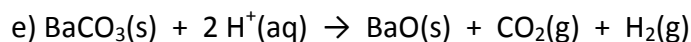
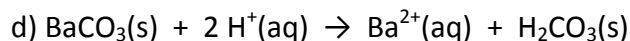
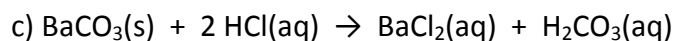
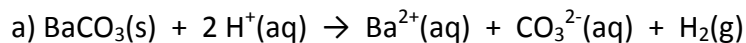


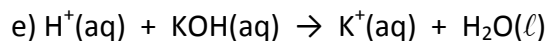
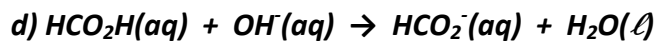
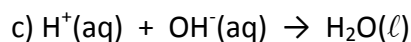
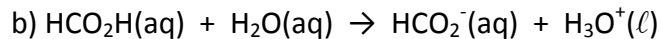
## Vining- Exam #2, Version 26

- Which of the following compounds are soluble in water:  $\text{Cu}(\text{NO}_3)_2$ ,  $\text{Al}_2\text{S}_3$ ,  $\text{Ba}_3(\text{PO}_4)_2$ , and  $\text{CaBr}_2$ ?
  - $\text{Cu}(\text{NO}_3)_2$  only
  - $\text{Cu}(\text{NO}_3)_2$  and  $\text{Al}_2\text{S}_3$
  - $\text{Al}_2\text{S}_3$  and  $\text{Ba}_3(\text{PO}_4)_2$
  - $\text{Ba}_3(\text{PO}_4)_2$  and  $\text{CaBr}_2$
  - $\text{Cu}(\text{NO}_3)_2$  and  $\text{CaBr}_2$**
- A precipitate will form when aqueous  $\text{NiCl}_2$  is added to an aqueous solution of \_\_\_\_\_.
  - $\text{SrI}_2$
  - $\text{Cu}(\text{NO}_3)_2$
  - $\text{KOH}$**
  - $\text{Na}_2\text{SO}_4$
  - $\text{NaF}$
- Write a balanced chemical equation for the reaction of aqueous solutions of aluminum nitrate and potassium phosphate.
  - $\text{Al}(\text{NO}_3)_3(\text{aq}) + \text{K}_3\text{PO}_4(\text{aq}) \rightarrow \text{K}_3\text{Al}(\text{s}) + \text{PO}_4(\text{NO}_3)_3(\text{aq})$
  - $3 \text{Al}(\text{NO}_3)_2(\text{aq}) + 2 \text{K}_3\text{PO}_4(\text{aq}) \rightarrow \text{Al}_3(\text{PO}_4)_2(\text{s}) + 6 \text{KNO}_3(\text{aq})$
  - $\text{AlNO}_3(\text{aq}) + \text{KPO}_4(\text{aq}) \rightarrow \text{AlPO}_4(\text{s}) + \text{KNO}_3(\text{aq})$
  - $\text{AlNO}_3(\text{aq}) + \text{KPO}_4(\text{aq}) \rightarrow \text{AlPO}_4(\text{aq}) + \text{KNO}_3(\text{s})$
  - $\text{Al}(\text{NO}_3)_3(\text{aq}) + \text{K}_3\text{PO}_4(\text{aq}) \rightarrow \text{AlPO}_4(\text{s}) + 3 \text{KNO}_3(\text{aq})$**
- What is the net ionic equation for the reaction of aqueous sodium hydroxide and aqueous iron(II) chloride?
  - $\text{Na}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{NaOH}(\text{s})$
  - $\text{Na}^+(\text{aq}) + \text{Cl}^-(\text{aq}) \rightarrow \text{NaCl}(\text{s})$
  - $\text{Fe}^{2+}(\text{aq}) + 2 \text{OH}^-(\text{aq}) \rightarrow \text{Fe}(\text{OH})_2(\text{s})$**
  - $\text{Fe}^{2+}(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{FeOH}^+(\text{s})$
  - $\text{Fe}^{2+}(\text{aq}) + 2 \text{Cl}^-(\text{aq}) \rightarrow \text{FeCl}_2(\text{s})$

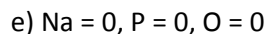
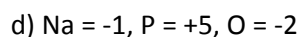
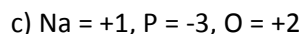
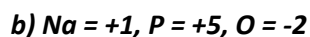
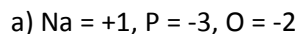
5. Write a balanced net ionic equation for the reaction of barium carbonate and aqueous hydrochloric acid.



