

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

- 1) Calculate the energy change, in joules, that occurs when an electron is raised from the $n = 3$ to the $n = 5$ energy level of a hydrogen atom. (Rydberg constant: $2.179 \times 10^{-18} \text{ J}$)

A) 0.872 B) -1.55 C) 1.55×10^{-19} D) -2.42 E) 2.42×10^{-19}

Answer: C

- 2) Calculate the frequency, in s^{-1} , of the radiation absorbed when an electron is raised from the $n = 3$ to $n = 5$ energy level of a hydrogen atom. (Planck's constant: $6.626 \times 10^{-34} \text{ J s}$)

A) 2.34×10^{14} B) 7.33×10^7 C) 1.36×10^{-19} D) 486.1 E) 4.09×10^{-19}

Answer: A

- 3) 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.

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

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

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

Answer: E

- 5) A laser produces red light of wavelength 632.8 nm. Which energy of 1 mol of photons of this red light (in kilojoules)?

A) 209.8 kJ/mol B) 199.7 kJ/mol C) 189.1 kJ/mol D) 99.8 kJ/mol

Answer: C

- 6) The maximum wavelength of light that will cause ejection of a photoelectron in silver metal is 262 nm. What is the threshold energy or minimum energy, in J, required to eject an electron from silver? (Planck's constant: $6.626 \times 10^{-34} \text{ J s}$)

A) 7.59×10^{19} B) 1.21×10^{15} C) 8.73×10^{-16} D) 7.59×10^{-19} E) 1.31×10^{18}

Answer: D

- 7) For which of the following types of electromagnetic radiation would the photons have the greatest energy?

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

Answer: A

- 8) What is the approximate mass-to-charge ratio for Br^- ion? (charge per electron = $-1.602 \times 10^{-19} \text{ C}$)

A) $-8.29 \times 10^{-4} \text{ kg/C}$
 B) $-8.29 \times 10^{-7} \text{ kg/C}$
 C) $+8.29 \times 10^{-7} \text{ kg/C}$
 D) $-2.00 \times 10^{-21} \text{ kg/C}$
 E) $+2.00 \times 10^{-10} \text{ kg/C}$

Answer: B

9) Calculate the wavelength, in nanometers, of an electron moving at a speed of 3.84×10^5 m/s. The mass of an electron is 9.11×10^{-31} kg. (Planck's constant: 6.626×10^{-34} J s, $1 \text{ J} = 1 \text{ kg} \cdot \text{m}^2 \cdot \text{s}^{-2}$)

- A) 6.77×10^{-4} B) 1.89 C) 1.48×10^3 D) 3.84×10^5 E) 0.53

Answer: B

10) What is the lowest-numbered principal shell in which $m_\ell = 1$ is possible?

- A) 0 B) 1 C) 2 D) 3 E) 4

Answer: C

11) How many electrons are there in a complete filled $n = 3$ principal shell?

- A) 2 B) 6 C) 8 D) 18 E) 32

Answer: D

12) How many subshells, which determines the shape of the orbitals, are there in an energy level with $n = 4$?

- A) 1 B) 2 C) 3 D) 4 E) 5

Answer: D

13) For which subshell notation is correct for the set of quantum numbers with $n = 2$ and $\ell = 0$?

- A) 2s B) 2p C) 3s D) 3p E) 3d

Answer: A

14) Which of the following is a possible set of quantum numbers for a 4f electron?

(n, ℓ, m_ℓ, m_s)

- A) 3, 4, 3, $+\frac{1}{2}$
B) 4, 3, 3, $+\frac{1}{2}$
C) 4, 3, -4, $-\frac{1}{2}$
D) 4, 2, 1, $-\frac{1}{2}$
E) 4, 2, 2, $+\frac{1}{2}$

Answer: B

15) Which element in ground state has the electron configuration: $[\text{Kr}]5s^2 4d^{10} 5p^2$?

- A) Sb B) Sn C) Pb D) Ge E) Te

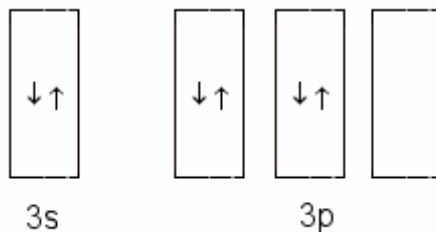
Answer: B

16) For which element would the outer shell electrons be described as $2s^2 2p^2$?

- A) Mg B) C C) Si D) S E) O

Answer: B

17) Consider the orbital diagram shown below:



Which, if any, of the principles that determine the most stable electron configuration does this configuration violate?

- A) Aufbau Principle
- B) Pauli exclusion principle
- C) Hund's rule
- D) Periodicity Principle
- E) Uncertainty Principle

Answer: C

18) 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

19) In which atom is the 2p subshell lowest in energy?

- A) N
- B) Be
- C) C
- D) Li
- E) B

Answer: A

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

- A) Mg < Si < Cl
- B) Te < S < O
- C) Li < Na < K
- D) Al < B < C

Answer: C

21) Which order is correct for increasing radius (least radius first)?

- A) $\text{Br}^- < \text{Cl} < \text{Br} < \text{P}$
- B) $\text{P} < \text{Br} < \text{Br}^- < \text{Cl}$
- C) $\text{Br}^- < \text{Br} < \text{P} < \text{Cl}$
- D) $\text{Br}^- < \text{Cl} < \text{P} < \text{Br}$
- E) $\text{Cl} < \text{P} < \text{Br} < \text{Br}^-$

Answer: E

22) Which of the following atoms has the most negative first electron affinity?

