NATURE OF MATTER
ELEMENTS-METALS, NON-METALS, METALLOIDS AND NOBLE GASES
SOLUTIONS
Teaching Task

1. Which of the following is a liquid non-metal at room temperature?
A) Bromine B) Iodine C) Sulfur D) Carbon
Solution:Bromine is the only non-metal that is liquid at room temperature.
Iodine and sulfur are solids, while carbon is a solid in forms like graphite or diamond.
Answer:A

2. Which gas is used in glowing advertisement signs?
A) Oxygen B) Neon C) Carbon dioxide D) Nitrogen
Solution:Neon gas is used in glowing signs because it emits a bright red-orange light when electricity passes through it.
Other noble gases like argon (blue) and helium (pink) are also used for different colors.
Answer:B

3. Which element is a metalloid used in computer chips?
A) Iron B) Silicon C) Gold D) Chlorine
Solution:Silicon is a metalloid (has properties of both metals and non-metals) and is widely used in semiconductors and computer chips.
Iron, gold, and chlorine are not metalloids.
Answer:B

4. Which metal is so soft it can be cut with a knife?
A) Sodium B) Aluminum C) Copper D) Zinc
Solution:Sodium (and potassium) are alkali metals so soft that they can be easily cut with a knife.
Aluminum, copper, and zinc are harder metals.
Answer:A

5. Which non-metal is essential for burning?
A) Nitrogen B) Oxygen C) Argon D) Hydrogen
Solution:Oxygen supports combustion (burning) and is essential for fire.
Nitrogen and argon are inert gases, and hydrogen is flammable but not required for burning other substances.
Answer:B

6. Which element is a noble gas and lighter than air?
A) Helium B) Krypton C) Xenon D) Radon
Solution:Helium is a noble gas and is lighter than air (less dense), which is why it is used in balloons.
Krypton, xenon, and radon are also noble gases but are heavier than air.
Answer:A
7. Which substance is polyatomic (forms molecules with multiple atoms)?
A) Gold (Au) B) Ozone (O_3) C) Iron (Fe) D) Copper (Cu)
Solution:Ozone (O3) is a polyatomic molecule made of three oxygen atoms.
Gold (Au), iron (Fe), and copper (Cu) are monatomic (exist as single atoms in their pure form).
Answer:B
8. Which metal is magnetic?
A) Aluminum B) Silver C) Iron D) Copper
Solution:Iron is a ferromagnetic metal, meaning it is strongly attracted to magnets.
Aluminum, silver, and copper are non-magnetic.
Answer:C
9. Which non-metal is lustrous (shiny)?
A) Sulfur B) Graphite C) Phosphorus D) Chlorine
Solution:Graphite (a form of carbon) is a non-metal with a shiny, metallic luster.
Sulfur, phosphorus, and chlorine are non-lustrous.
Answer:B
10. Which element is radioactive and used in nuclear power?
A) Uranium B) Sodium C) Magnesium D) Calcium
Solution:Uranium is a radioactive element used as fuel in nuclear power plants.
Sodium, magnesium, and calcium are not radioactive.
Answer:A

MULTIPLE CORRECT ANSWER TYPE

11. Which of the following are monoatomic elements?
A) Helium (He) B) Neon (Ne) C) Gold (Au) D) Oxygen (O_2)
Solution:Helium (He) and Neon (Ne) are noble gases, existing as single atoms.
Gold (Au) is a metal and exists as individual atoms in its pure form.
Oxygen (O_2) is diatomic (forms O_2 molecules).
Answer:A,B,C
12. Which of the following are liquid at room temperature?
A) Bromine (Br) B) Mercury (Hg) C) Gallium (Ga) D) Sodium (Na)
Solution:Bromine (Br) is the only liquid non-metal at room temperature.
Mercury (Hg) is a liquid metal at room temperature.
Gallium (Ga) melts at ~29.8°C, so it is liquid just above room temperature.
Sodium (Na) is a soft solid metal at room temperature.
Answer:A,B,C
13. Which of the following are metalloids?
A) Silicon (Si) B) Arsenic (As) C) Aluminum (Al) D) Carbon (C)
Solution:Silicon (Si) and Arsenic (As) are metalloids (have properties of both metals and non-metals).

