

CHEMISTRY

1. CHEMISTRY

Writer: American Heritage

Toss Up: Short Answer

What type of hybridization occurs in the molecule sulfur hexafluoride?

Bonus Answer: $d^2 sp^3$

Bonus: Multiple Choice

Which of the following best describes a bonding molecular orbital

W) A molecular orbital lower in energy than the atomic orbitals of which it is composed

X) A molecular orbital higher in energy than the atomic orbitals of which it is composed

Y) A molecular orbital equal in energy to the atomic orbitals of which it is composed

Z) A molecular orbital with exactly twice the energy of the atomic orbitals of which it is composed

Bonus Answer: W

2. CHEMISTRY

Writer: American Heritage

Toss Up: Multiple Choice

Which of the following compounds is soluble in water at room temperature?

W) $AgSO_4$

X) CaS

Y) $CaSO_4$

Z) PbF_2

Toss Up Answer: X

Bonus: Short Answer

A solution is prepared with an unknown solvent, and $NaNO_3$. 4L of the solvent are mixed with 42 moles of $NaNO_3$ to produce a 7 molar solution. Find the density of the solvent in grams per centimeter cubed.

Bonus Answer: 1.5 g/cm^3

3. CHEMISTRY

Writer: American Heritage

Toss Up: Multiple Choice

Which of the following elements has the highest first ionization energy?

W) Boron

X) Nitrogen

Y) Carbon

Z) Oxygen

Toss Up Answer: X

Bonus: Multiple Choice

Livermorium (element 116) was synthesized by bombarding curium (element 96) with what other element?

W) Neon

X) Argon

Y) Titanium

Z) Calcium

Bonus Answer: Z

4. CHEMISTRY

Writer: Stuyvesant

Toss Up: Multiple Choice

What form of hybridization is found in Sulfur Hexafluoride?

- W) sp^3
- X) sp^3d^2
- Y) sp^3d^3
- Z) sp^4d^3

Toss Up Answer: X

Bonus: Multiple Choice

Which of the following amino acids is aromatic?

- W) Tryptophan
- X) Glutamic Acid
- Y) Methionine
- Z) Lysene

Bonus Answer: W

5. CHEMISTRY

Writer: Stuyvesant

Toss Up: Multiple Choice

Which of the following is the ionic charge of the Dimercury ion?

- W) $1+$
- X) 0
- Y) $2+$
- Z) $1-$

Toss Up Answer: Y

Bonus: Short Answer

What is the electron configuration of Iron(III)? Include its full electron configuration.

Bonus Answer: $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5$

6. CHEMISTRY

Writer: Stuyvesant

Toss Up: Short Answer

What is the name of the elements in Group 16?

Bonus Answer: Chalcogens (Accept: Chalcogen, Oxygen Family)

Bonus: Short Answer

When Carbonic acid is created what does it always decompose into?

Bonus Answer: Dihydrogen Monoxide and Carbon Dioxide (Accept: H_2O and CO_2 , Water and CO_2)

7. CHEMISTRY

Writer: Centennial

Toss Up: Short Answer

What is the most significant component in duralumin, other than aluminum?

Bonus Answer: Copper

Bonus: Short Answer

The addition of copper makes the alloy susceptible to which process, from which pure aluminum is usually protected?

Bonus Answer: Corrosion

8. CHEMISTRY

Writer: Centennial

Toss Up: Short Answer

63/37 leaded solder is this type of mixture, which melts at once instead of melting as components.

Bonus Answer: Eutectic

Bonus: Short Answer

Apart from tin whiskers, lead-free solder also suffers from this problem at low temperatures.

Bonus Answer: Tin pest

9. CHEMISTRY

Writer: Granada Hills

Toss Up: Multiple Choice

What is the name of the group of the periodic table that includes selenium?

W) Halogens

X) Noble gases

Y) Alkali metals

Z) Chalcogens

Toss Up Answer: Z

Bonus: Short Answer

What is the general name of the compounds that are highly toxic and are formed from reacting ammonia with baking soda?

Bonus Answer: Chloramines

10. CHEMISTRY

Writer: Granada Hills

Toss Up: Short Answer

Helium has a molar mass of 4 grams per mole and effuses at a rate of 10 moles per minute. If you have an unknown gas with a molar mass of 16 grams per mole, How many moles per minute would it effuse at?

Bonus Answer: 5

Bonus: Short Answer

By name or number, indicate all of the following choices that would undergo SN1.

I. 2-bromo-2-methylpropane

II. CH₃CHCHCH₂Cl

III. Polyethylene

Bonus Answer: I only

11. CHEMISTRY

Writer: Granada Hills

Toss Up: Short Answer

What element has one electron in the 4f subshell?

Bonus Answer: Lanthanum

Bonus: Multiple Choice

The compound NbCl_5 would have which of the following shapes?