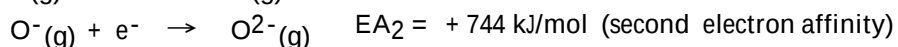
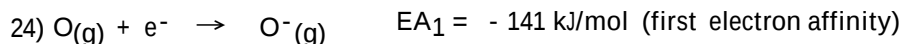
- A) Cl
- B) Ga
- C) Na
- D) Sb
- E) More information is needed.

Answer: A

23) Which of the following is paramagnetic with three unpaired electrons?

- A) Li
- B) Al
- C) As
- D) S
- E) Br

Answer: C



Which of the values given is a reasonable estimate of the second electron affinity for sulfur?

- A) -200 kJ/mol B) $+450 \text{ kJ/mol}$ C) $+800 \text{ kJ/mol}$ D) $+1200 \text{ kJ/mol}$

Answer: B

25) Which of the following is a p-block element?

- A) Br B) Cs C) Be D) Mn E) Ce

Answer: A

26) Which of the following atoms is a noble gas?

- A) Ne B) Li C) As D) N E) Ba

Answer: A

27) Which of the following is a metalloid?

- A) C B) Se C) Si D) Fr E) Rn

Answer: C

28) Which of the following elements, when combined with fluorine, would produce the most nonpolar covalent bond?

- A) Be B) F C) K D) Si E) Co

Answer: B

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

- | | | | |
|------|-------|------|-------|
| S-Cl | Si-Cl | P-Cl | Si-Si |
| A | B | C | D |

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

Answer: E

30) How many valence electrons are there in Be?

- A) 4 B) 2 C) 5 D) 1 E) 3

Answer: B

31) How many valence electrons are there in the electron configuration for F^- ?

- A) 1 B) 6 C) 7 D) 8 E) 9

Answer: D

32) What is the correct formula for the product of the reaction of strontium metal and nitrogen?

- A) Sr_3N_2 B) SrN C) SrN_2 D) Sr_2N_3 E) SrN_3

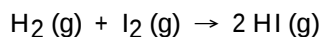
Answer: A

33) Which of the following is the correct Lewis symbol for Br⁻?

- A) $\begin{array}{c} \cdot\cdot \\ \vdots \text{Br} \cdot \\ \cdot \end{array}$ B) $\begin{array}{c} \cdot\cdot \\ \vdots \text{Br} \vdots \\ \cdot\cdot \end{array}$ C) $\begin{array}{c} \cdot\cdot \\ \vdots \text{Br} \vdots \\ \cdot \end{array}$ D) $\begin{array}{c} \cdot\cdot \\ \cdot \text{Br} \cdot \\ \cdot \end{array}$ E) $\begin{array}{c} \cdot \\ \cdot \text{Br} \cdot \\ \cdot \end{array}$

Answer: B

34) Estimate the ΔH° , in kJ, for the following reaction, 1 mol H₂(g) react with 1 mol I₂(g):



Bond energy (kJ/mol): H-H, 436; H-I, 297; I-I, 151.

- A) +7 B) 884 C) -290 D) +290 E) -7

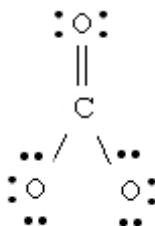
Answer: E

35) Which of the following is the correct structural formula for 1-pentyne?

- A) CH₃CH₂CH₂CH₂CH=CH₂
 B) CH₃CH₂CH₂CH=CH₂
 C) CH₃CH₂CH=CHCH₃
 D) CH₃CH₂CH₂C≡CH
 E) CH₃CH(CH₃)CH=CH₂

Answer: D

36) What is the formal charge on each oxygen in the figure below?



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

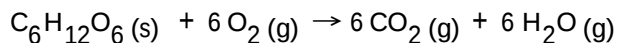
Answer: B

37) Which equation corresponds to the heat of formation for lithium fluoride?

- A) $\text{Li}(\text{s}) + \frac{1}{2}\text{F}_2(\text{g}) \rightarrow \text{LiF}(\text{s})$
 B) $\text{Li}^+(\text{g}) + \text{F}^-(\text{g}) \rightarrow \text{LiF}(\text{g})$
 C) $\text{Li}^+(\text{aq}) + \text{F}^-(\text{aq}) \rightarrow \text{LiF}(\text{s})$
 D) $\text{Li}^+(\text{g}) + \text{F}^-(\text{g}) \rightarrow \text{LiF}(\text{s})$
 E) $2 \text{Li}(\text{s}) + \text{F}_2(\text{g}) \rightarrow 2 \text{LiF}(\text{s})$

Answer: A

- 38) The heat capacity of a bomb calorimeter is found to be $5.68 \text{ kJ } ^\circ\text{C}^{-1}$. When a 1.652 g sample of glucose, $\text{C}_6\text{H}_{12}\text{O}_6$, is burned in the calorimeter, the temperature of the calorimeter increases from 24.56°C to 29.10°C . Calculate the ΔH for the following reaction:



- A) 25.8 kJ
- B) -25.8 kJ
- C) 15.6 kJ
- D) -42.6 kJ
- E) $-2.81 \times 10^3 \text{ kJ}$

Answer: E

- 39) Calculate the molarity of Br^- ions in $250. \text{ mL}$ of a solution containing 25.9 g NaBr and $0.155 \text{ moles of HBr}$.

- A) 0.155
- B) 1.55
- C) 1.266
- D) 1.00
- E) Additional information is necessary.

Answer: C

- 40) At 25°C and constant pressure, carbon monoxide gas combines with oxygen gas to give carbon dioxide gas with the evolution of 10.1 kJ per gram of carbon monoxide consumed. What is the value of ΔH for the balanced reaction?

- A) 283 kJ/mol
- B) -566 kJ/mol
- C) 141 kJ/mol
- D) -141 kJ/mol
- E) -283 kJ/mol

Answer: B