Welcome to our CHEM 4 lecture

Review question: Gas forming reactions
Go to LearningCatalytics.com **Session ID =**

1) Which of these reactions is not expected to produce a gas as one of the products? *[For practice also write the balanced molecular equation for each gas forming reaction.]*

A) $Na_2S(aq) + HClO_4(aq)$
B) $NaOH(aq) + NH_4I(aq)$
C) $NaHSO_3(aq) + HNO_3(aq)$
D) $HC_2H_3O_2(aq) + Na_2CO_3(aq)$
E) $HBr(aq) + Na_2SO_4(aq)$

A) sulfide + acid
B) base + ammonium
C) hydrogen sulfite + acid
D) acid + carbonate
E) ~~acid + sulfate~~

Here are the balanced molecular equations for the 4 gas forming reaction:

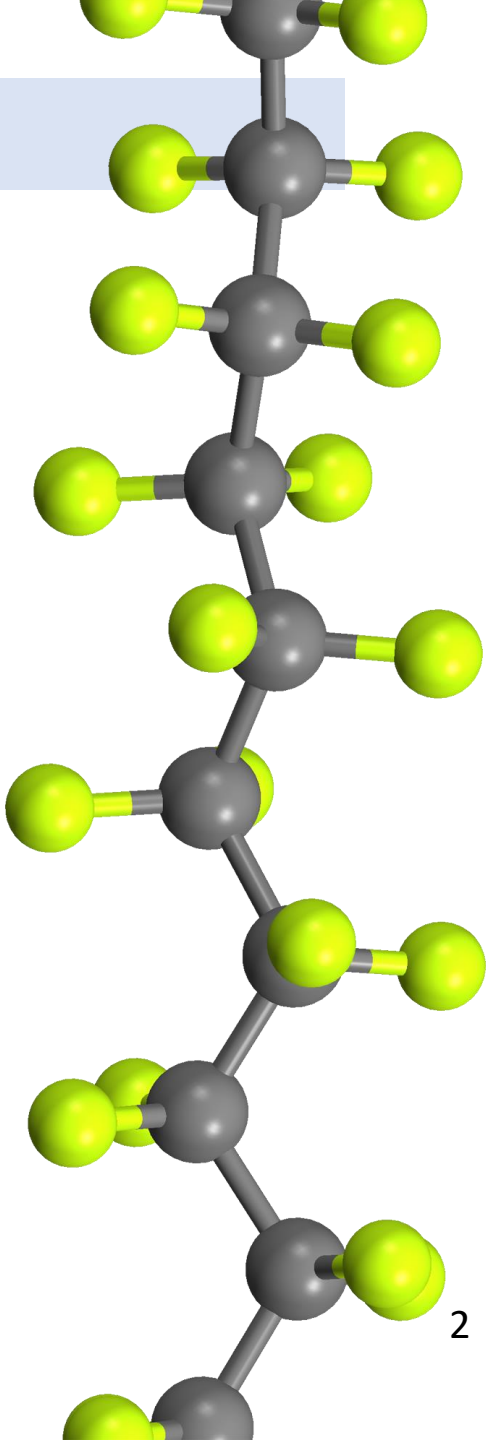
A) $Na_2S(aq) + 2HClO_4(aq) \rightarrow H_2S(g) + 2NaClO_4(aq)$
B) $NaOH(aq) + NH_4I(aq) \rightarrow NH_3(g) + H_2O(l) + NaI(aq)$
C) $NaHSO_3(aq) + HNO_3(aq) \rightarrow SO_2(g) + H_2O(l) + NaNO_3(aq)$
D) $2HC_2H_3O_2(aq) + Na_2CO_3(aq) \rightarrow CO_2(g) + H_2O(l) + 2NaC_2H_3O_2(aq)$

Exam #3: Information

- **Exam #3 is Friday, December 4.**
  - During normal class period. Go to Canvas to take the exam.
  - Timed: 50 minutes
  - 20 multiple choice questions; worth 5 pts each.
  - Both questions and answers will be randomized for each student.

  - Can use class handouts, textbook, lecture notes, PowerPoint slides.
  - Get all your materials (such as handouts, calculator and paper/pencil) ready before you start the exam.

  - Even though it is open book, you will not have enough time to look up every single thing, so you must study and be fully prepared going into the exam.