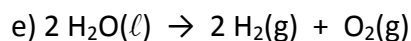
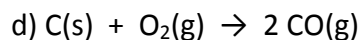
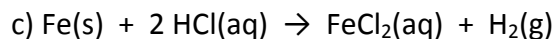
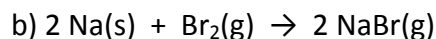
6. Formic acid,  $\text{HCO}_2\text{H}$ , is a weak acid. Write a net ionic equation for the reaction of aqueous formic acid and aqueous potassium hydroxide.



7. What is the oxidation number of each atom in sodium phosphate,  $\text{Na}_3\text{PO}_4$ ?



8. All of the following are oxidation-reduction reactions EXCEPT



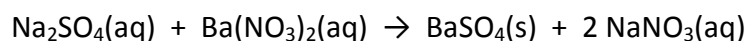
9. If 8.19 g  $\text{KIO}_3$  is dissolved in enough water to make 500.0 mL of solution, what is the molarity of the potassium iodate solution? The molar mass of  $\text{KIO}_3$  is 214 g/mol.

- a) 0.0164 M      b) 0.0191 M      **c) 0.0765 M**  
d) 3.51 M      e) 16.4 M

10. What is the pH of 0.51 M  $\text{HCl}(\text{aq})$ ?

- a) -0.29      **b) 0.29**      c) 0.31      d) 0.51      e) 0.67

11. What volume of 0.200 M  $\text{Na}_2\text{SO}_4(\text{aq})$  will completely react with 50.0 mL of 0.135 M  $\text{Ba}(\text{NO}_3)_2(\text{aq})$ ?



- a) 33.8 mL**      b) 67.5 mL      c) 74.1 mL      d) 148 mL      e) 540. mL

12. Specific heat capacity is

- a) the quantity of heat needed to change the temperature of 1.00 g of a substance by 1.00 °C.**  
b) the quantity of heat needed to change the temperature of 1.00 g of a substance by 4.184 °C.  
c) the mass of a substance that 1.00 J of energy will heat by 1.00 °C.  
d) the temperature change undergone when 1.00 g of a substance absorbs 4.184 J.  
e) the maximum amount of heat that 1.00 g of a substance may absorb without decomposing.

13. If 245 J is required to change the temperature of 14.4 g of chromium by 38.0 °C, what is the specific heat capacity of chromium?

- a) 0.448 J/g·°C**      b) 2.23 J/g·°C      c) 4.18 J/g·°C      d) 4.68 J/g·°C      e) 92.8 J/g·°C

14. If the same amount of energy in the form of heat is added to 5.00 g samples of each of the metals below, which metal will undergo the largest temperature change?

<u>Metal</u>	<u>Specific Heat Capacity (J/g·°C)</u>
Ag	0.235
Al	0.897
Cu	0.385
Fe	0.449
Mg	1.017

- a) **Ag**                      b) Al                      c) Cu                      d) Fe                      e) Mg

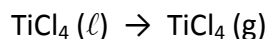
15. Calculate the energy in the form of heat (in kJ) required to change 50.0 g ice at -15.0 °C to liquid at 65.0 °C. (Heat of fusion = 333 J/g; heat of vaporization = 2256 J/g; specific heat capacities: ice = 2.06 J/g·°C, liquid water = 4.184 J/g·°C)

- a) 15.5 kJ                      b) 16.7 kJ                      **c) 31.8 kJ**                      d) 128 kJ                      e) 145 kJ

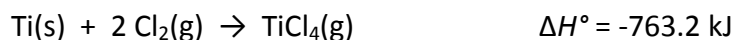
16. When 10.0 g KOH is dissolved in 100.0 g of water in a coffee-cup calorimeter, the temperature rises from 25.18 °C to 47.53 °C. What is the enthalpy change per gram of KOH dissolved in the water? Assume that the solution has a specific heat capacity of 4.18 J/g·°C.

