations possess lesser no of electron than electron on the other hand anions possess more no of electron than proton no. So for cation mucleus attracts electron highly resulting smaller radii compared to parent atom and opposite for anion.	2
27.	i) H_2O is a liquid at room temperature while H_2S is a gas because water molecules form strong hydrogen bonds due to the high electronegativity of oxygen, which significantly increases intermolecular attraction and raises its boiling point. In contrast, H_2S molecules do not form hydrogen bonds (since sulfur is less electronegative), and only weak Van der Waals forces exist between them, resulting in a much lower boiling point and a gaseous state at room temperature. ii)  Diamagnetic	1 1 1
28.	a)heat capacity (C) is the amount of heat energy required to raise the temperature of a specific body by one degree Celsius or one Kelvin At constant pressure P, we have $q_P = n\,C_P\Delta T$ This value is equal to the change in enthalpy, that is, $q_P = n\,C_P\Delta T = \Delta H$ Similarly, at constant volume V, we have $q_V = n\,C_V\Delta T$ This value is equal to the change in internal energy, that is, $q_V = n\,C_V\Delta T = \Delta U$ We know that for one mole (n=1) of an ideal gas, $\Delta H = \Delta U + \Delta(pV) = \Delta U + \Delta(RT) = \Delta U + R\,\Delta T$ Therefore, $\Delta H = \Delta U + R\,\Delta T$ Substituting the values of ΔH and ΔU from above in the former equation, $C_P\Delta T = C_V\Delta T + R\,\Delta T$ $C_P = C_V + R$ b) $C_P - C_V = R$	1 2
	SECTION D	
29.	i) a ii)b iii) d iv) b	1 1 1 1

30.	1. 0 2. $\Delta U = -W$ 3. internal energy change (ΔU) is the change in the total energy of a system's particles, including their kinetic (motion) and potential (intermolecular forces) energies. 4. $w=-P_{ext}\Delta V$ $w=-(1atm)(10L)$ $1Latm=101.3J$ $w=-10\times101.3=-1013J$ $\Delta U=500+(-1013)= -513J$ **OR** Given: $q=+60$ kJ, $\Delta T=24{\circ}C-20{\circ}C=4$ K, $q=+60$ kJ $\Delta U=q+w=60$ kJ$+0=60$kJ $C_V=q/\Delta T=60/4=15$kJ K^{-1}	1 1 1 1 1
	SECTION E	
31.	A) C B) I) Al>Ga>B ii) Cl>F>Br iii) Al_2O_3 is **amphoteric** because the high polarising power of $Al^{3+}Al^{3+}$ makes its oxide show **both acidic and basic properties**. iv) Although both have the **same electronic configuration (Neon-like)**, • Mg^{2+} is **smaller** because of its **higher nuclear charge and reduced e^-–e^- repulsion**, • whereas O^{2-} is **larger** because of its **lower nuclear charge and increased repulsion**. **Or** **A)** a) Halogens have **very high negative electron gain enthalpies** because they are **one electron short of stable octet**, and addition of an electron is highly exothermic. b) The **ionisation enthalpy of nitrogen is higher than that of oxygen** because **nitrogen has a stable half-filled 2p3 configuration**, while oxygen's 2p4 configuration suffers from extra repulsion, making its first electron easier to remove. C) The **d-block elements** are those in which the **last electron enters a d-orbital** of the penultimate shell. **General electronic configuration $(n-1)d^{1-10}ns^{1-2}$** **Property:** i) Shows variable valency ii) Act as catalyst iii) Form coloured ions etc any two	5 ×1 1 1 1 1 1
32.	a)	1 1



1
2

Correct diagram according to the question

b) 1+3+5=9 1

c) a)3s b)4d c) 5f d) 1s

or 1

a)

i) The Aufbau principle dictates the manner in which electrons are filled in the atomic orbitals of an atom in its ground state. 1
2

ii) It states that no two electrons in the same atom can have all four quantum numbers (n, l, m, s) identical

iii) t states that electrons fill degenerate orbitals (orbitals of the same energy) singly first, with parallel spins, before pairing starts.

b) I) [Ar] $3d^5$ ii) [Ar]

33\.

i) The enthalpy change of a chemical reaction is the same, whether the reaction takes place in a single step or in a series of steps.One Suitable example of cyclic process. 2

ii) ΔHcomb=(products)−(reactants)=−3218.7 − (+45.9)=−3264.6 kJ. 3

Or

a)

Difference between Intensive and Extensive properties	
INTENSIVE	**EXTENSIVE**
Independent property	Dependent property
Size does not change	Size changes
It cannot be computed	It can be computed
Can be easily identified	Cannot be easily identified

2

	Example: melting point, colour, ductility, conductivity, pressure, boiling point, lustre, freezing point, odour, density, etc | *Example:* length, mass, weight, volume c) Enthalpy is a thermodynamic property representing the total heat content of a system. It's defined as the sum of the system's internal energy and the product of its pressure and volume H=U+PV ΔH=ΔU+Δ(PV). For ideal gases PV=nRTPV=nRTPV=nRT, so Δ(PV)=Δ(nRT)=RTΔng Thus ΔH=ΔU+ RTΔng	1 2