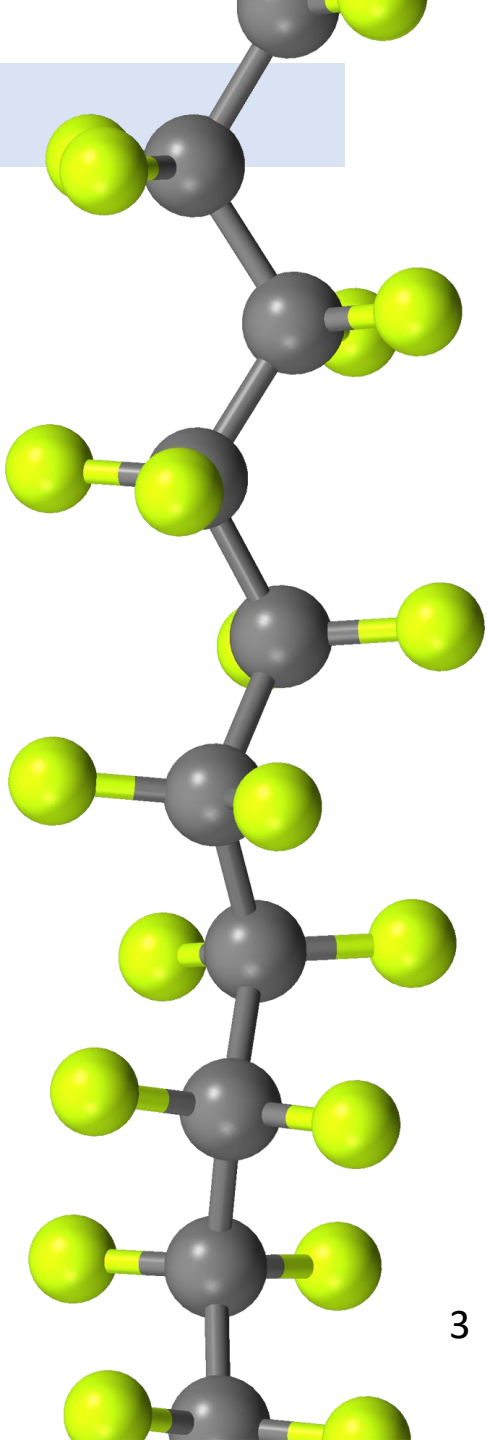
Exam #3: Resources

October calendar: tinyurl.com/SacStateChem4

- ✓ Learning Outcomes for Exam #3.
- ✓ PowerPoint slides and recordings of lecture.
- ✓ Practice exams, 4 versions: A, B, C, and D. [NOTE: they are not on Canvas]
  - ✓ Time yourself; take it like a real exam.
  - ✓ Make a list of the type of questions you are getting wrong and focus your study on those topics.
  - ✓ For extra practice on those topics: Video recording of lecture, PowerPoint slides, e-text, optional homework problems, PAL worksheets.
- ✓ Finish up any late homework for credit.

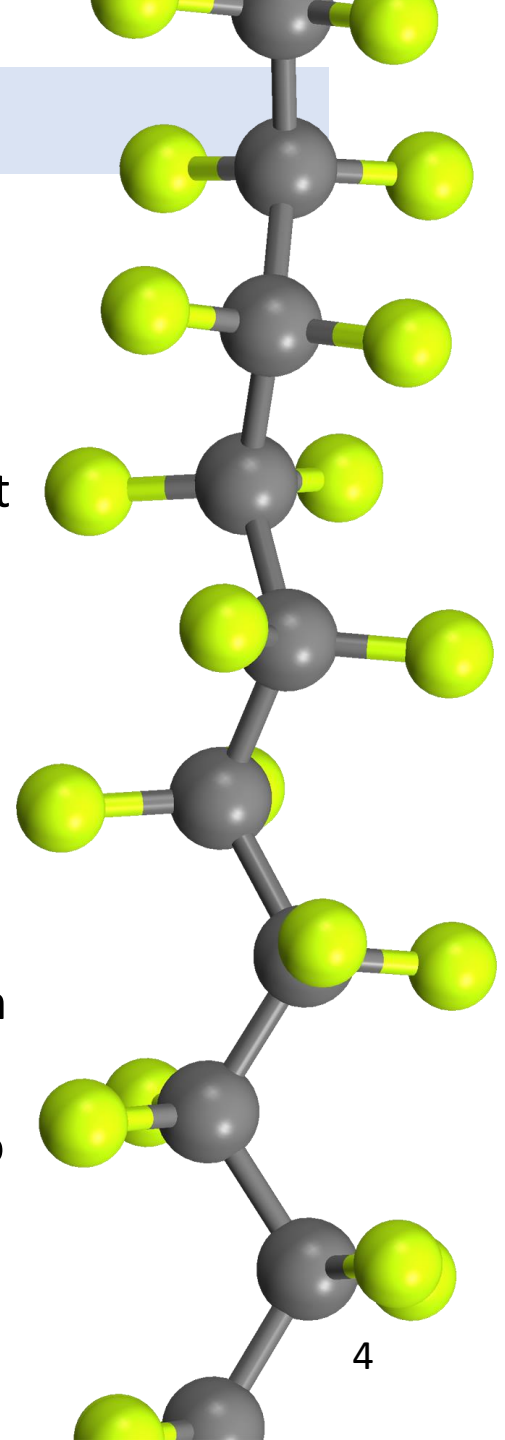
Need help?

