

The Periodic Table

<i>IA</i> H 1 1.01																	<i>VIIIA</i> He 2 4.00	
<i>IIA</i> Li 3 6.94	Be 4 9.01											<i>IIIA</i> B 5 10.81	<i>IVA</i> C 6 12.01	<i>VA</i> N 7 14.01	<i>VIA</i> O 8 16.00	<i>VIIA</i> F 9 19.00	Ne 10 20.18	
Na 11 22.99	Mg 12 24.31			<i>IIIB</i>	<i>IVB</i>	<i>VB</i>	<i>VIB</i>	<i>VIIIB</i>	<i>VIIIB</i>	<i>VIIIB</i>	<i>IB</i>	<i>IIB</i>	<i>IIIA</i> Al 13 26.98	<i>IVA</i> Si 14 28.09	<i>VA</i> P 15 30.97	<i>VIA</i> S 16 32.07	<i>VIIA</i> Cl 17 35.45	Ar 18 39.95
K 19 39.10	Ca 20 40.08	Sc 21 44.96	Ti 22 47.88	V 23 50.94	Cr 24 52.00	Mn 25 54.94	Fe 26 55.85	Co 27 58.93	Ni 28 58.69	Cu 29 63.55	Zn 30 65.39	Ga 31 69.72	Ge 32 72.61	As 33 74.92	Se 34 78.96	Br 35 79.90	Kr 36 83.80	
Rb 37 85.47	Sr 38 87.62	Y 39 88.91	Zr 40 91.22	Nb 41 92.91	Mo 42 95.94	Tc 43 (97.9)	Ru 44 101.07	Rh 45 102.91	Pd 46 106.42	Ag 47 107.87	Cd 48 112.41	In 49 114.82	Sn 50 118.71	Sb 51 121.76	Te 52 127.60	I 53 126.90	Xe 54 131.29	
Cs 55 132.91	Ba 56 137.33	La 57 138.91	Hf 72 178.49	Ta 73 180.95	W 74 183.85	Re 75 186.21	Os 76 190.2	Ir 77 192.22	Pt 78 195.08	Au 79 197.97	Hg 80 200.59	Tl 81 204.38	Pb 82 207.2	Bi 83 208.98	Po 84 (209)	At 85 (210)	Rn 86 (222)	
Fr 87 223.02	Ra 88 226.03	Ac 89 227.03	Rf 104 (261)	Db 105 (262)	Sg 106 263)	Bh 107 (262)	Hs 108 (265)	Mt 109 (266)	Ds 110 (271)	Rg 111 (272)	Uub 112 (285)	Uut 113 (284)	Uuq 114 (289)	Uup 115 (288)				
Ce 58 140.12	Pr 59 140.91	Nd 60 144.24	Pm 61 (145)	Sm 62 150.36	Eu 63 152.97	Gd 64 157.25	Tb 65 158.93	Dy 66 162.50	Ho 67 164.93	Er 68 167.26	Tm 69 168.93	Yb 70 173.04	Lu 71 174.97					
Th 90 232.04	Pa 91 231.04	U 92 238.03	Np 93 237.05	Pu 94 (240)	Am 95 243.06	Cm 96 (247)	Bk 97 (248)	Cf 98 (251)	Es 99 252.08	Fm 100 257.10	Md 101 (257)	No 102 259.10	Lr 103 262.11					

Some Useful (maybe) Constants:

a) $R = 8.314 \text{ J}\cdot\text{mol}^{-1}\text{K}^{-1}$

b) Some Useful (maybe) Formula:

$$\ln \frac{P_2}{P_1} = \frac{\Delta H_{\text{vap}}^{\circ}}{R} \left(\frac{1}{T_1} - \frac{1}{T_2} \right)$$

$$P_{\text{solution}} = X_{\text{solvent}} \times P_{\text{solvent}}^{\circ}$$

Integrated Rate Laws for Reactions of Type A → Products

Rate Law	Integrated Rate Law
rate = $k[A]^0 = k$	$[A]_t = [A]_0 - kt$
rate = $k[A]$	$\ln \frac{[A]_t}{[A]_0} = -kt$
rate = $k[A]^2$	$\frac{1}{[A]_t} = \frac{1}{[A]_0} + kt$

