Solving Multiple Choice Math Problems

KNOW WHAT THE EXAM WILL LOOK LIKE

Be familiar with the format of the exam – that always makes you a better test taker.

- ✓ 60 MC/90 min ~ 90 seconds/question
- ✓ **NO CALCULATOR**
- ✓ Periodic Table/ Formula Sheet allowed
- ✓ 4 choices A B C D
- ✓ Choices go from the lowest number to the highest number
- ✓ Answers are lined up by decimal points
- ✓ Even though this does not make the number list "straight", you can see decimal points and significant figures more easily
- ✓ Estimate--> Look for the word "approximate" – you don't have to be exact – make estimations to get the answer

KNOW HOW TO USE YOUR TIME

1ST Read Through
Go through the MC once and answer all the questions you get right away.
Questions that you need more time on mark with a star *
If you read a problem and have no idea – CIRCLE the number and move on.
2nd Read Through
Answer the * questions
3rd Read Through
Answer the circled questions

Each MC question is worth 1 point – don't waste your time on one hard question.

Make sure that you bubble your answer sheet as you go. **DO NOT WAIT UNITL THE END!**

NEW FOCUS SET QUESTIONS

SET QUESTIONS typically have a paragraph, a data set, a graph or a combination of these and then 3-4 questions that are related to the information provided.

You are given a lot of information in SET QUESTIONS– be sure to read and note or annotate carefully.

MATH TO MEMORIZE

$\frac{1}{5} = 0.20 = 20.0\%$ $\frac{2}{5} = 0.40 = 40.0\%$ $\frac{3}{5} = 0.60 = 60.0\%$ $\frac{4}{5} = 0.80 = 80.0\%$

$\frac{1}{8} = 0.125 = 12.5\%$ $\frac{3}{8} = 0.375 = 37.5\%$ $\frac{5}{8} = 0.625 = 62.5\%$ $\frac{7}{8} = 0.875 = 87.5\%$

$\frac{1}{3} = 0.33 = 33\%$ $\frac{2}{3} = 0.67 = 67\%$ $\frac{1}{4} = 0.25 = 25\%$ $\frac{3}{4} = 0.75 = 75\%$

$\frac{1}{2} = 0.50 = 50\%$

Example 1

What is 1/6 as a decimal?

Example 2

What is 0.025 as a fraction?

Example 3

Write 0.150 and 0.120 as fractions.

1) Complete the following chart – have the fractions in lowest terms.

	Decimal	Fraction		Decimal	Fraction
a)	0.375		j)	0.67	
b)	0.75		k)	0.125	
c)	0.875		l)	0.33	
d)	0.60		m)	0.5	
e)	0.25		n)	0.20	
f)	0.020		o)		$\frac{3}{4}$
g)	0.075		p)		$\frac{1}{4}$
h)	0.005		q)		$\frac{1}{5}$
i)	0.625		r)		$\frac{1}{16}$

2) Solve the following by rewriting them as fractions (if needed) and **show your work**.

Express answers in this column as a fraction or whole number			Express answers in this column as a decimal (may approximate if needed)	
a)	$\frac{0.5}{0.125}$		g)	$\frac{1}{1.25}$
b)	$\frac{0.25}{0.50}$		h)	$\frac{0.5}{0.2}$
c)	$\frac{0.025}{0.075}$		i)	$\frac{\frac{1}{8}}{\frac{1}{5}}$
d)	$\frac{0.125}{0.075}$		j)	$\frac{1}{2\frac{1}{5}}$
e)	$\frac{0.6}{0.02}$		k)	$\frac{\frac{3}{8}}{2.5}$
f)	$\frac{0.6}{0.2}$		l)	$\frac{2.625}{1.75}$

3) Solve the following, **showing all of your work.**

a)	$\frac{6 \times 10^{18}}{4 \times 10^{-5}} =$
b)	$\frac{1}{4 \times 10^{-5}} =$
c)	$\frac{(4 \times 10^{-5})(1.5 \times 10^{13})}{1.5 \times 10^{4}} =$
d)	$(4 \times 10^{-5})(1.5 \times 10^{13}) =$
e)	$\frac{(2 \times 10^{7})(1.5 \times 10^{4})}{4.5 \times 10^{8}} =$
f)	$(4 \times 10^{-5})^{3} =$

