Quiz 6 Prep 40 Questions About the Group V through VIII Elements

1) Which of the following statements about nitrogen's abundance are true?

(I) Nitrogen is the most abundant element in the Earth's crust.
(II) Nitrogen is the halogen of greatest abundance in the Earth's crust.
(III) Nitrogen is the third most abundant gas in the atmosphere.
(IV) Nitrogen is the second most abundant element in the universe after hydrogen.

- **A.** (I) and (III)
- **B.** (II) and (IV)
- **C.** (IV)
- **D.** None of the above

2) Plants need nitrogen to grow, but they cannot use N_2 directly. Why?

- **A.** Because of the strength of the N≡N bond.
- **B.** Because nitrogen gas is almost as inert as the noble gases.
- **C.** Because a large amount of energy is needed to break the N≡N bond.
- **D.** All of the above.

3) Which of the following are possible oxidation numbers of nitrogen in its known compounds?

- **A.** −3, 0, +5
- **B.** −3, +1, +2, +3, +4, +5
- **C.** −3, −2, −1, 0, +1, +2, +3, +4, +5
- **D.** −3, −2, −1, +1, +2, +3, +4, +5

4) Which of the following statements about nitrogen monoxide are true?

(I) It contributes to the problem of acid rain.
(II) It contributes to the formation of smog.
(III) It contributes to the destruction of the ozone layer.
(IV) It helps to dilate blood vessels.
(V) It acts as a neurotransmitter.
(VI) It is quickly destroyed because it is a radical.

- **A.** (I), (II) and (III)
- **B.** (I), (II), (III), (IV), (V) and (VI)

- **C.** (IV), (V) and (VI)
- **D.** (I), (II), (III), (IV) and (VI)

5) Which of the following statements about adenosine triphosphate are true?

(I) It is found in every living cell.
(II) It is found in most living cells.
(III) A large amount of energy is released when it is converted to adenosine diphosphate.
(IV) A water molecule is formed when it is converted to adenosine diphosphate.

- **A.** (II) and (IV)
- **B.** (II) and (III)
- **C.** (I) and (III)
- **D.** (I), (III) and (IV)

6) Decide which allotrope of oxygen, dioxygen or trioxygen (ozone), best fits each of the following statements:

(I) It condenses to a blue liquid.
(II) Its normal form is a blue gas.
(III) It is an odorless gas.
(IV) It has a higher boiling point.
(V) It has a lower density (for the liquid at its boiling point).

- **A.** Dioxygen: (I), (III) and (V); trioxygen: (I), (II) and (IV).
- **B.** Dioxygen: (III) and (IV); trioxygen: (I), (II) and (V).
- **C.** Dioxygen: (I), (IV) and (V); trioxygen: (I), (II) and (III).
- **D.** Dioxygen: (III) ; trioxygen: (I), (II), (IV) and (V).

7) Chlorine is added to drinking water as a disinfectant. What makes it a disinfectant?

- **A.** Chlorine reacts with water to form Cl^-, which is toxic to bacteria.
- **B.** Chlorine lowers the pH.
- **C.** Chlorine raises the pH.
- **D.** Chlorine reacts with water to form HClO, which is toxic to bacteria.

8) Decide which of the halogens best fits each of the following statements:

I. It is the halogen of greatest abundance in the Earth's crust.
II. It is the most strongly oxidizing element.

III. It is the most electronegative element of all.

- **A.** (I) chlorine; (II) fluorine; (III) chlorine
- **B.** (I) chlorine; (II) fluorine; (III) fluorine
- **C.** (I) fluorine; (II) fluorine; (III) fluorine
- **D.** (I) fluorine; (II) chlorine; (III) fluorine

9) The oceans are salty with chlorides rather than fluorides. Which of the following may be the reason for that?

- **A.** Chlorine is more abundant than fluorine in the Earth's crust.
- **B.** Fluorine does not form ionic compounds.
- **C.** The lattice enthalpies of fluoride's ionic compounds tend to be low.
- **D.** Fluorides are less soluble than other halides.

10) Iodine trifluoride, IF_3, is a solid at 25°C and 1 atm, whereas iodine heptafluoride, IF_7, is a gas. What may be the reason for this?