Aluminum (Al) is a pure metal.
Carbon (C) is a non-metal
Answer:A,B
14. Which of the following are diatomic molecules?
A) Nitrogen (N_2) B) Ozone (O_3) C) Chlorine (Cl_2) D) Phosphorus (P_4)
Solution:Nitrogen (N2) and Chlorine (Cl_2) exist as diatomic molecules in nature.
Ozone (O_3) is triatomic.
Phosphorus (P_4) exists as a tetratomic molecule in its white phosphorus form.
Answer:A,C
15. Which of the following are exceptions to typical non-metal properties?
A) Graphite (conducts electricity) B) Iodine (shiny solid)
C) Sulfur (brittle yellow solid) D) Bromine (liquid non-metal)
Solution:Graphite (carbon) conducts electricity (unlike most non-metals).
Iodine (I_2) is a shiny, crystalline solid (most non-metals are dull).
Bromine (Br_2) is the only liquid non-metal at room temperature.
Sulfur (S) is a typical brittle yellow non-metal (not an exception).
Answer:A,B,D
STATEMENT TYPE:
16.Statement-I: Bromine is the only non-metal that is liquid at room temperature.
Statement-II: Non-metals are usually gases or brittle solids, but bromine breaks this trend.
Solution:Statement-I:True. Bromine (Br2) is the only non-metal that exists as a liquid at room temperature (25°C).
Statement-II: True. Most non-metals (e.g., oxygen, sulfur, carbon) are gases or brittle solids, but bromine is an exception due to its liquid state.
Statement-II logically explains why bromine is an exception, supporting Statement-I.
Answer:A
17.Statement-I: Graphite conducts electricity even though it is a non-metal.
Statement-II: All non-metals are bad conductors of electricity.
Solution:Statement-I: True. Graphite (a form of carbon) is a non-metal but conducts electricity due to its layered structure with delocalized electrons.
Statement-II: False. While most non-metals are insulators, graphite is an exception (it conducts electricity).
Answer:C
COMPREHENSION -I
18. Which property of metals allows them to be hammered into thin sheets?
A) Ductility B) Malleability C) Sonority D) Conductivity
Solution:Malleability is the property of metals that allows them to be hammered or rolled into thin sheets (e.g., aluminum foil).
Ductility (A) refers to drawing into wires, sonority (C) to sound production, and conductivity (D) to heat/electricity transfer.
Answer:B
19. Why are copper wires used in electrical circuits?

A) They are shiny B) They are good conductors of electricity
C) They produce ringing sounds D) They melt easily
Solution:Copper is widely used in wiring because it is an excellent conductor of electricity

Answer:B

20. Which of these is NOT a characteristic of most metals?
A) High melting point B) Brittleness
C) Lustrous appearance D) Solid at room temperature
Solution:Metals are typically not brittle (they are malleable/ductile). Brittleness is a property of non-metals

Answer:B

21.What makes iron suitable for making bells?
A) It is a liquid metal B) It is sonorous
C) It has low melting point D) It is a poor conductor
Solution:Sonority means metals produce ringing sounds when struck, making iron ideal for bells.

Answer:B

INTEGER TYPE

22. The atomicity of phosphorus (P_4) is ____.
Solution:Atomicity refers to the number of atoms in a molecule.
Phosphorus exists as P_4 (tetratomic molecule) in its most stable white phosphorus form.

Answer:4

23. The number of liquid non-metals at room temperature is ____
Solution:Bromine (Br_2) is the only non-metal that is liquid at room temperature (~25°C).

Answer:1

24.The total number of metalloids in the periodic table is ____.
Solution:Standard metalloids (7):Boron, Silicon, Germanium,Arsenic,Antimony, Selenium ,Tellurium

Answer:7

MATRIX MATCH TYPE:

25.Solution:

COLUMN-I	COLUMN-II
a) Liquid metal at room temperature	v) Mercury
b) Shiny non-metal	ii) Graphite
c) Gas essential for burning	iv) Oxygen
d) Hardest natural non-metal	iii) Diamond
e) Metal used in wires	i) Copper

Answer:a-v,b-ii,c-iv,d-iii,e-i

26.Solution:

COLUMN-I	COLUMN-II
A) Element with atomicity 1	iii) Neon (Ne
B) Element with atomicity 2	v) Nitrogen (N_2)
C) Element with atomicity 3	i)Ozone (O_3)

D) Element with atomicity 4 iv) Phosphorus (P_4)
E) Element with atomicity 8 ii) Sulfur (S_8)

Answer:A-iii,B-v,C-i,D-iv,E-ii

Learners Task

CONCEPTUAL UNDERSTANDING QUESTIONS (CUQ's)

1. Atomicity of Sulfur (S_8) is:

A) 2 B) 4 C) 8 D) 1

Solution:Sulfur exists as S8 molecules (8 atoms bonded in a ring structure).

