

Name _____

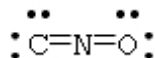
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) Which is the correct valence electron configuration for the 4A group?

- A) ns^1 B) ns^2 C) ns^1np^3 D) np^4 E) ns^2np^2

Answer: E

2) What is the formal charge on nitrogen in the figure below?



- A) -1 B) 0 C) -2 D) +2 E) +1

Answer: E

3) Which one of the following processes would be expected to be exothermic?

- A) $\text{K}^+ (\text{g}) + \text{Br}^- (\text{g}) \rightarrow \text{KBr} (\text{s})$
 B) $\text{K} (\text{g}) \rightarrow \text{K}^+ (\text{g}) + \text{e}^-$
 C) $\text{K} (\text{s}) \rightarrow \text{K} (\text{g})$
 D) $\text{Br}_2 (\text{l}) \rightarrow \text{Br}_2 (\text{g})$
 E) $\text{Br}_2 (\text{g}) \rightarrow 2 \text{Br} (\text{g})$

Answer: A

4) How many electrons are there in a filled 4f subshell?

- A) 2 B) 6 C) 10 D) 14 E) 18

Answer: D

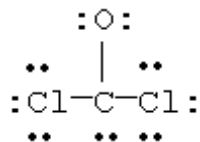
5) In an effusion experiment measuring distance as a function of time, an unknown gas moved 3.42 m in 60 s while O_2 under identical conditions moved 4.84 m. Calculate the molar mass of the unknown gas.

- A) 128 B) 16 C) 64 D) 48 E) 45

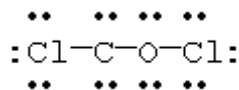
Answer: C

6) Which is the best Lewis structure for COCl_2 ? (Formal charges are not shown.)

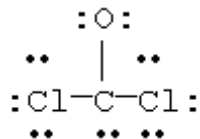
A)



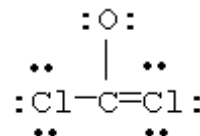
B)



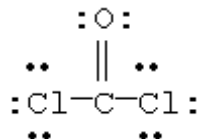
C)



D)



E)



Answer: E

7) How many pairs of electrons are there around the central atom in the Lewis structure of the following species?



A) 2

B) 3

C) 4

D) 5

E) 6

Answer: D

8) In which atom are the 3s and 3p orbitals equal in energy?

A) C

B) H

C) O

D) He

E) none of the above

Answer: B

9) Which of the following sets is not an acceptable set of quantum numbers.

A) $n = 2, \ell = 1, m_\ell = +1$

B) $n = 7, \ell = 3, m_\ell = +3$

C) $n = 2, \ell = 1, m_\ell = -1$

D) $n = 1, \ell = 0, m_\ell = 0$

E) $n = 3, \ell = 1, m_\ell = -3$

Answer: E

10) Which of the following is not a weak electrolyte?

A) HCOOH

B) HNO₃

C) CH₃COOH

D) NH₃

E) CH₃NH₂

Answer: B

11) How many electrons are there in the 3d orbitals of ground state calcium atom?

A) 0

B) 1

C) 2

D) 5

E) 10

Answer: A

12) What is the major factor driving the formation of NaBr (s) from Na (s) and Br₂ (g)?

A) The favorable lattice energy for NaBr.

B) The attraction of a single positive Na ion for a single negative Br ion.

C) The high electron affinity of bromine atoms.

D) The low heat of sublimation for sodium atoms.

E) The low ionization energy of the sodium atom.

Answer: A

13) Which of the following is a possible set of quantum numbers for a 3d electron?

(n, *l*, m_{*l*}, m_s)

A) 4, 3, 2, - $\frac{1}{2}$

B) 3, 3, 2, + $\frac{1}{2}$

C) 3, 0, 0, + $\frac{1}{2}$

D) 3, 1, 1, + $\frac{1}{2}$

E) 3, 2, 0, - $\frac{1}{2}$

Answer: E

14) A compound is found to form between As and Br. What is the most likely formula for this compound?

A) AsBr₃

B) As₂Br₃

C) As₂Br

D) AsBr

E) As₃Br

Answer: A

15) Boron exists as two isotopes: ¹⁰B with a mass of 10.0129 u and a fractional abundance of 0.1978, and ¹¹B with a mass of 11.00931 u and a fractional abundance of 0.8022. Calculate the atomic weight of boron.

A) 10.81

B) 11.01

C) 10.01

D) 10.51

E) 10.19

Answer: A

16) Which element would have the following configuration in the ground state?

[Ar]4s¹3d⁵

A) V

B) Cr

C) Mn

D) K

E) none of these

Answer: B

17) Which order is correct for increasing polarity (least polar first)?

C-C	C-Cl	C-F	C-I
A	B	C	D

- A) $A < D < B < C$
- B) $D < C < B < A$
- C) $A < B < C < D$
- D) $A < D < C < B$
- E) $C < B < A < D$

Answer: A

18) Predict which of the following bonds would be the weakest.