- **A.** Iodine trifluoride has a lower value of free energy of formation.
- **B.** Iodine trifluoride has a dipole moment, whereas iodine heptafluoride is nonpolar.
- **C.** Iodine trifluoride has a lower heat capacity.
- **D.** Iodine trifluoride has a smaller molar mass.

11) Which halogen is found in Teflon?

- **A.** Bromine
- **B.** Chlorine
- **C.** Fluorine
- **D.** Astatine

12) Which of the following statements about helium are true?

I. It is rare on Earth.
II. It occurs as a monatomic gas.
III. It does not freeze to a solid at any temperature at 1 atm.

- **A.** (I) and (II)

- **B.** (II) and (III)
- **C.** (I), (II) and (III)
- **D.** (I) and (III)

13) Both hydrogen and helium, being very light, move at such high average speeds that they tend to escape from the Earth's gravity. Helium is heavier than hydrogen, yet helium is a much less abundant element on Earth. What may be the reason for this?

- **A.** Hydrogen molecules move at lower speeds despite being lighter.
- **B.** Hydrogen is found in compounds, and helium is not.
- **C.** Hydrogen is the most abundant element in the human body.
- **D.** Helium atoms are not stable.

14) Explain the low reactivity of the noble gases and the fact that the ease of compound formation increases down the group.

- **A.** Heavier noble gases are more abundant.
- **B.** The ionization energies of the noble gases are very high but decrease down the group.
- **C.** Heavier noble gases are more electronegative.
- **D.** A large amount of energy is needed to break the bonds between the atoms of He and Ne molecules.

15) State whether each of the following oxides is acidic, basic, or amphoteric.
P_2O_5
NO_2
Sb_2O_3
As_4O_6
Bi_2O_3

Answer

16) Which of the Group 15 elements is(are) a metalloid(s)?

- **A.** As only
- **B.** As and Sb
- **C.** P and As
- **D.** P, As, and Sb

- **E.** As, Sb, and Bi

17) Ammonium nitrate is explosive because

- **A.** the ammonium ion decomposes readily.
- **B.** the ammonium ion can be oxidized by the nitrate ion.
- **C.** the nitrate ion decomposes readily.
- **D.** the ammonium ion is readily reduced.
- **E.** nitrate reacts readily with oxygen in air.

18) Nitrogen triiodide can be prepared as the ammoniate, $NI_3 \cdot NH_3$. This compound is explosive when dry and decomposes according to the reaction below.

$$2NI_3 \cdot NH_3 \rightarrow N_2 + 2NH_3 + 3I_2$$

In this reaction, nitrogen undergoes a change in oxidation number from

- **A.** +3 to 0.
- **B.** +3 to –3.
- **C.** There is no change in oxidation number occurs because this is not a redox reaction.
- **D.** +6 to 0.
- **E.** +1 to 0.

19) White phosphorus

- **A.** is an amorphous substance.
- **B.** is not very toxic.
- **C.** is very unreactive.
- **D.** consists of large, random aggregates of phosphorus atoms.
- **E.** consists of tetrahedral P_4 molecules.

20) In the Ostwald process, the total change in oxidation number of nitrogen from reactant to nitric acid is

- **A.** 5.
- **B.** 3.
- **C.** 6.
- **D.** 8.
- **E.** 7.

21) When sulfur is produced by the Claus process, the starting material is

- **A.** $H_2SO_4(l)$.
- **B.** $Na_2SO_3(s)$.
- **C.** $SO_3(g)$.
- **D.** $SO_2(g)$.
- **E.** $H_2S(g)$.

22) Which of the following pairs are allotropes?

- **A.** $S_8(s)$ and $H_2S(g)$
- **B.** $S(s)$ and $SO_2(g)$
- **C.** $O_2(g)$ and $H_2O_2(l)$
- **D.** $C(s)$ and $CO_2(g)$
- **E.** $O_2(g)$ and $O_3(g)$

23) In the contact process for the production of sulfuric acid, sulfur is first burned in oxygen to produce $SO_2(g)$. The $SO_2(g)$ is then

- **A.** reduced to $H_2S(g)$.
- **B.** dissolved in water to form oleum.
- **C.** dissolved in water to form $H_2SO_4(aq)$.
- **D.** dissolved in water to form $H_2SO_3(aq)$.
- **E.** oxidized to $SO_3(g)$.

