

CHS 1440-0001  
Exam 1 version A

Fall Semester, Sep. 2021  
A **UCF ID** is required.

On your pink TEST FORM, write your correct **Name** and the **Date**.

Shade in the following: correct **PID**; **test version (form)**. **Your grade cannot be posted in webcourses if your PID or test form, or both, are incorrect or missing!**

Use of a nonprogrammable (nongraphing) calculator is permitted, e.g., TI-30X series! No graphing calculators, nor cell phones. All other electronic devices should be properly stored away.

Read the questions and the answers carefully. Write/work on the test!

*Choose the correct answer to each question. There are total **20** questions with 5 choices, a-e!!*

A periodic table is attached.

The useful constants and relationships are attached.

The solubility guideline table is attached.

1. Which of the following represent(s) a chemical change?

1. melting of ice.
2. rusting of an iron bridge.
3. burning of a wooden stick.
4. dissolving of sugar in water.
5. electrolysis of water.

a) 1 and 3              b) 1, 3 and 4              c) 2 and 4              d) 1 to 4              **e) 2, 3 and 5**

2. The name of the compound is copper (I) oxide. This implies that

- a) the ratio of copper to oxygen is 1.
- b) copper is a nonmetal.
- c) the empirical formula is  $\text{Cu}_2\text{O}$ .**
- d) the charge on the copper is 1-.
- e) there is one copper atom in the compound.

3. What is the net ionic equation for the reaction between aqueous sodium hydroxide and aqueous nitric acid?

- a)  $\text{HNO}_3(\text{aq}) + \text{NaOH}(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l}) + \text{NaNO}_3(\text{aq})$
- b)  $\text{Na}^+(\text{aq}) + \text{OH}^-(\text{aq}) + \text{H}^+(\text{aq}) + \text{NO}_3^-(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l}) + \text{Na}^+(\text{aq}) + \text{NO}_3^-(\text{aq})$
- c)  $\text{HNO}_3(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l}) + \text{NO}_3^-(\text{aq})$
- d)  $\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l})$**
- e)  $\text{Na}^+(\text{aq}) + \text{NO}_3^-(\text{aq}) \rightarrow \text{NaNO}_3(\text{aq})$

4. Give the name of the following compound:  $\text{N}_2\text{O}$

- a) nitrogen oxide                      **b) dinitrogen monoxide**                      c) nitrogen monoxide
- d) dinitrogen oxide                      e) dinitrogen monooxygen

5. Which of the following properties of metal is (are) chemical properties?

I. It dissolves in acid    II. It rusts in air    III. Its density is  $5.5 \text{ g/cm}^3$     IV. It melts at  $420^\circ\text{C}$

**a) I and II**              b) II and IV              c) II only              d) III and IV              e) all of I to IV

6. Determine the initial volume needed to generate 4.50 L of 1.60 M  $\text{HNO}_3$  from 2.40 M  $\text{HNO}_3$  by dilution.
- a) 4.50 L      **b) 3.00 L**      c) 2.40 M      d) 1.60 L      e) 6.75 mL
7. A liquid boils at  $-452.2^\circ\text{F}$ . What is this temperature in Kelvin?
- a)  $-195.8\text{ K}$       b)  $-47.2\text{ K}$       **c)  $4.2\text{ K}$**       d)  $77.4\text{ K}$       e)  $160.2\text{ K}$
8. How many protons, neutrons, and electrons are in the  $^{41}\text{Ca}$  atom?
- a) 41 protons, 0 neutrons, 41 electrons      **b) 20 protons, 21 neutrons, 20 electrons**  
c) 21 protons, 20 neutrons, 21 electrons      d) 20 protons, 21 neutrons, 21 electrons  
e) 21 protons, 20 neutrons, 20 electrons
9. Determine the simplest formula of the compound which has the composition 74.0 % C, 8.65 % H, and 17.4 % N by mass.
- a) CHN  
b)  $\text{C}_3\text{H}_5\text{N}_2$   
c)  $\text{C}_4\text{H}_5\text{N}_2$   
**d)  $\text{C}_5\text{H}_7\text{N}$**   
e)  $\text{C}_6\text{H}_7\text{N}$
10. Which of the following is an example of an alcohol?
- a)  $\text{CH}_3\text{CHO}$       b)  $\text{CH}_3\text{OCH}_3$       c)  $\text{CH}_3\text{COOH}$       d)  $\text{CH}_3\text{NH}_2$       **e)  $\text{C}_2\text{H}_5\text{OH}$**
11. Write a balanced chemical equation describing the reaction between butane ( $\text{C}_4\text{H}_{10}$ ) and oxygen ( $\text{O}_2$ ) to form carbon monoxide and water?
- a)  $\text{C}_4\text{H}_{10} (l) + \text{O}_2 (g) \rightarrow \text{CO} (g) + \text{H}_2\text{O} (l)$   
**b)  $2\text{C}_4\text{H}_{10} (l) + 9\text{O}_2 (g) \rightarrow 8\text{CO} (g) + 10\text{H}_2\text{O} (l)$**   
c)  $2\text{C}_4\text{H}_{10} (l) + 13\text{O}_2 (g) \rightarrow 8\text{CO}_2 (g) + 10\text{H}_2\text{O} (l)$   
d)  $\text{C}_4\text{H}_{10} (l) + 4.5\text{O}_2 (g) \rightarrow 4\text{CO} (g) + 5\text{H}_2\text{O} (l)$   
e)  $\text{C}_4\text{H}_{10} (l) + 6.5\text{O}_2 (g) \rightarrow 4\text{CO}_2 (g) + 5\text{H}_2\text{O} (l)$