4) Solve the following problems, using cross canceling of numbers. **Show your work.**

a) $9 \times \frac{1}{18} \times \frac{2}{4} \times \frac{44}{1} =$ _____

b) $280 \times \frac{1}{28} \times \frac{3}{1} \times \frac{6}{1} =$ _____

c) $70 \times \frac{1}{28} \times \frac{1}{1} \times \frac{42}{1} =$ _____

d) $48 \times \frac{1}{32} \times \frac{2}{3} \times \frac{158}{1} =$ _____

e) $87 \times \frac{1}{174} \times \frac{3}{2} \times \frac{28}{1} =$ _____

f) $12 \times \frac{1}{2} \times \frac{1}{2} \times \frac{42}{1} =$ _____

g) $165 \times \frac{1}{55} \times \frac{2}{4} \times \frac{158}{1} =$ _____

h) $0.33 \times \frac{1}{44} \times \frac{1}{1} \times \frac{100}{1} =$ _____

5) Solve for "x".

a) $\frac{(x)(x)}{0.5} = 5.0\times10^{-5}$

b) $\frac{(x)(x)}{0.25} = 6.4\times10^{-7}$

c) $\frac{(x)(x)}{0.125} = 3.2\times10^{-9}$

d) $(x)(2x)^2 = 3.2\times10^{-8}$

e) $\frac{(x)(x)}{0.5} = 8.0\times10^{-16}$

f) $(3x)^3(2x)^2 = 1.08\times10^{-3}$

Example 4

What volume of 0.150-molar HCl is required to neutralize 25.0 millilters of 0.120-molar $Ba(OH)_2$?

Example 5

You are given 0.0075 moles of a substance with a molar mass of 110.1 grams/mol. Determine the number of grams of the substance.

SCIENTIFIC & EXPONENTIAL NOTATIONS ARE YOUR FRIENDS

Brief Review and Strategies

PRACTICE

1. How many nitrogen atoms are in a 0.10 mole of aluminum nitrate, $Al(NO_3)_3$?

(A) 2.0×10^{23}
(B) 1.8×10^{23}
(C) 1.4×10^{22}
(D) 6.0×10^{23}

2. The identity of an unknown metal can be determined by reacting the metal in an excess of oxygen and collecting the mass of the metallic oxide formed. A chemist masses out 2.000 g of element X and reacts it with excess oxygen to form 2.539 g of its oxide according to the balanced chemical equation below.

$$X(s) + O_2(g) \rightarrow XO_2(s)$$

Element	Molar Mass (g/mol)
Silicon	28.09
Tin	118.71
Titanium	47.90
Cobalt	58.93

Which of the following elements best represents the identity of element X?

(A) silicon
(B) tin
(C) titanium
(D) cobalt

3. The hemoglobin from the red corpuscles of most mammals contains 0.33% iron by mass. Physical measurements indicate that hemoglobin is a macromolecule with a molar mass of 68,000 g/mol . How many iron atoms are in one hemoglobin molecule?

(A) two
(B) three
(C) four
(D) five

Questions 4-6 refer to the following.

Students were challenged during a lab to generate the largest gas volume in a plastic bag by reacting baking soda, $NaHCO_3$, with acetic acid, CH_3COOH. The chemical equation representing the reaction is shown below.

$NaHCO_3$ (s) + CH_3COOH (aq) --> CH_3COONa (aq) + H_2O (l) + CO_2 (g)

A pair of students performed the following trials in building their airbags.