24) The starting material for the production of sulfuric acid by the contact process is

- **A.** $H_2S(g)$.
- **B.** $H_2S_2O_7(l)$.
- **C.** $S(g)$.
- **D.** $SO_3(g)$.
- **E.** $SO_2(g)$.

25) The stable forms of chlorine, bromine, and iodine at 25°C and 1 atm are

- **A.** $Cl_2(g)$, $Br_2(g)$, and $I_2(g)$.
- **B.** $Cl_2(g)$, $Br_2(l)$, and $I_2(s)$.
- **C.** $Cl_2(g)$, $Br_2(l)$, and $I_2(l)$.
- **D.** $Cl_2(g)$, Br(l), and I(s).
- **E.** $Cl_2(g)$, Br(l), and $I_2(g)$.

26) Which of the following noble gases is least likely to react with fluorine?

- **A.** Ar
- **B.** Rn
- **C.** Xe
- **D.** Kr
- **E.** Ne

27) Both ammonia and phosphine are soluble in water. Which is less soluble? Why?

Answer

Answer: PH3 is less soluble because it cannot form hydrogen bonds with water.

28) Which of the following is(are) true of sulfuric acid?

- **A.** Sulfuric acid is an oxidizing agent.
- **B.** Sulfuric acid is a strong dehydrating agent.
- **C.** Sulfuric acid is a strong Brønsted acid.
- **D.** B, C, and D are all properties of sulfuric acid.

29) Which of the following is not a redox reaction?

- **A.** $3Mg + N_2 \rightarrow Mg_3N_2$
- **B.** $2P^{3-} + 6H_2O \rightarrow 2PH_3 + 6OH^-$
- **C.** $2NaN_3 \rightarrow 2Na + N_2$
- **D.** $2NO + O_2 \rightarrow 2NO_2$
- **E.** $N_2H_4 + O_2 \rightarrow N_2 + 2H_2O$

30) When hydrogen peroxide reacts with chlorine, the O_2 formed may be produced in an excited state and emit light. This process is called

- **A.** chemiluminescence.
- **B.** bioluminescence.
- **C.** phosphorescence.
- **D.** triboluminescence.
- **E.** incandescence.

31) What is the original source of nitrogen in the Ostwald process for the production of nitric acid?

- **A.** HN_3
- **B.** NH_3
- **C.** NO
- **D.** NO_2
- **E.** N_2

32) Which member of Group 16/VI is used in the vulcanization of rubber?

- **A.** O
- **B.** S
- **C.** Se
- **D.** Te
- **E.** Po

33) Which industry uses the most O_2?

- **A.** medical
- **B.** cosmetic
- **C.** chemical
- **D.** steel
- **E.** petrochemical

34) What is a common form of molecular sulfur?

- **A.** chains of S_4
- **B.** rings of S_4
- **C.** chains of S_8
- **D.** rings of S_8
- **E.** molecules of S_2

35) Which member of Group 17/VII is most abundant in the earth's crust?

- **A.** F
- **B.** Cl
- **C.** Br
- **D.** I
- **E.** At

36) Which member of Group 17/VII is most abundant in the earth's oceans?

- **A.** F
- **B.** Cl
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37) Organic compounds of which halide are used as textile flame retardants?

- **A.** F
- **B.** Cl
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- **D.** I
- **E.** At

38) Which compounds is used as a source of oxygen and in fireworks and matches?

- **A.** NaClO
- **B.** NaBrO

- **C.** $NaClO_3$
- **D.** $KBrO_3$
- **E.** $KClO_3$

39) Which noble gas is most abundant in the atmosphere?

- **A.** He
- **B.** Ne
- **C.** Ar
- **D.** Kr
- **E.** Xe

40) Pyrite, which is commonly known as fool's gold, includes which main group element?