- W) octahedral
- X) seesaw
- Y) square planar
- Z) trigonal bipyramidal

Bonus Answer: W

12. CHEMISTRY

Writer: Centennial

Toss Up: Short Answer

How many alkenes have the formula of C_4H_8 ?

Bonus Answer: four

Bonus: Short Answer

Rank the following elements in increasing order of melting point: vanadium, iron, cobalt, tantalum

Bonus Answer: cobalt, iron, vanadium, tantalum

13. CHEMISTRY

Writer: Brooklyn Tech

Toss Up: Short Answer

What type of energy release allows the formation of ionic bonds to be an exothermic process?

Bonus Answer: lattice energy

Bonus: Short Answer

How many electrons fill the f orbital?

Bonus Answer: 14

14. CHEMISTRY

Writer: Brooklyn Tech

Toss Up: Multiple Choice

Which of the following two compounds will react in an aqueous solution to form a precipitate?

- W) Ammonium Nitrate and Sodium Chloride
- X) Potassium Hydroxide and Calcium Acetate
- Y) Magnesium Bromide and Sodium Chromate
- Z) Lead Chlorate and Potassium Sulfide

Toss Up Answer: Z

Bonus: Short Answer

Which isotope of Uranium is fissile?

Bonus Answer: Uranium-235

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15. CHEMISTRY

Writer: Brooklyn Tech

Toss Up: Multiple Choice

Bromine is a

W) black solid

X) red liquid

Y) colorless gas

Z) highly inflammable gas

Toss Up Answer: X

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Bonus: Multiple Choice

Which of the following is not an isotope of hydrogen?

W) Tritium

X) Deuterium

Y) Protium

Z) Yttrium

Bonus Answer: Z

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16. CHEMISTRY

Writer: Brooklyn Tech

Toss Up: Multiple Choice

The inert gas which is substituted for nitrogen in the air used by deep sea divers for breathing, is

W) Argon

X) Xenon

Y) Helium

Z) Krypton

Toss Up Answer: Y

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Bonus: Multiple Choice

The property of a substance to absorb moisture from the air on exposure is called

W) osmosis

X) deliquescence

Y) efflorescence

Z) desiccation

Bonus Answer: X

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17. CHEMISTRY

Writer: Brooklyn Tech

Toss Up: Short Answer

How many electrons can fill the d orbital?

Bonus Answer: 10 electrons

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Bonus: Short Answer

If a process is only thermodynamically favorable at high temperatures then it has...

Bonus Answer: High enthalpy and high entropy

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18. CHEMISTRY

Writer: Brooklyn Tech

Toss Up: Multiple Choice

What is the name of CoCl_2 ?

W) Cobalt(II) Chloride

X) Cobalt(III) Chloride

Y) Copper(II) Chloride

Z) Copper(III) Chloride

Toss Up Answer: W

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Bonus: Short Answer

What type of compound is CoCl_2 ?

Bonus Answer: Ionic Compound

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19. CHEMISTRY

Writer: Brooklyn Tech

Toss Up: Short Answer

At what point does a liquid boil?

Bonus Answer: When the vapor pressure and atmospheric pressure are equal.

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Bonus: Short Answer

Which term is used to describe the resistance to flow of a liquid?

Bonus Answer: viscosity

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20. CHEMISTRY

Writer: Brooklyn Tech

Toss Up: Multiple Choice

At what temperature in degrees Celsius is water most dense?

W) 11

X) 4

Y) 0

Z) -5

Toss Up Answer: X

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Bonus: Multiple Choice

In which compound or molecule is Oxygen's oxidation number not -2?

W) Hydrogen oxide

X) Hydrogen fluoride

Y) Dioxygen difluoride

Z) Potassium hydroxide

Bonus Answer: Y

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21. CHEMISTRY

Writer: Lakeside

Toss Up: Short Answer

Order the following three gases from least to greatest in terms of value of b in the Van der Waals equation: Benzene, Neon, and Hydrogen.

Bonus Answer: HYDROGEN, NEON, BENZENE

Bonus: Multiple Choice

Adding an inert gas into a gas-phase equilibrium at constant volume will result in an equilibrium shift in which direction?

- W) the equilibrium will shift towards the side with fewer moles of gas
- X) the equilibrium will shift towards the side with more moles of gas
- Y) the equilibrium will not shift
- Z) it depends on the gas

Bonus Answer: Y

22. CHEMISTRY

Writer: Lakeside

Toss Up: Short Answer

What is the hybridization and the molecular geometry about the central atom in the molecule phosphorous pentachloride?

Bonus Answer: DSP3 AND TRIGONAL BIPYRAMIDAL

Bonus: Short Answer

What is the bond order for diatomic oxygen?

Bonus Answer: TWO

23. CHEMISTRY

Writer: Lakeside

Toss Up: Multiple Choice

Which of the following is true about Raoult's Law?

