

Name _____

If you do NOT want your graded exam placed in the cardboard box outside my office, then please mark a cross here _____

(1-10) are True / False

- 1) A hypothesis is a proposed explanation for a phenomenon, usually made as the starting point for further investigation.
- 2) Color is an intensive property.
- 3) Ionic compounds are generally combinations of metals and non-metals.
- 4) The mass of a single neutron is around 10^{24} grams.
- 5) A compound must contain at least two different elements.
- 6) Air has the chemical symbol Ar.
- 7) A physical property is a property that can be observed or measured without a change to the identity or composition of a substance.
- 8) All digits in measurement up to and including the first estimated digit are significant.
- 9) Opposite charges repel one another.
- 10) Ionic compounds contain ions.

- 11) Without using profanity, provide a one sentence definition (or description) of Chemistry.

12) What is the name given to the type of mixture where the composition is the same throughout?

13) A chemical reaction (or chemical change) has the requirement that something particular happens – what is that requirement?

14) What is the name (not symbol) of the element between Vanadium and Manganese in the periodic table?

15) State one similarity between degrees Celsius, and Kelvin.

16-17) If $K = ^\circ C + 273.15$, then what is $99.99\ ^\circ C$ expressed in Kelvin?

18) A numerical value expressed using a number between 1 and 10 followed by some power of 10 is called a certain type of notation – what is that notation?

19) An exact number is defined as a number that has no uncertainty (e.g. a dozen eggs is exactly 12 eggs). So how are such numbers treated in calculations when we need to pay attention to the number of significant figures?

20) P_2O_5 is a binary molecular compound. What does “binary” refer to?

21) What is the correct name of P_2O_5 ?

22) The elements in Group 17 (7A/VIIA) in the Periodic table are known collectively by what group name?

23) Balance the following equation:



24) The product of the reaction above is imprecisely named as “Iron Bromide”. What extra information is needed to provide the full correct name of the product?

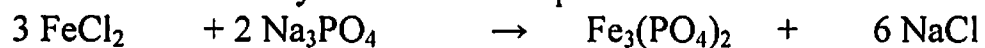
25) If BO_3^{3-} is “borate”, what is the name of the corresponding acid H_3BO_3 ?

26) What structural feature makes H_3BO_3 an acid?

27) Provide the important missing detail from this (incomplete) definition of Avogadro’s number (6.022×10^{23}) - *The number of atoms in exactly 12 grams of Carbon.*

28) If a reaction has a theoretical yield of 10.0 grams of product, and a researcher performs the reaction and collects 7.7 g of product, what is the Percent Yield of the reaction?

29) For the reaction described by this balanced equation:



If 300 moles of FeCl_2 is used, and the Na_3PO_4 is present in excess, how many moles of Sodium Chloride can theoretically be produced?

30) What is the molar mass of the ionic compound $(\text{NH}_4)_2\text{CrO}_4$?

(31-40) are multiple choice

- 31) The scientific method is best described as:
- Carefully following the lab manual instructions.
 - Making measurements as accurately as possible.
 - The explanation of why Chemistry is better than Physics.
 - The process of making observations and then designing ways to evaluate and explain those observations.
 - Copying answers from the student in front of you.
- 32) If the average atomic mass of ${}_{36}\text{Kr}$ is 83.8 amu, then 204.0 g of Kr contains this number of Kr atoms:
- $0.411 \times \text{Avogadro's number}$
 - 324
 - $2.43 \times \text{Avogadro's number}$
 - Unanswerable, since there is insufficient data provided about Kr.
 - $13.8 \times \text{Avogadro's number}$
- 33) In terms of experimental measurement, "precision" is best described as:
- whether the output is viewable on a mobile device.
 - the reproducibility of the results.
 - how expensive your instrument is.
 - its accuracy.
 - closeness to the correct answer.
- 34) The number 1005 has how many significant figures?
- 1
 - 2
 - 3
 - 4
 - None since there is no decimal place indicated.
- 35) 1657.3 grams of an illegal drug was shared equally between 12 students – using the correct number of significant figures, how many grams does each student have?
- 138.108 g
 - 1.4×10^2 g
 - 138.1 g
 - 138.11 g
 - 138 g