- a) -116 J/g                      b) -934 J/g                      **c)  $-1.03 \times 10^3$  J/g**  
d)  $-2.19 \times 10^3$  J/g                      e)  $-1.03 \times 10^4$  J/g

17. Determine the heat of condensation of titanium(IV) chloride,



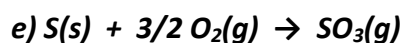
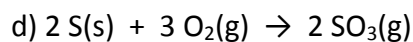
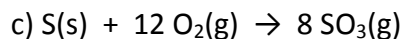
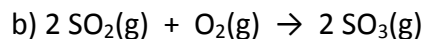
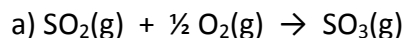
given the enthalpies of reaction below.



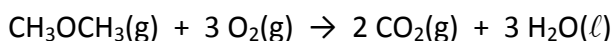
- a) -1567.4 kJ                      b) -41.0 kJ                      c) +1.054 kJ                      **d) +41.0 kJ**                      e) +1567.4 kJ

I also accepted (b) because the word "condensation" refers to the opposite reaction. I missed it when reversing the reaction to make the second version of the question.

18. Which of the following chemical equations corresponds to the standard molar enthalpy of formation of  $\text{SO}_3$ ?



19. Calculate  $\Delta H^\circ$  for the combustion of gaseous dimethyl ether,



using standard molar enthalpies of formation.

<u>molecule</u>	<u><math>\Delta H_f^\circ</math> (kJ/mol)</u>
$\text{CH}_3\text{OCH}_3(\text{g})$	-184.1
$\text{CO}_2(\text{g})$	-393.5
$\text{H}_2\text{O}(\ell)$	-285.8

a) -76.4 kJ

b) -495.2 kJ

c) -863.4 kJ

**d) -1460.3 kJ**

e) -1828.5 kJ

20. An argon ion laser emits light at 457.9 nm. What is the frequency of this radiation?

a)  $4.338 \times 10^{-19} \text{ s}^{-1}$

b)  $1.527 \times 10^{-15} \text{ s}^{-1}$

c)  $1.373 \times 10^{11} \text{ s}^{-1}$

**d)  $6.547 \times 10^{14} \text{ s}^{-1}$**

e)  $2.305 \times 10^{18} \text{ s}^{-1}$

21. As the wavelength of light increases, the energy \_\_\_\_\_ and the frequency \_\_\_\_\_.

a) increases, increases

b) increases, decreases

c) decreases, increases

**d) decreases, decreases**

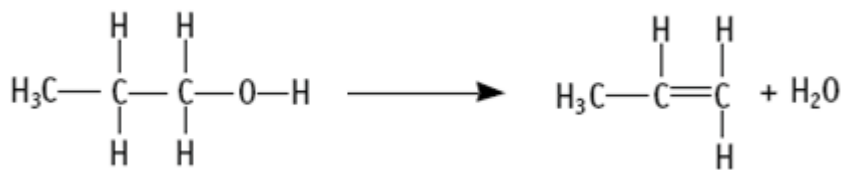
22. Excited hydrogen atoms emit light in the infrared at  $1.87 \times 10^{-6}$  m. What is the energy of a single photon with this wavelength?

- a)  $1.24 \times 10^{-39}$  J    b)  $4.13 \times 10^{-20}$  J    **c)  $1.06 \times 10^{-19}$  J**    d)  $6.24 \times 10^{-15}$  J    e)  $1.60 \times 10^{14}$  J

23. For which of the following transitions would a hydrogen atom **absorb** a photon with the longest wavelength?

- a)  $n = 1$  to  $n = 2$     b)  $n = 2$  to  $n = 4$     c)  $n = 5$  to  $n = 1$     d)  $n = 7$  to  $n = 6$     **e)  $n = 5$  to  $n = 6$**

24. What type of organic reaction is shown here?



1) addition

**2) elimination**

3) substitution

4) isomerization

25. Which of the following two compounds can be used to synthesize pure  $\text{KNO}_3$  without the need to filter anything? Assume you have water available.

1)  $\text{KCl}$  and  $\text{NaNO}_3$

**2)  $\text{KOH}$  and  $\text{HNO}_3$**

3)  $\text{KCl}$  and  $\text{AgNO}_3$

4)  $\text{KF}$  and  $\text{NaNO}_3$

5) This can't be done. Filtering must occur.