- ✓ Jeff's office hours this week: **MW 9 – 9:30 am and 11 – 11:30 am**.
- ✓ Review session, Wednesday (12/2) during lecture. **New format: I'll use clickers to have everyone vote on which questions from the first 2 practice exams (A and B) they want me to go over. Be prepared to vote.**
- ✓ PAL office hours: link is on our CHEM 4 website
- ✓ PAL study hall (open to all CHEM 4 students): **TBD** *Zoom code:*



Academic dishonesty:

- ✓ Cannot use any online resources that are not explicitly associated with class.
- ✓ Students posting to sites like Chegg, Bartleby, or Study.com are cheating.
- ✓ **Remember:** Everyone get's hurt by cheating:
  - ✓ Cheaters are stealing the hard work of others by taking a grade that they haven't earned.
  - ✓ Cheaters hurt themselves because they won't be prepared for our next exam or for CHEM 1A/1E, not to mention the MCAT, EIT, DAT, PCAT.
  - ✓ Cheaters risk getting caught and being brought up on disciplinary charges.
  - ✓ SacState's reputation is hurt when employers realize our grads don't know anything!
- ✓ **Bottom line:** There is no reason to cheat in this class. You are smart enough to earn a good grade. So, do your studying and be proud of the grade that you earn.
- ✓ **My promise to you:** There will be no surprises and no trick questions. I just want to see if you have been learning the material that we've covered.



CHEM 4 lecture

Monday – November 30, 2020

Sec 7.9 – 7.10

Types of reactions

Reading question: Types of reactions (Sec 7.9-7.10)
Go to LearningCatalytics.com **Session ID =**

2) Which of the following statements about oxidation-reduction reactions is false?

A) Oxidation-reduction reactions require oxygen as a reactant.

B) Oxidation-reduction reactions are also called redox reactions.

C) Reduction is the gain of electrons.

D) Oxidation-reduction reactions involve the transfer of electrons from one substance to another.

E) If one substance is oxidized, then another substance must be reduced.

F) Oxidation is the loss of electrons.

G) Combustion reactions are a type of oxidation-reduction reaction.

Remember…

LEO goes **GER**

Lose **E**lectrons **O**xidized

Gain **E**lectron **R**educed

Background: Redox reactions

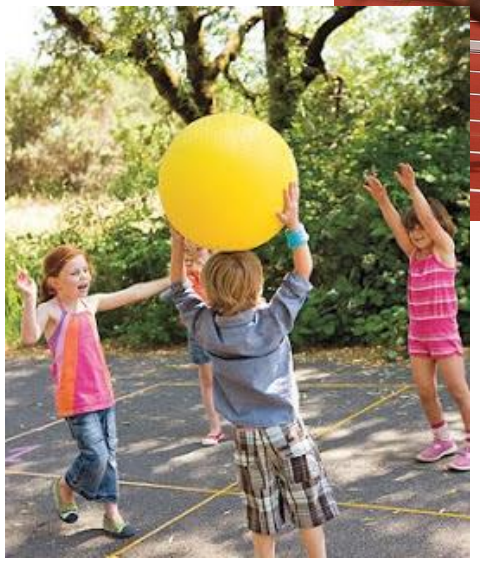
- Redox reactions are one of the most important categories of reactions:
- Combustion reactions: **Fuel + $O_2(g) \rightarrow CO_2(g) + H_2O(g)$**