Answer:C

2. Which of the following is a liquid metal?

A) Bromine B) Gallium C) Iodine D) Carbon

Solution:Gallium melts at ~29.8°C, making it liquid just above room temperature.

Bromine (A) is a liquid non-metal, while iodine (C) and carbon (D) are solids.

Answer:B

3. Which non-metal is essential for respiration?

A) Nitrogen B) Oxygen C) Hydrogen D) Neon

Solution:Oxygen (O2) is required for cellular respiration in living organisms.

Answer:B

4. The atomicity of Helium (He) is:

A) 1 B) 2 C) 3 D) 0

Solution:Helium is a monoatomic noble gas (exists as single atoms).

Answer:A

5. Which element is a metalloid used in computer chips?

A) Aluminum B) Silicon C) Gold D) Chlorine

Solution:Silicon is a metalloid and the primary material in semiconductors/computer chips.

Answer:B

6. Which of the following is NOT a noble gas?

A) Argon B) Krypton C) Fluorine D) Xenon

Solution:Fluorine is a halogen, not a noble gas. Argon (A), krypton (B), and xenon (D) are noble gases.

Answer:C

7. Which metal is stored in oil to prevent reactions?

A) Iron B) Sodium C) Copper D) Silver

Solution:Sodium (Na) reacts violently with air/water, so it's stored in oil

to prevent oxidation.

Answer:B

8. Which non-metal is a good conductor of electricity?

A) Sulfur B) Graphite C) Phosphorus D) Oxygen

Solution:Graphite (carbon) conducts electricity due to its delocalized electrons.

Answer:B

9. The atomicity of Hydrogen gas (H_2) is:

A) 1 B) 2 C) 3 D) 4

Solution:Hydrogen exists as a diatomic molecule (H_2).

Answer:B

10. Which element is radioactive and used in nuclear reactors?

A) Uranium B) Sodium C) Magnesium D) Calcium

Solution:Uranium (U) is radioactive and used as fuel in nuclear reactors.

Answer:A

JEE MAIN LEVEL QUESTIONS

1. Which elements are un-reactive and used in light-up signs?

A) Alkali metals B) Noble gases C) Halogens D) Transition metals

Solution:Noble gases (Neon, Argon, etc.) are chemically inert (unreactive) and glow when electricity passes through them, making them ideal for lighting (e.g., neon signs).

Answer:B

2. Silicon is used in computers because it's a:

A) Metal B) Non-metal C) Metalloid D) Gas

Solution:: Silicon is a metalloid (properties of both metals and non-metals), making it a semiconductor essential for computer chips.

Answer:C

3. Which metal is liquid in your hand?

A) Iron B) Gallium C) Copper D) Sodium

Slution: Gallium melts at 29.8°C (below body temperature), so it liquefies in your hand

Answer:B

4. Non-metals are usually poor conductors, but an exception is:

A) Sulfur B) Graphite C) Phosphorus D) Oxygen

Solution: Graphite (a carbon allotrope) conducts electricity due to its delocalized electrons, unlike sulfur (A), phosphorus (C), or oxygen (D).

Answer:B

5. Which pair are BOTH diatomic gases?

A) O_2 & Cl_2 B) He & Ne C) P_4 & S_8 D) Cu & Fe

Solution: Oxygen (O_2) and chlorine (Cl_2) exist as diatomic molecules in their natural state.

He & Ne (B) are monatomic, P4 & S8 (C) are polyatomic solids, and Cu & Fe (D) are metals.

Answer:A

6. The only metal liquid at room temperature is:

A) Bromine B) Mercury C) Gallium D) Sodium

Solution: Mercury (Hg) is the only metal liquid at 25°C.

Bromine (A) is a liquid non-metal, gallium (C) melts just above room temp, and sodium (D) is solid.

Answer:B

7. If an element shatters when hit, it's likely a:

A) Metal B) Non-metal C) Metalloid D) Alloy

Solution: Non-metals (e.g., sulfur) are brittle, while metals (A) are malleable. Metalloids (C) have intermediate properties.

Answer:B

8. Which element is radioactive AND a noble gas?

A) Radon B) Uranium C) Plutonium D) Krypton

Solution: Radon (Rn) is the only radioactive noble gas.