- W) total vapor pressure of a solution is based on the vapor pressures and mole fractions of the constituents
- X) there is no such thing as a nonideal solution when using Raoult's law
- Y) low boiling azeotropes can be fractionally distilled via addition of another chemical
- Z) ideal solutions contain constituents that have stronger intermolecular interactions with the each other than themselves

Toss Up Answer: W

Bonus: Short Answer

Because Gibbs free energy is limited to isobaric reactions, which thermodynamic potential is used instead, which assumes constant temperature and volume?

Bonus Answer: HELMHOLTZ FREE ENERGY

24. CHEMISTRY

Writer: Brooklyn Tech

Toss Up: Multiple Choice

Which element has the highest electronegativity?

- W) Bromine
- X) Krypton
- Y) Iodine
- Z) Xenon

Toss Up Answer: X

Bonus: Multiple Choice

What is the anhydride of sulfuric acid?

- W) Hydrogen Sulfide
- X) Hydrogen Oxide
- Y) Sulfur Dioxide
- Z) Sulfur Trioxide

Bonus Answer: Z

25. CHEMISTRY

Writer: Brooklyn Tech

Toss Up: Multiple Choice

Which of the following hydrocarbons is the most reactive?

- W) C₂H₆
- X) C₂H₄
- Y) C₂H₂
- Z) CH₄

Toss Up Answer: Y

Bonus: Short Answer

What is the name of the acid mixture that can dissolve Gold?

Bonus Answer: Aqua Regia

26. CHEMISTRY

Writer: Brooklyn Tech

Toss Up: Multiple Choice

Which of the following substances would be expected to have the highest melting point?

- W) Sodium Chloride
- X) Calcium Chloride
- Y) Potassium Hydride
- Z) Magnesium Oxide

Toss Up Answer: Z

Bonus: Multiple Choice

HF is a weak acid when compared with HCl. How can this be explained?

- W) HF has a stronger covalent bond than does HCl
- X) HF has a weaker covalent bond than does HCl
- Y) HF has hydrogen bonding, while HCl has dipole-dipole bonding
- Z) HF has dipole-dipole bonding, while HCl has hydrogen bonding

Bonus Answer: W

27. CHEMISTRY

Writer: Brooklyn Tech

Toss Up: Multiple Choice

Sodium hydroxide and copper(II) nitrate solutions are mixed. What precipitates out?

- W) No precipitate because no reaction occurs

- X) Copper
- Y) Sodium Nitrate
- Z) Copper(II) Hydroxide

Toss Up Answer: Z

Bonus: Short Answer

What is the oxidation number of Manganese in MnO_2 ?

Bonus Answer: +4

28. CHEMISTRY

Writer: Brooklyn Tech

Toss Up: Short Answer

What is the most electropositive element on the periodic table?

Bonus Answer: Francium

Bonus: Short Answer

What is the lightest element to have isotopes that are all radioactive?

Bonus Answer: Technetium

29. CHEMISTRY

Writer: Brooklyn Tech

Toss Up: Multiple Choice

The law which states that the amount of gas dissolved in a liquid is proportional to its partial pressure is

- W) Dalton's law
- X) Gay Lussac's law
- Y) Henry's law
- Z) Raoult's law

Toss Up Answer: Y

Bonus: Multiple Choice

The most malleable metal is

- W) platinum
- X) silver
- Y) iron
- Z) gold

Bonus Answer: Z

30. CHEMISTRY

Writer: Venice

Toss Up: Multiple Choice

Which of the following is not a copolymer?

- W) Myoglobin
- X) Polyvinyl chloride
- Y) High-impact polystyrene
- Z) Teflon

Toss Up Answer: Z

Bonus: Short Answer

If the cathode of a galvanic cell is copper, name all of the following four elements that would not produce a spontaneous current when placed at the other electrode: 1) zinc; 2) manganese; 3) gold; 4) hydrogen

Bonus Answer: MANGANESE AND GOLD (ACCEPT: 2 AND 3)

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31. CHEMISTRY

Writer: Venice

Toss Up: Short Answer

You have a solution with a mixture of common cations. What acid could you add to the solution if you only wanted to remove the silver, lead, and mercurous ions?

Bonus Answer: HYDROCHLORIC AID

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Bonus: Multiple Choice

Given that the K_a of hypochlorous acid is 3.5×10^{-8} [three point five times ten to the negative eighth], which of the following best approximates the pH of a 0.1 M solution of hypochlorous acid?

W) 1.2

X) 4.2

Y) 6.4

Z) 7.6

Bonus Answer: X

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32. CHEMISTRY

Writer: Venice

Toss Up: Short Answer

A combination of which two acids in a 3:1 ratio has a large enough standard reduction potential to dissolve gold and platinum?

Bonus Answer: HYDROCHLORIC ACID AND NITRIC ACID

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Bonus: Multiple Choice

For which of the following molecules do enantiomers not exist?

W) 2-butanol

X) Dichloromethane

Y) 1,1-chlorofluoropropane

Z) 3-hexanol

Bonus Answer: X

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