12. An element has three naturally occurring isotopes with the following masses and natural abundances:

Isotope	Mass (amu)	Abundances (%)
1	53.94	5.845
2	53.93	91.75
3	56.94	2.405

What is the identity of the element above?

- a) Fe                      b) Co                      c) Ni                      d) Cr                      e) Zn

13. Which of the following can be classified as a precipitation reaction?

- a)  $2 \text{Na(s)} + 2 \text{H}_2\text{O(l)} \rightarrow 2 \text{NaOH(aq)} + \text{H}_2\text{(g)}$   
b)  $\text{ZnCO}_3\text{(s)} + 2 \text{HNO}_3\text{(aq)} \rightarrow \text{Zn(NO}_3)_2\text{(aq)} + \text{H}_2\text{O(l)} + \text{CO}_2\text{(g)}$   
c)  $\text{Pb(NO}_3)_2\text{(aq)} + 2 \text{KI(aq)} \rightarrow \text{PbI}_2\text{(s)} + 2 \text{KNO}_3\text{(aq)}$   
d)  $\text{HBr(aq)} + \text{NaOH(aq)} \rightarrow \text{H}_2\text{O(l)} + \text{NaBr(aq)}$   
e)  $\text{SO}_3\text{(g)} + \text{H}_2\text{O(l)} \rightarrow \text{H}_2\text{SO}_4\text{(aq)}$

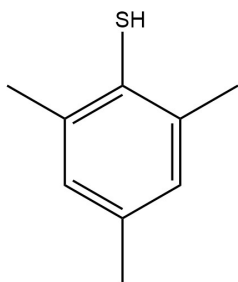
14. Determine the number of electrons in the  $\text{Au}^{3+}$  ion?

- a) 76                      b) 79                      c) 82                      d) 3                      e) 0

15. How many oxygen atoms are present in 8.70 g of  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ ?

- a)  $3.48 \times 10^{-2}$       b)  $1.20 \times 10^{23}$       c)  $2.10 \times 10^{22}$       d)  $1.89 \times 10^{23}$       e) 9

16. What is the molecular formula of the following compound?



- a)  $\text{C}_{10}\text{H}_{14}\text{S}$       b)  $\text{C}_9\text{H}_{11}\text{S}$       c)  $\text{C}_8\text{H}_{10}\text{S}$       d)  $\text{C}_6\text{H}_6\text{S}$       e)  $\text{C}_9\text{H}_{12}\text{S}$