- **A.** Al
- **B.** S
- **C.** Si
- **D.** C
- **E.** P

Answer Key
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1) Which of the following statements about nitrogen's abundance are true?

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- **A.** (I) and (III)
- **B.** (II) and (IV)
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- **D.** None of the above

Answer: D

2) Plants need nitrogen to grow, but they cannot use N_2 directly. Why?

- **A.** Because of the strength of the N≡N bond.
- **B.** Because nitrogen gas is almost as inert as the noble gases.
- **C.** Because a large amount of energy is needed to break the N≡N bond.
- **D.** All of the above.

Answer: D

3) Which of the following are possible oxidation numbers of nitrogen in its known compounds?

- **A.** −3, 0, +5
- **B.** −3, +1, +2, +3, +4, +5
- **C.** −3, −2, −1, 0, +1, +2, +3, +4, +5
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Answer: C

4) Which of the following statements about nitrogen monoxide are true?

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Answer: B

5) Which of the following statements about adenosine triphosphate are true?

(I) It is found in every living cell.
(II) It is found in most living cells.
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(IV) A water molecule is formed when it is converted to adenosine diphosphate.

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Answer: C

6) Decide which allotrope of oxygen, dioxygen or trioxygen (ozone), best fits each of the following statements:

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Answer: A

7) Chlorine is added to drinking water as a disinfectant. What makes it a disinfectant?

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- **B.** (I) chlorine; (II) fluorine; (III) fluorine
- **C.** (I) fluorine; (II) fluorine; (III) fluorine
- **D.** (I) fluorine; (II) chlorine; (III) fluorine

Answer: C

9) The oceans are salty with chlorides rather than fluorides. Which of the following may be the reason for that?

- **A.** Chlorine is more abundant than fluorine in the Earth's crust.
- **B.** Fluorine does not form ionic compounds.
- **C.** The lattice enthalpies of fluoride's ionic compounds tend to be low.
- **D.** Fluorides are less soluble than other halides.

Answer: D

10) Iodine trifluoride, IF_3, is a solid at 25°C and 1 atm, whereas iodine heptafluoride, IF_7, is a gas. What may be the reason for this?

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- **C.** Iodine trifluoride has a lower heat capacity.
- **D.** Iodine trifluoride has a smaller molar mass.

Answer: B

11) Which halogen is found in Teflon?

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Answer: C

12) Which of the following statements about helium are true?

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Answer: C

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14) Explain the low reactivity of the noble gases and the fact that the ease of compound formation increases down the group.

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- **D.** A large amount of energy is needed to break the bonds between the atoms of He and Ne molecules.

Answer: B

15) State whether each of the following oxides is acidic, basic, or amphoteric.
P_2O_5
NO_2
Sb_2O_3
As_4O_6
Bi_2O_3

Answer

Answer: P2O5, acidic; NO2, acidic; Sb2O3, amphoteric; As4O6, amphoteric; Bi2O3, basic

16) Which of the Group 15 elements is(are) a metalloid(s)?

- **A.** As only
- **B.** As and Sb

- **C.** P and As
- **D.** P, As, and Sb
- **E.** As, Sb, and Bi

Answer: B

17) Ammonium nitrate is explosive because

- **A.** the ammonium ion decomposes readily.
- **B.** the ammonium ion can be oxidized by the nitrate ion.
- **C.** the nitrate ion decomposes readily.
- **D.** the ammonium ion is readily reduced.
- **E.** nitrate reacts readily with oxygen in air.

Answer: B

18) Nitrogen triiodide can be prepared as the ammoniate, $NI_3 \cdot NH_3$. This compound is explosive when dry and decomposes according to the reaction below.

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In this reaction, nitrogen undergoes a change in oxidation number from

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- **D.** +6 to 0.
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Answer: A

19) White phosphorus

- **A.** is an amorphous substance.
- **B.** is not very toxic.
- **C.** is very unreactive.
- **D.** consists of large, random aggregates of phosphorus atoms.
- **E.** consists of tetrahedral P_4 molecules.