Background: Redox reactions

- Electrochemical reactions and batteries

Background: Redox reactions

- Cellular respiration and biological processes



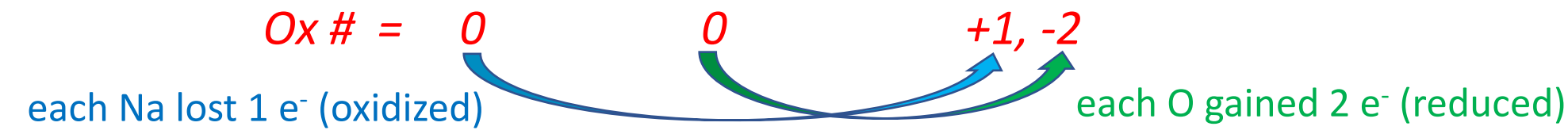
Background: Redox reactions

- Not all redox reactions are good: Rusting and corrosion

Background: Identifying redox reactions

- Redox reactions involve something **g**aining **e**lectrons (***r****eduction***) and something **l**osing **e**lectrons (***o****xidation***). Can't have one without the other.
- Easiest way to tell is to look at the oxidation numbers, Ox # (not in our textbook).
- If the Ox # changes during the reaction, then it is a redox reaction.
- Rules for determining Ox # are complex, but for now only 2:
  - **Ox # for a pure element = 0** (ex. Ox # for H_2, Ne, Cu = 0)
  - **Ox # for an ion = ion charge** (ex. Ox # for KCl = +1 for K and -1 for Cl)

- **Ex.** $4\ Na\ (s) + O_2\ (g) \rightarrow 2\ Na_2O\ (s)$



- To make it even easier for CHEM 4, on tests, you'll always have a pure element (Ox # = 0) on one side of the reaction that becomes part of a compound (Ox # ≠ 0).

Clicker question: Identifying redox reactions

3) Which of the following reactions is not a redox reaction?

A) $H_2(g) + S(s) \rightarrow H_2S(g)$

B) $C_3H_8(g) + 5\ O_2(g) \rightarrow 3\ CO_2(g) + 4\ H_2O(g)$

C) $HCl(aq) + NaOH(aq) \rightarrow H_2O(l) + NaCl(aq)$

D) $H_2(g) + F_2(g) \rightarrow 2\ HF(g)$

E) $2\ Fe(s) + 3\ Cl_2(g) \rightarrow 2\ FeCl_3(s)$

In addition to being a redox reaction, B) is also a combustion reaction:
Fuel + O_2 (g) $\rightarrow$ CO_2(g) + H_2O(g)

C) is an acid-base neutralization reaction and a double displacement reaction.

Clicker question: Writing redox reactions

4) Write the balanced equation for the combustion of octane, C_8H_{18}. What is coefficient in front of the CO_2?

