

991_3rd_Exam_991215

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

1) What is the frequency of radiation with a wavelength of 440. nm? ($C = 3.0 \times 10^8$ m/s)

- A) $2.02 \times 10^{-11} \text{ s}^{-1}$
- B) $6.81 \times 10^{14} \text{ s}^{-1}$
- C) $1.51 \times 10^{-27} \text{ s}^{-1}$
- D) $4.95 \times 10^{-12} \text{ s}^{-1}$
- E) $6.81 \times 10^5 \text{ s}^{-1}$

Answer: B

2) The existence of discrete (quantized) energy levels in an atom may be inferred from:

- A) atomic line spectra
- B) diffraction of electrons by crystals
- C) visible spectrum
- D) X-ray diffraction by crystals
- E) experiments on the photoelectric effect

Answer: A

3) The photoelectric effect:

- A) was discovered by Max Planck
- B) results in a beam of electrons which increases in number, but not velocity, as the wavelength of incident light decreases
- C) contradicted the view that light energy was dependent upon intensity only
- D) describes the phenomenon of producing light by shining a beam of electrons by on any metal surface
- E) is not the same principle used in modern electric eyes and solar calculators

Answer: C

4) What is the energy in joules of a mole of photons with the energy of the 434 nm spectral line of hydrogen? ($h = 6.62 \times 10^{-34} \text{ Js}$)

- A) $9.21 \times 10^{-4} \text{ J}$
- B) $2.76 \times 10^{-4} \text{ J}$
- C) $2.76 \times 10^5 \text{ J}$
- D) 434 J
- E) $5.78 \times 10^{-25} \text{ J}$

Answer: C

5) What is the wavelength of a bullet that is 0.450 g traveling at 2000. m/s?

- A) $1.49 \times 10^{-40} \text{ m}$
- B) $2.94 \times 10^{-24} \text{ m}$
- C) $7.36 \times 10^{-34} \text{ m}$
- D) 2000. m
- E) $7.36 \times 10^{-37} \text{ m}$

Answer: C

6) An atomic orbital represents:

- A) the region of electron density for a covalent bond
- B) the shape of an atom
- C) a fixed path that an electron follows around the nucleus of an atom
- D) the repulsion of all the electrons among themselves
- E) the region of high probability for an electron around the nucleus of an atom

Answer: E

7) The possible values of the magnetic quantum number, m_ℓ , of a $3p$ electron are:

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

Answer: E

8) All of the terms below are quantum numbers EXCEPT:

- A) magnetic
- B) spin
- C) valence
- D) orbital angular momentum
- E) principal

Answer: C

9) Which of the following statements about orbital shapes is NOT true?

- A) A $1s$ orbital is spherical.
- B) Four of the $3d$ orbitals are alike except for the orientation with respect to the axes.
- C) $2p$ orbitals have a node at $r = 0$.
- D) There are 5 $3d$ orbitals.
- E) There are only two $2p$ orbitals, each directed along an x or y axis.

Answer: E

10) Which of the following subshells is correctly designated?

- A) $3f^2$
- B) $4d^{11}$
- C) $2p^6$
- D) $3s^3$
- E) $1p^5$

Answer: C

11) Which of the following statements about electron spin is FALSE?

- A) The electron's magnetic field can be oriented in two directions in the presence of an external magnetic field.
- B) Electron spin only exists when $m_\ell = 0$.
- C) An experiment with silver atoms passing through a magnetic field seems to prove that electron spin exists.
- D) An electron produces a magnetic field.
- E) Paired electrons produced no net magnetic field.

Answer: B

- 12) Arrange the following in order of increasing ENERGY:
UV radiation, visible radiation, X-rays, and microwaves.
- A) visible < UV < X-rays < microwave
 - B) microwave < visible < UV < X-rays
 - C) X-ray < microwave < visible < UV
 - D) X-rays < microwave < UV < visible
 - E) UV < X-rays < microwave < visible

Answer: B

- 13) Use the spdf notation to write out the complete electron configuration of Br.
- A) [Ar] $3d^{10}4p^65s^2$
 - B) [Ar] $3d^{10}4s^24p^5$
 - C) [Kr] $3d^{10}4s^24p^4$
 - D) [Ar] $3d^94s^24p^6$
 - E) [Ar] $4s^24p^24d^9$

Answer: B

- 14) Why was Moseley so sure from his X-ray work that there were no other undiscovered elements besides the three that he predicted in the range of atomic numbers 13-79?
- A) All of the possible atomic weights were assigned.
 - B) The rows on the periodic table were filled.
 - C) The columns of the periodic table were full.
 - D) Mendeleev didn't predict any more.
 - E) All of the integer atomic numbers were assigned.