17. Alkali metal cations carry a charge of what?

- a) 2+      **b) 1+**      c) 0      d) 1-      e) 2-

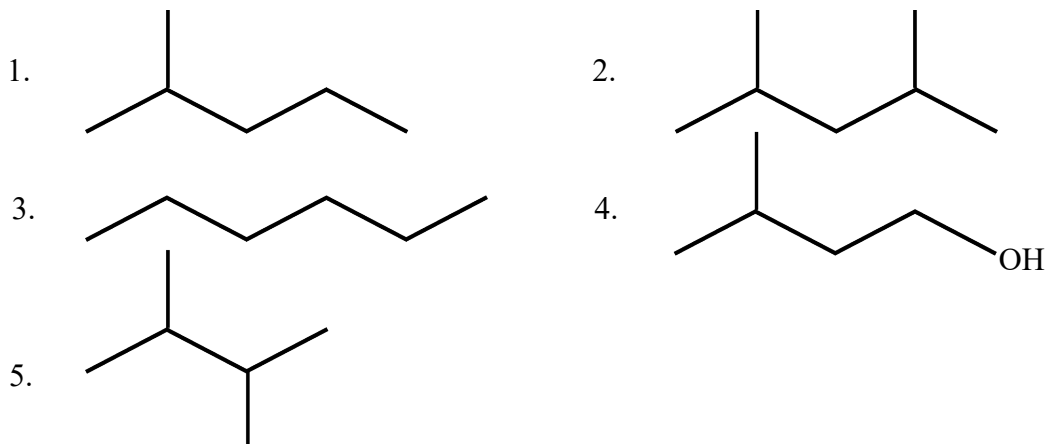
18. The correct formula for iron(II) phosphate is:

- a)  $\text{FePO}_4$       b)  $\text{Fe}_2\text{PO}_4$       c)  $\text{Fe}(\text{PO}_4)_2$       **d)  $\text{Fe}_3(\text{PO}_4)_2$**       e)  $\text{Fe}_2(\text{PO}_4)_3$

19. Given that:  $\text{CuBr}_2(aq) + \text{Li}_2\text{CrO}_4(aq) \rightarrow \text{CuCrO}_4(s) + 2 \text{LiBr}(aq)$ , which of the following species are classified as a spectator ion?

1.  $\text{Cu}^{2+}(aq)$       2.  $\text{Br}^-(aq)$       3.  $\text{Li}^+(aq)$       4.  $\text{CrO}_4^{2-}(aq)$       5.  $\text{CuCrO}_4(s)$
- a) 1 and 2      **b) 2 and 3**      c) 3 and 4      d) 1 and 4      e) 5

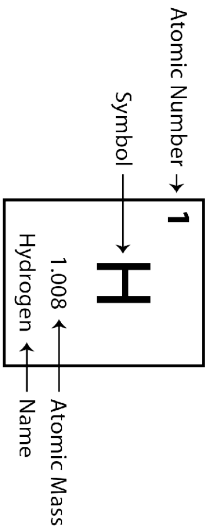
20. Which of the following hydrocarbons are isomers?



- a) 1, 2 and 3      b) 1 and 4      **c) 1, 3 and 5**      d) 2, 3 and 4      e) 3, 4 and 5

End.....

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 H 1.0079 Hydrogen																	2 He 4.0026 Helium
2 3 Li 6.941 Lithium	4 Be 9.0122 Beryllium											5 B 10.811 Boron	6 C 12.011 Carbon	7 N 14.0067 Nitrogen	8 O 15.9994 Oxygen	9 F 18.9984 Fluorine	10 Ne 20.1797 Neon
3 11 Na 22.9898 Sodium	12 Mg 24.3050 Magnesium											13 Al 26.9815 Aluminium	14 Si 28.0855 Silicon	15 P 30.9738 Phosphorus	16 S 32.065 Sulfur	17 Cl 35.453 Chlorine	18 Ar 39.948 Argon
4 19 K 39.0983 Potassium	20 Ca 40.078 Calcium	21 Sc 44.9559 Scandium	22 Ti 47.87 Titanium	23 V 50.9415 Vanadium	24 Cr 51.9961 Chromium	25 Mn 54.9380 Manganese	26 Fe 55.85 Iron	27 Co 58.9332 Cobalt	28 Ni 58.6934 Nickel	29 Cu 63.546 Copper	30 Zn 65.38 Zinc	31 Ga 69.723 Gallium	32 Ge 72.64 Germanium	33 As 74.9216 Arsenic	34 Se 78.96 Selenium	35 Br 79.904 Bromine	36 Kr 83.80 Krypton
5 37 Rb 85.4678 Rubidium	38 Sr 87.62 Strontium	39 Y 88.9059 Yttrium	40 Zr 91.224 Zirconium	41 Nb 92.9064 Niobium	42 Mo 95.96 Molybdenum	43 Tc 98 Technetium	44 Ru 101.07 Ruthenium	45 Rh 102.9055 Rhodium	46 Pd 106.42 Palladium	47 Ag 107.8682 Silver	48 Cd 112.411 Cadmium	49 In 114.82 Indium	50 Sn 118.710 Tin	51 Sb 121.76 Antimony	52 Te 127.60 Tellurium	53 I 126.9045 Iodine	54 Xe 131.29 Xenon
6 55 Cs 132.9055 Caesium	56 Ba 137.327 Barium	57 71 71 Lanthanum	72 Hf 178.49 Hafnium	73 Ta 180.9479 Tantalum	74 W 183.84 Tungsten	75 Re 186.207 Rhenium	76 Os 190.2 Osmium	77 Ir 192.22 Iridium	78 Pt 195.08 Platinum	79 Au 196.9665 Gold	80 Hg 200.59 Mercury	81 Tl 204.3833 Thallium	82 Pb 207.2 Lead	83 Bi 208.9804 Bismuth	84 Po 209 Polonium	85 At 210 Astatine	86 Rn 222 Radon
7 87 Fr 223 Francium	88 Ra 226 Radium	89 103 103 Actinium	104 Rf 267 Rutherfordium	105 Db 268 Dubnium	106 Sg 269 Seaborgium	107 Bh 270 Bohrium	108 Hs 269 Hassium	109 Mt 278 Meitnerium	110 Ds 281 Darmstadtium	111 Rg 281 Roentgenium	112 Cn 285 Copernicium	113 Uut 286 Ununtrium	114 Fl 289 Flerovium	115 Uup 289 Ununpentium	116 Lv 293 Livermorium	117 Uus 294 Ununseptium	118 Uuo 294 Ununoctium