A) 8 C) 18 **E) 16**

B) 4 D) 6 F) 2

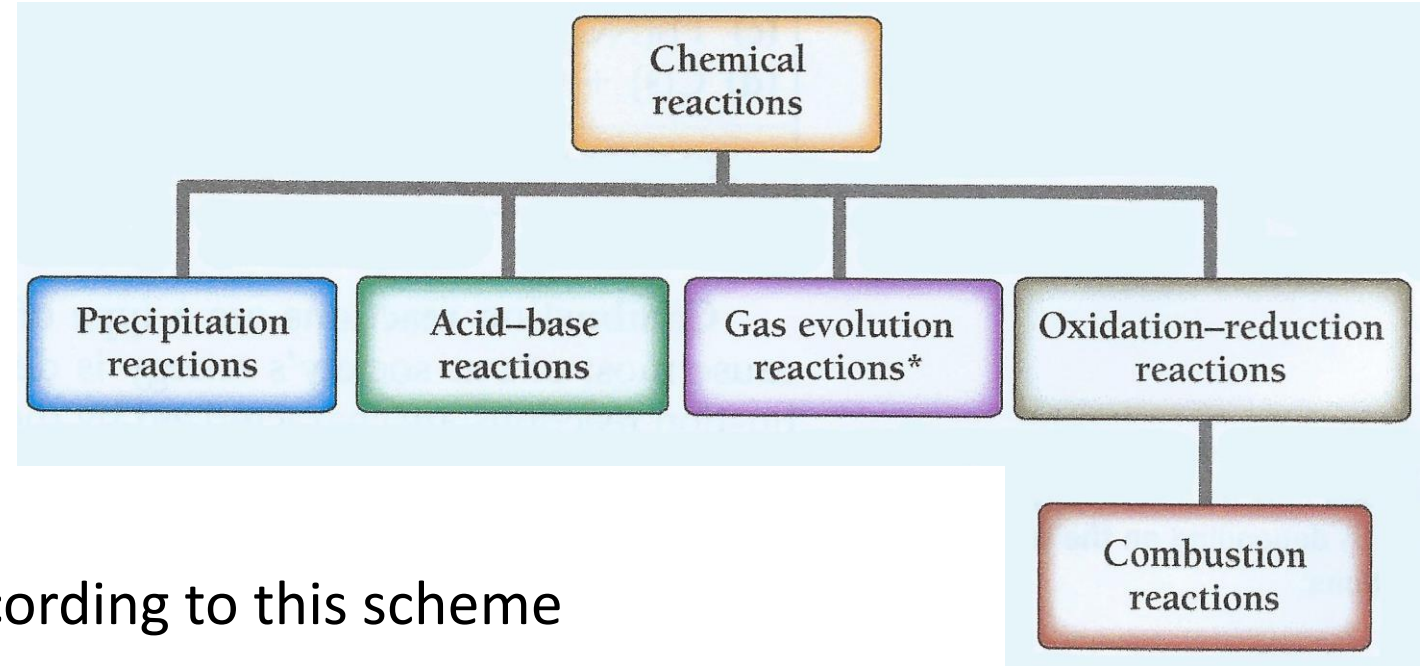
Answer:

$$\_\_\_\_\_\ C_8H_{18}\ (l) + \_\_\_\_\_\ O_2\ (g) \rightarrow \_\_\_\_\_\ CO_2\ (g) + \_\_\_\_\_\ H_2O\ (g)$$

$$2\ C_8H_{18}(l) + 25\ O_2(g) \rightarrow 16\ CO_2(g) + 18\ H_2O(g)$$

Combustion reaction = fuel + O_2 → CO_2(g) H_2O

Big picture: Types of chemical reactions



Be able to:

- Classify any given reaction according to this scheme
- Predict products for any of the reactions (except redox)
  - Precipitation, acid-base, and gas forming = double displacement
  - Combustion = form CO_2 and water
- Balance any of them

Clicker question: Answer this question based on your assigned reading (Sec 7.10) for today.

5) Which of the following generic reactions is not correctly classified?

A)	$AB + CD \rightarrow AD + CB$	is a double-displacement reaction
B)	$AB \rightarrow A + B$	is a decomposition reaction
C)	$A + B \rightarrow AB$	is a synthesis reaction
D)	$A + BC \rightarrow AC + B$	is a displacement reaction
E)	$A + B \rightarrow C$	is a conversion reaction

Clicker question: Identifying types of reactions

6) Which of these reactions is not correctly classified using the codes below?

1)	precipitation	6)	synthesis
2)	acid-base	7)	decomposition
3)	gas evolution	8)	displacement
4)	oxidation-reduction	9)	double displacement
5)	combustion		

A)	$2\ HNO_3\ (aq) + Ca(OH)_2\ (aq) \rightarrow 2\ H_2O\ (l) + Ca(NO_3)_2\ (aq)$	2, 9
B)	$2\ HNO_3\ (aq) + SrS\ (aq) \rightarrow H_2S\ (g) + Sr(NO_3)_2\ (aq)$	3, 9
C)	$N_2(g) + 3\ H_2(g) \rightarrow 2\ NH_3(g)$	4, 6
D	$Li_2SO_4\ (aq) + SrCl_2\ (aq) \rightarrow SrSO_4\ (s) + 2\ LiCl\ (aq)$	1, 9
E)	$2\ C_8H_{18}\ (l) + 25\ O_2\ (g) \rightarrow 16\ CO_2\ (g) + 18\ H_2O\ (g)$	4, 5
F)	$Fe(s) + Ni(NO_3)_2(aq) \rightarrow Ni(s) + Fe(NO_3)_2(aq)$	1, 8

F) is 4 and 8