- | | | | | |
|---------|--------|----------|-----------------|----------|
| A) C-Cl | B) C-C | C) Cl-Cl | D) $C \equiv C$ | E) $C=C$ |
|---------|--------|----------|-----------------|----------|

Answer: C

19) How many orbitals are there of the 4f type?

- | | | | | |
|------|------|------|------|------|
| A) 2 | B) 3 | C) 5 | D) 7 | E) 9 |
|------|------|------|------|------|

Answer: D

20) Which of the following is not a true statement concerning the energy of orbitals?

- A) In high numbered principal shells of a multielectron atom, some subshells of different principal shells have nearly identical energies.
- B) All orbitals within a subshell of a multielectron atom are at the same energy level.
- C) Orbital energies are higher in multielectron atoms than in the hydrogen atom.
- D) In a multielectron atom, the various subshells of a principal shell are at different energy levels.
- E) In the hydrogen atom, all subshells of a principal shell are at the same energy level.

Answer: C

21) What keeps the electrons from leaving the atom in the Thompson "Raisin Pudding" model of the atom?

- A) A membrane on the surface of the cloud of positive charge
- B) Nothing stops them from leaving.
- C) They are embedded in a spherical cloud of positive charge.
- D) The repulsive forces between electrons
- E) The attractive force between the electrons and the nucleus

Answer: C

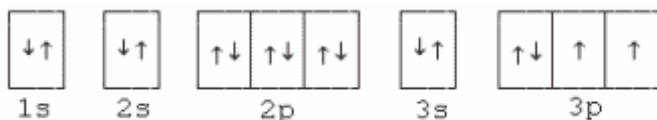
22) A mass spectrometer is a device that separates gaseous ions according to their

- A) charge.
- B) size.
- C) reactivity.
- D) mass.
- E) mass to charge ratio.

Answer: E

23) Which of the following orbital diagrams is not allowed in the ground state?

A)



B)



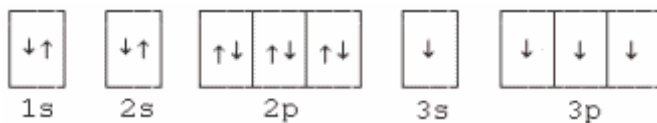
C)



D)



E)



Answer: E

24) Which p block element in the fifth-period has the most metallic character?

A) In

B) Sr

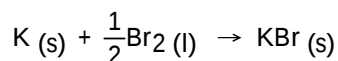
C) Al

D) As

E) Te

Answer: A

25) For potassium, the enthalpy of sublimation is 89 kJ/mol, and the first ionization energy is 419 kJ/mol. The bond dissociation energy of Br₂ (g) is 193 kJ/mol, and the electron affinity of bromine is -325 kJ/mol. The enthalpy of vaporization of Br₂ (l) is 31 kJ/mol. The lattice energy of KBr is -682 kJ/mol. Calculate the overall enthalpy change for the reaction:



A) -256

B) -780

C) -387

D) +256

E) -332

Answer: C

26) Which of the following subshell combinations are closest in energy?

A) 3p and 3d

B) 4s and 4p

C) 3d and 3s

D) 3d and 4p

E) 4s and 3d

Answer: E

27) Which set of elements is in an incorrect order of increasing first ionization energy (lowest value first, etc.)?

A) Li, Na, K

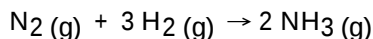
B) Al, B, C

C) Mg, Si, Cl

D) Te, S, O

Answer: A

28) Estimate the ΔH° , in kJ, for the following reaction from the bond energies given.



Bond energy (kJ/mol): N - N, 163; N=N, 418; N $\equiv$ N, 946; H - H, 436; N - H, 389.

- A) +863 B) +4588 C) +608 D) +80 E) -80

Answer: E

29) An orbital is best defined as

- A) a node where the probability of finding an electron is small.
 B) a region in space in which there is a high probability of finding an electron.
 C) a circular path that an electron takes around a nucleus.
 D) an energy level for neutrons.
 E) an orientation of the nucleus and electron in an atom.

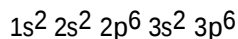
Answer: B

30) Which of the following subshell notations reflects an atom in the ground state?

- A) $1s^2 2s^2 2p^6 3s^2 3d^5$
 B) $1s^2 2s^2 2p^2 3s^1$
 C) $1s^2 2s^2 2p^6 3s^3$
 D) $1s^2 2s^2 3s^2$
 E) $1s^2 2s^2 2p^6$

Answer: E

31) Which anion would have the following electron configuration?



- A) Ca^{2+} B) O^{2-} C) F^- D) Cl^- E) S

Answer: D

32) What is the frequency, in Hz, of blue light with a wavelength of 465 nm?

- A) 465 B) 6.45×10^{14} C) 4.65×10^{14} D) 4.65 E) 1.55×10^{14}

Answer: B

Table 1 Consider the partial Periodic Table reproduced below.