Lanthanide Series	57 La 138.9055 Lanthanum	58 Ce 140.116 Cerium	59 Pr 140.9076 Praseodymium	60 Nd 144.24 Neodymium	61 Pm 145 Promethium	62 Sm 150.36 Samarium	63 Eu 151.964 Europium	64 Gd 157.25 Gadolinium	65 Tb 158.9253 Terbium	66 Dy 162.50 Dysprosium	67 Ho 164.9303 Holmium	68 Er 167.26 Erbium	69 Tm 168.9342 Thulium	70 Yb 173.054 Ytterbium	71 Lu 174.967 Lutetium
Actinide Series	89 Ac 227 Actinium	90 Th 232.0381 Thorium	91 Pa 231.0359 Protactinium	92 U 238.0289 Uranium	93 Np 237 Neptunium	94 Pu 244 Plutonium	95 Am 243 Americium	96 Cm 247 Curium	97 Bk 247 Berkelium	98 Cf 251 Californium	99 Es 252 Einsteinium	100 Fm 257 Fermium	101 Md 258 Mendelevium	102 No 259 Nobelium	103 Lr 262 Lawrencium

## SOME USEFUL CONSTANTS

(a more complete list appears in Appendix B)

Atomic mass unit	$1 \text{ amu} = 1.6606 \times 10^{-24} \text{ g}$
Avogadro's number	$N = 6.02214179 \times 10^{23} \text{ particles/mol}$
Electronic charge	$e = 1.60218 \times 10^{-19} \text{ coulombs}$
Faraday constant	$F = 96,485.3399 \text{ coulombs/mol } e^{-}$
Gas constant	$R = 0.08206 \frac{\text{L atm}}{\text{mol K}} = 1.987 \frac{\text{cal}}{\text{mol K}}$ $= 8.314472 \frac{\text{J}}{\text{mol K}} = 8.314472 \frac{\text{kPa dm}^3}{\text{mol K}}$
Pi	$\pi = 3.1415927$
Planck's constant	$h = 6.62606896 \times 10^{-34} \text{ J s}$
Speed of light (in vacuum)	$c = 2.99792458 \times 10^8 \text{ m/s}$

## SOME USEFUL RELATIONSHIPS

### Mass and Weight

SI Base Unit: Kilogram (kg)

- 1 kilogram = 1000 grams = 2.205 pounds
- 1 gram = 1000 milligrams
- 1 pound = 453.59 grams
- 1 amu =  $1.6606 \times 10^{-24}$  grams
- 1 gram =  $6.022 \times 10^{23}$  amu
- 1 ton = 2000 pounds

### Volume

SI Base Unit: Cubic Meter ( $\text{m}^3$ )

- 1 liter = 0.001 cubic meter
- 1 liter = 1000 cubic centimeters = 1000 mL
- 1 liter = 1.056 quarts
- 1 quart = 0.9463 liter
- 1 milliliter = 0.001 liter = 1 cubic centimeter
- cubic foot = 7.475 gallons = 28.316 liters
- 1 gallon = 4 quarts

### Pressure

SI Base Unit: Pascal (Pa)