Answer: E

- 15) The transition elements refer to what group of elements?
- A) *d*-block elements
 - B) *s*-block elements
 - C) lanthanides
 - D) actinides
 - E) *p*-block elements

Answer: A

- 16) Which of the following pairs of elements are classified as metalloids?
- A) argon and neon
 - B) bromine and sulfur
 - C) aluminum and silicon
 - D) copper and silver
 - E) arsenic and germanium

Answer: E

- 17) Most transition elements form some monatomic ions that are not:
- A) isoelectronic with any neutral atom
 - B) isoelectronic with any other species
 - C) isoelectronic with any noble gas
 - D) isoelectronic with any other cations
 - E) isoelectronic with any other transition metal ion

Answer: C

18) Which of the following statements is INCORRECT?

- A) The ionization energy increases from left to right through a period of elements.
- B) The atomic radius decreases from left to right through a period of elements.
- C) The atomic radius increases down the periodic table.
- D) Cations are larger than the atoms from which they are formed.
- E) The metallic character of elements decreases from left to right through a period of elements.

Answer: D

19) Among the alkali metals, cesium reacts more rapidly than sodium because:

- A) cesium has more neutrons
- B) cesium has more protons
- C) cesium has a higher atomic weight
- D) the valence electron of cesium is at a greater average distance from the nucleus
- E) cesium has more electrons

Answer: D

20) Which of the following isoelectronic species has the largest radius?

- A) F^-
- B) Mg^{2+}
- C) Ne
- D) Na^+
- E) O^{2-}

Answer: E

21) Which of the following occurs for the representative elements going left to right across the period?

- A) The outer electrons are held more weakly.
- B) Electronegativity decreases.
- C) Atomic size increases.
- D) Forces of attraction between electron and nucleus increase because nuclear charge increases.
- E) none of these

Answer: D

22) The first ionization energy for rubidium is +403.0 kJ/mol. How much energy would be required to convert 17.1 g of gaseous rubidium to its gaseous +1 monatomic ion at constant temperature? (atomic mass of rubidium is 85.4078 g/mol)

- A) 40.4 kJ
- B) 34.5 kJ
- C) 80.6 kJ
- D) 68.9 kJ
- E) 185 kJ

Answer: C

23) Choose the INCORRECT statement.

- A) Ba^{2+} is smaller than Ba^+ .
- B) The rare gas atoms complete the filling of the p orbitals.
- C) The ionization energy of Ca^+ is greater than that for Ca^{++} .
- D) When a metallic element unites with a nonmetallic element, electrons are lost by atoms of the metal and gained by atoms of the nonmetals.
- E) Within a given sublevel, each orbital is usually occupied by a single electron before any orbital has two electrons.

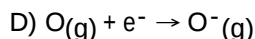
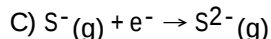
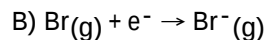
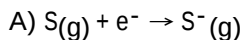
Answer: C

24) Which of the following elements is likely to have the largest second ionization energy?

- A) Mg
- B) Si
- C) Al
- D) Na

Answer: D

25) Which of the following reactions gives a positive value for the electron affinity?



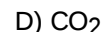
Answer: C

26) Which of the following species is diamagnetic?



Answer: B

27) Choose a basic oxide.



Answer: A

28) Chlorine has a large negative electron affinity. Therefore, chlorine is most likely to:

A) have a small first ionization energy

B) act as a reducing agent

C) release electrons readily to other atoms

D) form a basic oxide

E) act as an oxidizing agent

Answer: E

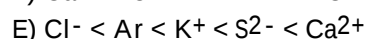
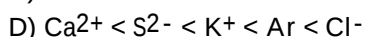
29) Which would you expect to have the highest melting point?



E) All have the same melting point.

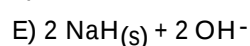
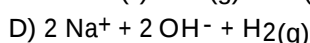
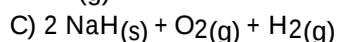
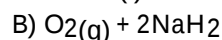
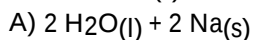
Answer: C

30) List in order of increasing size: Cl^- , Ar, K^+ , S^{2-} , Ca^{2+} .



Answer: C

31) Complete $2 \text{Na(s)} + 2 \text{H}_2\text{O} \rightarrow$



Answer: D

32) Choose the INCORRECT statement.

- A) The core electrons are called valence electrons.
- B) Covalent bonds are formed by atoms sharing electrons.
- C) Ionic bonds are formed from atoms by a transfer of electrons.
- D) Ionic bonds are formed by the attraction between cations and anions.
- E) An octet is 8 outer-shell electrons.