Trial	Moles of sodium bicarbonate, $NaHCO_3$	Moles of acetic acid, CH_3COOH	Moles of carbon dioxide, CO_2
A	0.012 mol	0.017 moles	
B	0.018 mol	0.017 moles	
C	0.018 mol	0.025 moles	
D	0.012 mol	0.025 moles	

4. Which of the trials shown in the table produced the optimal "GREEN" airbag (minimal unreacted starting material)?

(A) Trial A
(B) Trial B
(C) Trial C
(D) Trial D

5. The carbon dioxide produced in the reaction of baking soda and acetic acid is collected in a rigid, 100 mL metal container. What amount of CO_2 (g) will fill the container to a pressure of 5 atm at 300 K?

(A) 0.020 moles
(B) 100 mL
(C) 0.020 grams
(D) 20 moles

6. A sample of CO_2 is sealed in a metal container at 300 K. The pressure inside the container is 6 atm. What is an estimate of the pressure inside the container if you cool the gas to 100 K? At this temperature, CO_2 is a solid.

(A) 2.0 atm
(B) 1.8 atm
(C) 1.0 atm
(D) 0.01 atm

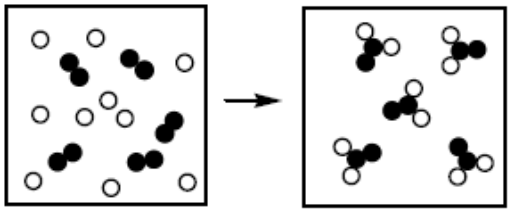
7. A chemist can choose between the following metallic carbonates as a source of carbonate ion, CO_3^{2-}.

Substance	Cost	Molar Mass
Li_2CO_3	$ 145.00/ 500 g	73.89 g/mol
K_2CO_3	$ 145.00/ 500 g	138.21 g/mol

Which of the following is the best source of carbonate ion with the correct justification?

(A) The chemist should choose K_2CO_3, because it will provide more carbonate ion per gram of K_2CO_3.
(B) The chemist should choose Li_2CO_3, because it will provide more carbonate ion per gram of Li_2CO_3.
(C)The chemist should choose Li_2CO_3, because lithium ion is smaller than potassium ion and Li_2CO_3 will have the greater lattice energy.
(D) The chemist should choose K_2CO_3, because potassium ion is larger than lithium ion and K_2CO_3 will have the greater lattice energy.

8. Reaction of A (white spheres) with B (black spheres) is shown schematically in the following diagram. Which equation best describes the stoichiometry of the reaction?

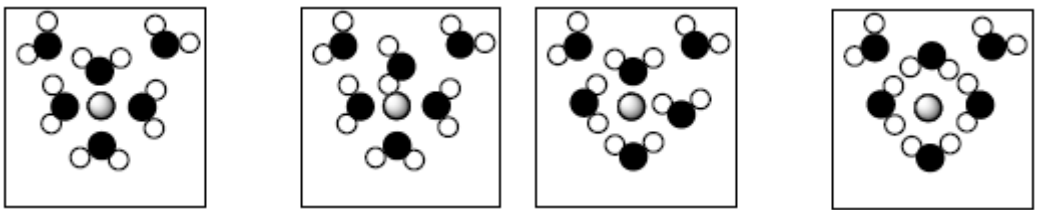


(A) $A_2 + 2\ B \rightarrow A_2B_2$
(B) $10\ A + 5\ B_2 \rightarrow 5\ A_2B_2$
(C) $2\ A + B_2 \rightarrow A_2B_2$
(D) $5\ A + 5\ B_2 \rightarrow 5\ A_2B_2$

9. Sodium iodide dissociates into solution according to the following balance chemical equation.

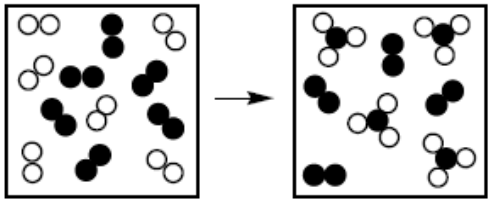
$$NaI(s) \text{ --> } Na^+(aq) + I^-(aq)$$

Which of the following pictures shows the correct orientation of water molecules surrounding the I^- ion?