- $1 \text{ pascal} = \frac{\text{kg}}{\text{m s}^2} = 1 \text{ Newton/m}^2$
- 1 atmosphere = 760 torr
- = 760 millimeters of mercury
- =  $1.01325 \times 10^5$  pascals
- = 1.01325 bar
- = 14.70 pounds per square inch
- 1 torr = 1 millimeter of mercury

### Length

SI Base Unit: Meter (m)

- 1 inch = 2.54 centimeters (exactly)
- 1 meter = 100 centimeters = 39.37 inches
- 1 yard = 0.9144 meter
- 1 mile = 1.609 kilometers
- 1 kilometer = 1000 meters = 0.6215 mile
- 1 Ångstrom =  $1.0 \times 10^{-10}$  meters =  $1.0 \times 10^{-8}$  centimeters

### Energy

SI Base Unit: Joule (J)

- 1 calorie = 4.184 joules =  $4.129 \times 10^{-2}$  L atm
- 1 joule =  $1 \frac{\text{kg m}^2}{\text{s}^2} = 0.23901 \text{ calorie}$
- 1 joule =  $1 \times 10^7$  ergs
- 1 electron volt =  $1.6022 \times 10^{-19}$  joule
- 1 electron volt = 96.485 kJ/mol
- 1 L atm = 24.217 calories = 101.325 joules

### Temperature

SI Base Unit: Kelvin (K)

- 0 K =  $-273.15^\circ\text{C}$
- K =  $^\circ\text{C} + 273.15^\circ$
- $^\circ\text{F} = 1.8(^\circ\text{C}) + 32^\circ$
- $^\circ\text{C} = \frac{^\circ\text{F} - 32^\circ}{1.8^\circ}$

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Solubility guidelines for ionic compounds in water at room temperature

Usually Soluble	Exceptions
Group 1 cations ( $\text{Li}^+$ , $\text{Na}^+$ , $\text{K}^+$ , $\text{Rb}^+$ , $\text{Cs}^+$ ), ammonium ( $\text{NH}_4^+$ )	No common exceptions
Nitrates ( $\text{NO}_3^-$ ), nitrites ( $\text{NO}_2^-$ )	Moderately soluble: $\text{AgNO}_2$
Chlorides, bromides, iodides ( $\text{Cl}^-$ , $\text{Br}^-$ , $\text{I}^-$ )	Insoluble: $\text{AgCl}$ , $\text{Hg}_2\text{Cl}_2$ , $\text{PbCl}_2$ , $\text{AgBr}$ , $\text{Hg}_2\text{Br}_2$ , $\text{PbBr}_2$ , $\text{AgI}$ , $\text{Hg}_2\text{I}_2$ , and $\text{PbI}_2$
Fluorides ( $\text{F}^-$ )	Insoluble: $\text{MgF}_2$ , $\text{CaF}_2$ , $\text{SrF}_2$ , $\text{BaF}_2$ , $\text{PbF}_2$
Sulfates ( $\text{SO}_4^{2-}$ )	Insoluble: $\text{BaSO}_4$ , $\text{PbSO}_4$ , $\text{HgSO}_4$ Moderately soluble: $\text{CaSO}_4$ , $\text{SrSO}_4$ , $\text{Ag}_2\text{SO}_4$
Chlorates ( $\text{ClO}_3^-$ ), perchlorates ( $\text{ClO}_4^-$ )	No common exceptions
Acetates ( $\text{CH}_3\text{COO}^-$ )	Moderately soluble: $\text{AgCH}_3\text{COO}$
Usually Insoluble	Exceptions
Phosphates ( $\text{PO}_4^{3-}$ )	Soluble: $(\text{NH}_4)_3\text{PO}_4$ , $\text{Na}_3\text{PO}_4$ , $\text{K}_3\text{PO}_4$
Carbonates ( $\text{CO}_3^{2-}$ )	Soluble: $(\text{NH}_4)_2\text{CO}_3$ , $\text{Na}_2\text{CO}_3$ , $\text{K}_2\text{CO}_3$
Hydroxides ( $\text{OH}^-$ )	Soluble: $\text{LiOH}$ , $\text{NaOH}$ , $\text{KOH}$ , $\text{Ba}(\text{OH})_2$ Moderately soluble: $\text{Ca}(\text{OH})_2$ , $\text{Sr}(\text{OH})_2$
Sulfides ( $\text{S}^{2-}$ )	Soluble: $(\text{NH}_4)_2\text{S}$ , $\text{Na}_2\text{S}$ , $\text{K}_2\text{S}$ , $\text{MgS}$ , $\text{CaS}$