- 36) Which statement is most accurate?
- Neutrons orbit the nucleus.
 - All subatomic particles weigh the same.
 - The nucleus is where all the charged subatomic particles reside.
 - The nucleus contains almost all the mass of an atom.
 - All atoms weigh the same.
- 37) Which pair is correctly described as *isotopes*?
- $^{107}_{47}\text{Ag}$ and $^{109}_{47}\text{Ag}$
 - Water vapor and liquid water
 - ^{14}C and ^{14}N
 - OH and H_2O_2
 - $^{12}_6\text{C}$ and ^{12}C
- 38) The correct names for CaO and CO are:
- Oxycalcide and Oxycarbide
 - Calcium Monoxide and Carbon Monoxide
 - Calcium Oxide and Carbon Monoxide
 - Calcoxide and Carboxide
 - Calcium Oxide and Carbon Oxide
- 39) Which statement is most accurate?
- The molecular weight of KCl is 74.6 amu
 - The formula weight of KCl is 58.4 amu
 - The sit-and weight of KCl is 7 mins 46 s
 - The formula weight of KCl is 58.4 g/mol
 - The formula weight of KCl is 74.6 amu
- 40) Based on their positions in the Periodic Table, the most likely formula for an ionic compound formed from Calcium and Selenium is:
- CaSe
 - Ca₂Se
 - CaSe₂
 - Ca₃Se₂
 - Ca₂Se₃

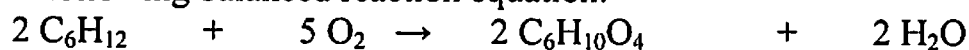
41-42) What is the volume (in cm^3 and to the correct amount of significant figures) of a 6.34 g piece of rock that has a density of 11.86 g/cm^3 ?

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

43-44) Vitamin C is a covalent compound with the molecular formula $\text{C}_6\text{H}_8\text{O}_6$. The recommended daily dietary allowance of vitamin C for children aged 4–8 years is 1.42×10^{-4} mol. What is the mass of this allowance in grams (using correct sig. figs)?

45-46) A 24.81 gram sample of a gaseous compound containing only carbon, oxygen, and chlorine is experimentally determined to contain 3.01 g C, 4.00 g O, and 17.81 g Cl. What is this compound's percent composition by mass of C, O and Cl?

47-50) For the following balanced reaction equation:



If 10.1 g of the hydrocarbon is reacted with 20.2 g of Oxygen, what is the maximum amount in grams of H₂O that is produced?

*****Bonus Questions for +1 points each*****

Name an element that is liquid under normal conditions.

What does the word "empirical" mean?

Provide one piece of experimental evidence that electrons are negatively charged.

1	1A	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
H	He	Li	Be	B	C	N	O	F	Ne	Na	Mg	Al	Si	P	S	Cl	Ar	Kr	Xe
1.01	4.00	6.94	9.01	10.81	12.01	14.01	16.00	19.00	20.18	22.99	24.31	26.98	28.09	30.97	32.07	35.45	39.95	83.80	131.29
3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Li	Be	B	C	N	O	F	Ne	Na	Mg	Al	Si	P	S	Cl	Ar	K	Ca	Sc	Ti
6.94	9.01	10.81	12.01	14.01	16.00	19.00	20.18	22.99	24.31	26.98	28.09	30.97	32.07	35.45	39.95	39.1	40.08	44.96	47.88
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe	Cs	Ba
85.47	87.62	88.91	91.22	92.91	95.94	(98)	101.07	102.91	106.42	107.87	112.41	114.82	118.71	121.76	127.6	126.9	131.29	132.9	137.3
87	88	89	104	105	106	107	108	109	110	111	200.6	204.4	207.2	209	209	210	222	223	226
Fr	Ra	Ac^	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Hq	Tl	Pb	Bi	Po	At	Rn	Fr	Ra
(223)	(226)	(227)	(261)	(262)	(263)	(264)	(265)	(268)	(271)	(272)	200.6	204.4	207.2	209	209	210	222	(223)	(226)

58	59	60	61	62	63	64	65	66	67	68	69	70	71
Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
140.1	140.9	144.2	(145)	150.4	152.0	157.3	158.9	162.5	164.9	167.3	168.9	173.0	175.0
90	91	92	93	94	95	96	97	98	99	100	101	102	103
Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr
232.0	(231)	238.0	(237)	(244)	(243)	(247)	(247)	(251)	(252)	(257)	(258)	(259)	(260)