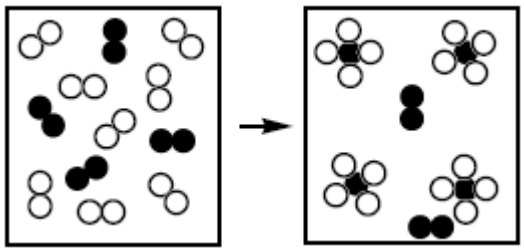
(A) (B) (C) (D)

10. The following diagrams represent the reaction of A_2 (shaded spheres) with B_2 unshaded spheres). Identify the limiting reactant and write a balanced equation for the reaction.



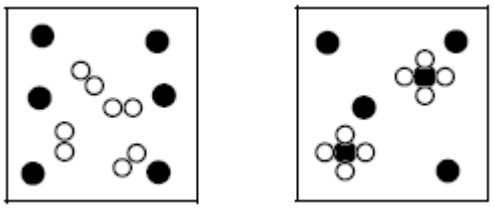
(A) A_2 is the limiting reactant; $A + 3\ B \rightarrow AB_3$.
(B) A_2 is the limiting reactant; $A_2 + 3\ B_2 \rightarrow 2\ AB_3$.
(C) B_2 is the limiting reactant; $A + 3\ B \rightarrow AB_3$.
(D) B_2 is the limiting reactant; $A_2 + 3\ B_2 \rightarrow 2\ AB_3$.

11. The following diagrams represent the reaction of A_2 (shaded spheres) with B_2 (unshaded spheres).Identify the limiting reactant and write a balanced equation for the reaction.



(A) A_2 is the limiting reactant; $A + 4\ B \rightarrow AB_4$
(B) A_2 is the limiting reactant; $A_2 + 4\ B_2 \rightarrow 2\ AB_4$
(C) B_2 is the limiting reactant; $A + 4\ B \rightarrow AB_4$
(D) B_2 is the limiting reactant; $A_2 + 4\ B_2 \rightarrow 2\ AB_4$

12. The following diagram represents the reaction of A_2 (unshaded spheres) with B (shaded spheres). What is the best balanced chemical equation for this reaction, and what is the limiting reactant?



(A) $2\ A_2 + B \rightarrow A_4B$; A_2 is the limiting reactant.
(B) $2\ A_2 + B \rightarrow A_4B$; B is the limiting reactant.
(C) $4\ A_2 + 6\ B \rightarrow 2\ A_4B$; A_2 is the limiting reactant.
(D) $4\ A_2 + 6\ B \rightarrow 2\ A_4B$; B is the limiting reactant.

13. A sample of sodium hydroxide (NaOH) contains 1.2×10^{23} atoms of H. How many grams of sodium hydroxide is that?

(A) 2.7 g
(B) 4.0 g
(C) 20 g
(D) 8.0 g

14. A student wants to determine the number of moles of water in the hydrated calcium sulfate salt ($CaSO_4 \cdot XH_2O$). She performs an experiment and her data is collected in the table below.

Mass of Hydrate ($CaSO_4 \cdot XH_2O$)	43.00 g
Mass of Hydrate after first heating	34.51 g
Mass of Hydrate after second heating	34.01 g
Mass of Hydrate after third heating	34.00 g

The molar mass of $CaSO_4$ is 136.14 g/mol . Upon analysis of the student's data, what is the value of X in the hydrate with the formula $CaSO_4 \cdot XH_2O$?

(A) 1
(B) 2
(C) 3
(D) 4

15. Thiamine (B1) is an important vitamin to overall health. The nitrogen atoms in thiamine help to regulate metabolism. Thiamine contains 16.6% N by weight. If 1 molecule of thiamine contains 4 nitrogen atoms, determine the molar mass of thiamine.

(A) 474
(B) 211
(C) 337
(D) 930

16. A student needs to estimate the approximate amount of $CuSO_4 \cdot 5\ H_2O$ (250 g/mol) required to prepare 250 mL of 0.10 M copper(II) sulfate solution. Approximately how many grams does the student need?

(A) 4.0 g
(B) 6.2 g
(C) 34 g
(D) 85 g