Answer: E

20) In the Ostwald process, the total change in oxidation number of nitrogen from reactant to nitric acid is

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Answer: D

21) When sulfur is produced by the Claus process, the starting material is

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- **B.** $Na_2SO_3(s)$.
- **C.** $SO_3(g)$.
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- **E.** $H_2S(g)$.

Answer: E

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- **E.** $O_2(g)$ and $O_3(g)$

Answer: E

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- **B.** dissolved in water to form oleum.
- **C.** dissolved in water to form $H_2SO_4(aq)$.
- **D.** dissolved in water to form $H_2SO_3(aq)$.
- **E.** oxidized to $SO_3(g)$.

Answer: E

24) The starting material for the production of sulfuric acid by the contact process is

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- **B.** $H_2S_2O_7(l)$.
- **C.** $S(g)$.

- **D.** $SO_3(g)$.
- **E.** $SO_2(g)$.

Answer: C

25) The stable forms of chlorine, bromine, and iodine at 25°C and 1 atm are

- **A.** $Cl_2(g)$, $Br_2(g)$, and $I_2(g)$.
- **B.** $Cl_2(g)$, $Br_2(l)$, and $I_2(s)$.
- **C.** $Cl_2(g)$, $Br_2(l)$, and $I_2(l)$.
- **D.** $Cl_2(g)$, Br(l), and I(s).
- **E.** $Cl_2(g)$, Br(l), and $I_2(g)$.

Answer: B

26) Which of the following noble gases is least likely to react with fluorine?

- **A.** Ar
- **B.** Rn
- **C.** Xe
- **D.** Kr
- **E.** Ne

Answer: E

27) Both ammonia and phosphine are soluble in water. Which is less soluble? Why?

Answer

Answer: PH3 is less soluble because it cannot form hydrogen bonds with water.

28) Which of the following is(are) true of sulfuric acid?

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- **C.** Sulfuric acid is a strong Brønsted acid.
- **D.** B, C, and D are all properties of sulfuric acid.

Answer: D

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- **D.** $2NO + O_2 \rightarrow 2NO_2$
- **E.** $N_2H_4 + O_2 \rightarrow N_2 + 2H_2O$

Answer: B

30) When hydrogen peroxide reacts with chlorine, the O_2 formed may be produced in an excited state and emit light. This process is called

- **A.** chemiluminescence.
- **B.** bioluminescence.
- **C.** phosphorescence.
- **D.** triboluminescence.
- **E.** incandescence.

Answer: A

31) What is the original source of nitrogen in the Ostwald process for the production of nitric acid?

- **A.** HN_3
- **B.** NH_3
- **C.** NO
- **D.** NO_2
- **E.** N_2

Answer: B

32) Which member of Group 16/VI is used in the vulcanization of rubber?

- **A.** O
- **B.** S
- **C.** Se
- **D.** Te
- **E.** Po

Answer: B

33) Which industry uses the most O_2?

- **A.** medical
- **B.** cosmetic
- **C.** chemical

- **D.** steel
- **E.** petrochemical

Answer: D

34) What is a common form of molecular sulfur?

- **A.** chains of S_4
- **B.** rings of S_4
- **C.** chains of S_8
- **D.** rings of S_8
- **E.** molecules of S_2

Answer: D

35) Which member of Group 17/VII is most abundant in the earth's crust?

- **A.** F
- **B.** Cl
- **C.** Br
- **D.** I
- **E.** At

Answer: A

36) Which member of Group 17/VII is most abundant in the earth's oceans?

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Answer: B

37) Organic compounds of which halide are used as textile flame retardants?

- **A.** F
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- **D.** I
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Answer: C

38) Which compounds is used as a source of oxygen and in fireworks and matches?

- **A.** NaClO
- **B.** NaBrO
- **C.** $NaClO_3$
- **D.** $KBrO_3$
- **E.** $KClO_3$

Answer: E

39) Which noble gas is most abundant in the atmosphere?

- **A.** He
- **B.** Ne
- **C.** Ar
- **D.** Kr
- **E.** Xe

Answer: C

40) Pyrite, which is commonly known as fool's gold, includes which main group element?

- **A.** Al
- **B.** S
- **C.** Si
- **D.** C
- **E.** P

Answer: B