Name UNTRUSTWORTHY ATOMS

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(1-10) are True / False

- 1) A hypothesis is a proposed explanation for a phenomenon, usually made as the starting point for further investigation. T
- 2) Color is an intensive property. T
- 3) Ionic compounds are generally combinations of metals and non-metals. T
- 4) The mass of a single neutron is around 10^{24} grams. false
- 5) A compound must contain at least two different elements. T
- 6) Air has the chemical symbol Ar. false
- 7) A physical property is a property that can be observed or measured without a change to the identity or composition of a substance. T
- 8) All digits in measurement up to and including the first estimated digit are significant. T
- 9) Opposite charges repel one another. false
- 10) Ionic compounds contain ions. True

11) Without using profanity, provide a one sentence definition (or description) of Chemistry.

The science of transformation. Atomic & molecular change.
The molecular science.

12) What is the name given to the type of mixture where the composition is the same throughout?

Homogeneous

13) A chemical reaction (or chemical change) has the requirement that something particular happens – what is that requirement?

New chemical substances must be produced.

14) What is the name (not symbol) of the element between Vanadium and Manganese in the periodic table?

Chromium

15) State one similarity between degrees Celsius, and Kelvin.

Both temperature scales; same unit size; both named after people.

16-17) If $K = ^\circ C + 273.15$, then what is $99.99\ ^\circ C$ expressed in Kelvin?

$$99.99 + 273.15 = 373.14\ K$$

18) A numerical value expressed using a number between 1 and 10 followed by some power of 10 is called a certain type of notation – what is that notation?

Standard notation, exponential notation, scientific notation.

19) An exact number is defined as a number that has no uncertainty (e.g. a dozen eggs is exactly 12 eggs). So how are such numbers treated in calculations when we need to pay attention to the number of significant figures?

Exact numbers are assumed to have an infinite number of sig. figs.

20) P_2O_5 is a binary molecular compound. What does "binary" refer to?

Two different elements.

21) What is the correct name of P_2O_5 ?

Diphosphorous Pentoxide

22) The elements in Group 17 (7A/VIIA) in the Periodic table are known collectively by what group name?

Halogens

23) Balance the following equation:



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Iron (III) Bromide

25) If BO_3^{3-} is "borate", what is the name of the corresponding acid H_3BO_3 ?

-ate \rightarrow -ic acid

Boric Acid

26) What structural feature makes H_3BO_3 an acid?

Has hydrogens that can be donated as H^+ .

27) Provide the important missing detail from this (incomplete) definition of Avogadro's number (6.022×10^{23}) - The number of atoms in exactly 12 grams of Carbon.

It must be carbon 12, ^{12}C .

28) If a reaction has a theoretical yield of 10.0 grams of product, and a researcher performs the reaction and collects 7.7 g of product, what is the Percent Yield of the reaction?

$$\% \text{ Yield} = \frac{\text{Actual}}{\text{Theoretical}} \times 100\% = \frac{7.7}{10.0} \times 100\% = 77\%$$

29) For the reaction described by this balanced equation:



If 300 moles of FeCl_2 is used, and the Na_3PO_4 is present in excess, how many moles of Sodium Chloride can theoretically be produced?



$$\text{so } 300 \text{ FeCl}_2 \Rightarrow 600 \text{ NaCl} \quad . \quad 600 \text{ moles of NaCl.}$$

30) What is the molar mass of the ionic compound $(\text{NH}_4)_2\text{CrO}_4$?

2 N	=	2 x 14.01	=	28.02
8 H	=	8 x 1.01	=	8.08
1 Cr	=	1 x 52.00	=	52.00
4 O	=	4 x 16.00	=	64.00
				152.10

Molar Mass is $\frac{\text{g}}{\text{mol}}$ so 152.10 g/mol.

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- a) 138.108 g
 - b) 1.4×10^2 g
 - c) 138.1 g
 - d) 138.11 g
 - e) 138 g
- Handwritten notes:*
 $1657.3 = 5 \text{ sig figs}$
 $12 = \text{infinite sig figs.}$
..... 5 sig figs.

- 36) Which statement is most accurate?
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- a) $^{107}_{47}\text{Ag}$ and $^{109}_{47}\text{Ag}$
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38) The correct names for CaO and CO are:

- a) Oxycalcide and Oxycarbide
- b) Calcium Monoxide and Carbon Monoxide
- c) Calcium Oxide and Carbon Monoxide
- d) Calcoxide and Carboxide
- e) Calcium Oxide and Carbon Oxide

39) Which statement is most accurate?