Ge 32	As 33	Se 34
Sn 50	Sb 51	Te 52

33) Refer to table 1. Which element has the lowest ionization energy?

- A) Sn B) Se C) Te D) Ge

Answer: A

34) Refer to table 1. Which element has the greatest (most negative) electron affinity?

- A) Sn B) Se C) Ge D) Te

Answer: B

35) Calculate the wavelength, in nanometers, that corresponds to the radiation required to raise an electron from the $n = 3$ to the $n = 5$ energy level of a hydrogen atom. (Rydberg constant: 2.179×10^{-18} J, Planck's constant: 6.626×10^{-34} J·s)

- A) 1.55×10^{-19} B) 2.34×10^5 C) 1.28×10^{-4} D) 1.28×10^3 E) 2.34×10^{14}

Answer: D

36) If successive ionization energies are numbered 1, 2, 3, etc., arrange the following in the increasing order (lowest I first, etc.).

Li, (I_1)	Na, (I_1)	Li, (I_2)	Be, (I_2)
A	B	C	D

- A) $A < B < C < D$
 B) $B < C < B < D$
 C) $A < B < D < C$
 D) $B < A < C < D$
 E) $B < A < D < C$

Answer: E

37) Which of the following ions would be deflected to the greatest degree as it traveled through a magnetic sector mass spectrometer?

- A) Ag^+ B) Li^+ C) Cu^+ D) Na^+ E) K^+

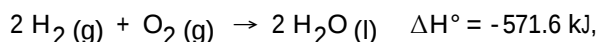
Answer: B

38) For which of the following types of electromagnetic radiation would the photons have the highest frequency?

- A) x-rays B) visible C) UV D) microwaves E) IR

Answer: A

39) Given the following equation,



which statement is incorrect?

- A) ΔH° for the reverse reaction is $+571.6$ kJ/mol.
 B) ΔH° for forming one mole of liquid water is -285.8 kJ/mol.
 C) The equation forming gaseous water would have a different ΔH° .
 D) ΔH° for the reaction of one-half mole of oxygen is -285.8 kJ/mol.
 E) The standard heat of formation of liquid water is -571.6 kJ/mol.

Answer: E

40) How many valence electrons are shown in the Lewis structure of NO_2^+ ?

- A) 11 B) 15 C) 16 D) 17 E) 18

Answer: C

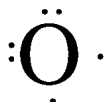
41) Which of the following is paramagnetic in atomic form?

- A) N B) He C) Zn D) Mg E) Be

Answer: A

42) Which of the following is the correct Lewis symbol for an atom of oxygen?

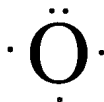
A)



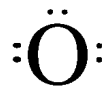
B)



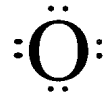
C)



D)



E)



Answer: A

43) Calculate the energy, in kilojoules, of one mole of photons of yellow laser light of wavelength 570 nm. (Planck's constant: $6.626 \times 10^{-34} \text{ J}\cdot\text{s}$)

A) 2.10×10^5

B) 2.10×10^2

C) 3.48×10^{-16}

D) 3.49×10^{-22}

E) 2.27×10^{-16}

Answer: B

44) Which of the following elements has the smallest atomic radius?

A) Si

B) F

C) P

D) S

E) O

Answer: B

45) In an experiment searching for the photoelectric effect, an incident beam of green light produced no ejected electrons from a metal. In order to eject electrons, the experimenter should

A) try blue light.

B) increase the brightness of the light.

C) try yellow light.

D) give up on that particular metal.

E) decrease the brightness of the light.

Answer: A

46) Which of the following electron transitions will emit a photon of the shortest wavelength in the Bohr hydrogen atom?

A) $n = 4$ to $n = 3$

B) $n = 1$ to $n = 5$

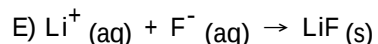
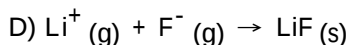
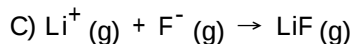
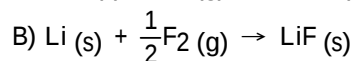
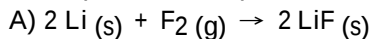
C) $n = 2$ to $n = 1$

D) $n = 3$ to $n = 1$

E) $n = 4$ to $n = 1$

Answer: E

47) Which equation corresponds to the lattice energy for lithium fluoride?



Answer: D

48) Which of the following elements is the least electronegative?

A) K

B) N

C) Sb

D) Mg

E) Se

Answer: A

49) Which of the following bonds is more ionic?

A) C-F

B) K-Cl

C) Mg-N

D) C-H

E) Si-Si

Answer: B

50) One can tell the difference between saturated and unsaturated fats, because

A) saturated fats can be converted to unsaturated fats by hydrogenation.

B) saturated fats have at least one C to C double bond.

C) there is no difference because they are both triglycerides.

D) unsaturated fats contain one or more alkene functional groups.

E) unsaturated fats have a higher melting point.

Answer: D