Answer: A

33) In which of the following molecules would you expect the nitrogen-to-nitrogen bond to be the shortest?

- A) N_2
- B) NH_3
- C) N_2O
- D) N_2O_4
- E) N_2H_4

Answer: A

34) Which chloride should have the greatest covalent character?

- A) NaCl
- B) KCl
- C) CaCl_2
- D) BeCl_2
- E) BaCl_2

Answer: D

35) Which of the following exhibits covalent bonding?

- A) OF_2
- B) NaF
- C) K_2S
- D) SrO
- E) LiH

Answer: A

36) Which of the following bonds is probably the most polar?

- A) Se-H in SeH_2
- B) C-H in CH_4
- C) O-H in H_2O
- D) N-H in NH_3
- E) P-H in PH_3

Answer: C

37) After drawing the Lewis dot structure of HC(O)OH , pick the INCORRECT statement from the following.

- A) The oxygen not also bonded to hydrogen has a double bond to carbon.
- B) The C-H bond is a single bond.
- C) The O-H bond is a single bond.
- D) The carbon has a lone pair.
- E) Both oxygens have two lone pairs.

Answer: D

38) As indicated by Lewis structures, which of the following molecules would probably be unstable?

- A) N_2H_6
- B) SiH_4
- C) CH_2F_2
- D) SF_4
- E) NH_3

Answer: A

39) Which of the following species exhibits resonance?

- A) PCl_5
- B) OF_2
- C) BrF_3
- D) ClO_3^-
- E) N_2

Answer: D

40) Which of the following has a molecular structure best described as involving an "incomplete octet"?

- A) BF_3
- B) NF_3
- C) OF_2
- D) F_2
- E) CF_4

Answer: A

41) Choose the correct statement about the compound SO_2 .

- A) The S atom has an unshared electron pair.
- B) The O atoms have no unshared electron pairs.
- C) The two S—O bonds have different lengths since one is a single bond and the other a double bond.
- D) The molecule has a linear structure.
- E) The S—O bonds are ionic in character.

Answer: A

42) Which of the following molecules is nonpolar?

- A) CHCl_3
- B) H_2O
- C) HClO_4
- D) HCN
- E) BCl_3

Answer: E

43) Which of the following species has a pyramidal structure?

- A) ClO_2
- B) ClO_4^-
- C) ClO_3^-
- D) ClO_2^-

Answer: C

44) Given the bond enthalpies C—C (348), C=O (707), O=O (498), H—O (464), C—H (414) all in kJ/mol, compute ΔH° kJ/mol for the complete combustion of C_7H_{16} .

- A) $+2.57 \times 10^3$ kJ/mol
- B) -2.57×10^3 kJ/mol
- C) -2.93×10^3 kJ/mol
- D) -3.13×10^3 kJ/mol
- E) -2.43×10^3 kJ/mol

Answer: D

45) After drawing the Lewis dot structure for CH_2O , determine the number of single bonds, double bonds, and lone pairs on the central atom.

- A) 3, 0, 1
- B) 3, 1, 0
- C) 2, 1, 0
- D) 2, 1, 1
- E) 1, 2, 0

Answer: C

46) What is the formal charge on N in NO_3^- ?

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

Answer: E

47) The electron-pair geometry of H_2O is _____.

- A) tetrahedral
- B) linear
- C) bent
- D) V-shaped
- E) trigonal planar

Answer: A

48) Enthalpy is defined as:

- A) the sum of the kinetic and potential energies
- B) the energy contained within a system
- C) the heat of combustion
- D) the work not limited to pressure volume work
- E) the sum of the internal energy and the pressure-volume product of a system

Answer: E

49) What is the work done in joules by the system when H_2 expands against a constant pressure of 75 atm at 45.3°C ? The change in volume is 24.0 L.

A) $-1.8 \times 10^5 \text{ J}$

B) $8.2 \times 10^4 \text{ J}$

C) $1.8 \times 10^3 \text{ J}$

D) $-8.2 \times 10^4 \text{ J}$

E) $1.8 \times 10^5 \text{ J}$

Answer: A

50) The addition of 2.0 g He(g) to a vessel of 10.0 L fixed volume already containing $\text{O}_2(\text{g})$ at 25°C and 740 mmHg will:

A) have no effect on the final gas pressure

B) cause the final pressure to exceed 2 atm

C) bring the final pressure to just slightly more than 1 atm

D) cause the final pressure to exceed 4 atm

E) produce a 20% increase in gas pressure

Answer: B