- a) The molecular weight of KCl is 74.6 amu
- b) The formula weight of KCl is 58.4 amu
- c) The sit-and weight of KCl is 7 mins 46 s
- d) The formula weight of KCl is 58.4 g/mol
- e) The formula weight of KCl is 74.6 amu

40) Based on their positions in the Periodic Table, the most likely formula for an ionic compound formed from Calcium and Selenium is:

- a) CaSe
- b) Ca_2Se
- c) CaSe_2
- d) Ca_3Se_2
- e) Ca_2Se_3



41-42) What is the volume (in cm^3 and to the correct amount of significant figures) of a 6.34 g piece of rock that has a density of 11.86 g/cm^3 ?

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

3 sig. figs

so $\text{Vol} = \frac{\text{Mass}}{\text{Density}}$ 4 sig. figs

$$= \frac{6.34 \text{ g}}{11.86 \text{ g}} \text{ cm}^3$$

$$= 0.5345699831 \text{ cm}^3$$

$$= 0.535 \text{ cm}^3$$

43-44) Vitamin C is a covalent compound with the molecular formula $\text{C}_6\text{H}_8\text{O}_6$. The recommended daily dietary allowance of vitamin C for children aged 4–8 years is 1.42×10^{-4} mol. What is the mass of this allowance in grams (using correct sig. figs)?

3 sig figs

$\text{C}_6\text{H}_8\text{O}_6$ has a molar mass of $176.14 \frac{\text{g}}{\text{mol}}$

$$\begin{array}{r} 6 \times 12.01 = 72.06 \\ 8 \times 1.01 = 8.08 \\ 6 \times 16.00 = 96.00 \\ \hline 176.14 \end{array}$$

$$1.42 \times 10^{-4} \text{ mol} \times 176.14 \frac{\text{g}}{\text{mol}} = 0.0250488 \text{ g}$$

$$= 0.0250 \text{ g (to 3 sig figs)}$$

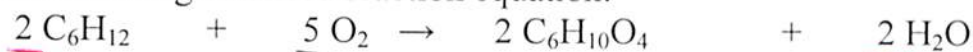
45-46) A 24.81 gram sample of a gaseous compound containing only carbon, oxygen, and chlorine is experimentally determined to contain 3.01 g C, 4.00 g O, and 17.81 g Cl. What is this compound's percent composition by mass of C, O and Cl?

$$\% \text{ C} = \frac{3.01}{24.81} \times 100\% = 12.1\% \text{ Carbon}$$

$$\% \text{ O} = \frac{4.00}{24.81} \times 100\% = 16.1\% \text{ Oxygen}$$

$$\% \text{ Cl} = \frac{17.81}{24.81} \times 100\% = 71.8\% \text{ Chlorine}$$

47-50) For the following balanced reaction equation:



If 10.1 g of the hydrocarbon is reacted with 20.2 g of Oxygen, what is the maximum amount in grams of H_2O that is produced?

$$\text{Moles of } \text{C}_6\text{H}_{12} = \frac{10.1}{84.18} = 0.120 \text{ moles which produces } 0.120 \times \frac{2}{2} = 0.120 \text{ moles of } \text{H}_2\text{O}$$

$$\text{MW} = \frac{6 \times 12.01}{12 \times 1.01} = \frac{72.06}{12.12} = 84.18$$

$$\text{Moles of } \text{O}_2 = \frac{20.2}{32.0} = 0.631 \text{ moles which produces } 0.631 \times \frac{2}{5} = 0.253 \text{ moles of } \text{H}_2\text{O}$$

$$\text{MW} = 2 \times 16.00 = 32.00$$

So C_6H_{12} is the limiting reagent. $0.120 \text{ moles of } \text{H}_2\text{O} = 0.120 \times 18.02 = 2.16 \text{ g } \text{H}_2\text{O}$

$$\text{MW } \text{H}_2\text{O} = \frac{2 \times 1.01}{1 \times 16.00} = 18.02 \frac{\text{g}}{\text{mol}}$$

*****Bonus Questions for +1 points each*****

Name an element that is liquid under normal conditions.

Bromine, Mercury

What does the word "empirical" mean?

Based upon experience, observation or experimentation.

Provide one piece of experimental evidence that electrons are negatively charged.

They are repelled (deflected) by other negative things.