Uranium (B) and plutonium (C) are metals, while krypton (D) is stable.

Answer:A

9. The atomicity of ozone (O_3) is:

A) 1 B) 2 C) 3 D) 4

Solution:Ozone is a triatomic molecule (O_3).

Answer:C

10. Which property allows metals to be rolled into sheets?

A) Ductility B) Malleability C) Sonority D) Luster

Solution: Malleability is the ability to be hammered/rolled into sheets (e.g., aluminum foil).

Answer:B

ADVANCED LEVEL QUESTIONS

MULTIPLE CORRECT ANSWER TYPE

11. Which of the following are properties of non-metals?

A) They are usually poor conductors of heat and electricity

B) They are brittle and break easily

C) They are shiny and malleable

D) They can be gases, liquids, or solids at room temperature

Solution:A) True. Most non-metals (e.g., sulfur, oxygen) are insulators. Exception: Graphite (conducts electricity).

B) True. Non-metals like sulfur or phosphorus are brittle in solid form.

C) False. Shiny and malleable properties describe metals. Exception: Iodine is shiny but still brittle.

D) True.

Gases: Oxygen (O2), Nitrogen (N2)

Liquid: Bromine (Br2)

Solids: Carbon (C), Sulfur (S)

Answer:A,B,D

COMPREHENSION TYPE

12. Why are noble gases chemically unreactive?

A) They form strong bonds with other elements

B) They have a full outer electron shell

C) They are always found as liquids

D) They are highly flammable

Solution: Noble gases have complete valence electron shells (octet/duplet), making them energetically stable and unreactive

Answer:B

13. Which noble gas is used in colorful advertisement signs?

A) Helium B) Radon C) Neon D) Xenon

Solution:Neon emits bright red-orange light when electrified, making it ideal for signs. Other noble gases glow in different colors (e.g., Argon ? blue, Xenon ? white).

Answer:C

14.1. What is the atomicity of oxygen gas (O_2)?

A) 1 B) 2 C) 3 D) 8

Solution:Oxygen exists as a diatomic molecule (O_2) in nature, meaning each molecule contains 2

Answer:B

15. Which element has an atomicity of 1?

A) Hydrogen (H_2) B) Ozone (O_3) C) Helium (He) D) Phosphorus (P_4)

Solution:Helium is a monoatomic noble gas (exists as single atoms).

Answer:C

INTEGER TYPE

16.The atomicity of phosphorus (P_4) is ____.

Solution: White phosphorus exists as P4 molecules (4 atoms bonded in a tetrahedral structure).

Answer:4

17.Among oxygen (O_2), ozone (O_3), nitrogen (N_2), and sulfur (S_8), how many are diatomic?

Solution:Diatomic (2 atoms): O_2, N_2.

Not diatomic: O_3 (triatomic), S_8 (polyatomic).

Answer:2

18.The number of naturally occurring liquid metals at room temperature is ____.

Solution:Only mercury (Hg) is a naturally occurring liquid metal at 25°C.

Gallium (Ga) melts at 29.8°C (solid at room temp but melts in hand).

Answer:1

19.Among carbon (C), phosphorus (P_4), sulfur (S_8), and iron (Fe), how many are polyatomic elements? _____.

Solution:Polyatomic ($\geq$2 atoms): P_4, S_8.

Not polyatomic: Carbon (C as graphite/diamond is a network solid), Iron (Fe is monatomic in pure form).

Answer:2

20.The atomicity of ozone (O_3) is ___

Solution:Ozone is a triatomic molecule (O3).

Answer:3

KEY

			Teaching Task						
1	2	3	4	5	6	7	8	9	10
A	B	B	A	B	A	B	C	B	A
11	12	13	14	15	16	17	18	19	20
A,B,C	A,B,C	A,B	A,C	A,B,D	A	C	B	B	B
21	22	23	24	25		26			
B	4	1	7	a-v,b-ii,c-iv,d-iii,e-i		A-iii,B-v,C-I,D-iv,E-ii			
			Learners Task						
			(CUQ's)						
1	2	3	4	5	6	7	8	9	10
C	B	B	A	B	C	B	B	B	A
			JEE MAIN LEVEL QUESTIONS						
1	2	3	4	5	6	7	8	9	10
B	C	B	B	A	B	B	A	C	B
11	12	13	14	15	16	17	18	19	20
A,B,D	B	C	B	C	4	2	1	2	3