Zero Order	First Order	Second Order
$t_{1/2} = \frac{[A]_0}{2k}$	$t_{1/2} = \frac{\ln 2}{k}$	$t_{1/2} = \frac{1}{k[A]_0}$
Directly proportional to $[A]_0$	Constant	Inversely proportional to $[A]_0$

SID

--	--	--	--	--	--	--	--

Last

First

Question 1

10 Points

The vapor pressure of bromoethane is 40.1 mm Hg at 246K. Assuming that its molar heat of vaporization is constant at 29.2 kJ/mol, determine the vapor pressure of bromoethane (C_2H_5Br) at 263K.

Must Show Work for Full Credit - $R = 8.314 \text{ J}\cdot\text{mol}^{-1}\cdot\text{K}^{-1}$

_____ Mm Hg

Question 2

6 Points

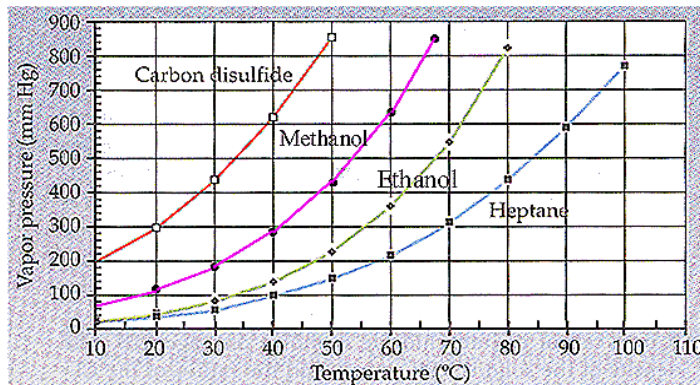
What type(s) of intermolecular forces are expected between HFCO molecules?
Circle all those that apply.

(C is the central atom)

- | | |
|--|---|
| <input type="checkbox"/> Ion - Ion | <input type="checkbox"/> Ion - Dipole |
| <input type="checkbox"/> Dipole - Dipole | <input type="checkbox"/> Hydrogen bonding |
| <input type="checkbox"/> Induced Dipole - Induced Dipole | |

Question 3

6 Points



A plot of vapor pressures vs temperature, is depicted above.

a) The molecule with the weakest intermolecular forces? _____

b) The Normal Boiling Point of Methanol is: (<65°C, ~65°C, >65°C) _____

Question 4
8 Points

An aqueous solution is 7.02 % by mass hydrochloric acid, HCl. What is the mole fraction of hydrochloric acid in the solution?

Must Show Work for Full Credit: Molar Masses, HCl = 36.5g.mol⁻¹, H₂O = 18.02g.mol⁻¹

Question 5
8 Points

Match the following aqueous solutions with the appropriate letter from the column on the right. Assume complete dissociation of electrolytes.

_____ 0.21 m CrSO₄

_____ 0.16 m CuCl

_____ 0.19 m Cu(NO₃)₂

_____ 0.44 m Glucose (nonelectrolyte)

A. **Lowest** freezing point

B. **Second lowest** freezing point

C. **Third lowest** freezing point

D. **Highest** freezing point

Question 6
6 Points

The Vapor Pressure of 4 substances was measured at 25°C and they were found to be 143.0 mmHg, 67.9 mm Hg, 151.7 mmHg, 514.4 mmHg. The four substances measured are given below. Which one of the four would you anticipate having the Vapor Pressure of 151.7 mm Hg?

CH₃OH

C₅H₁₂

C₆H₁₄

CH₃CH₂OH

Question 7
7 Points

The vapor pressure of water (H₂O) is 23.8 mm Hg at 25°C. What is the vapor pressure of a solution consisting of 8.55 mol of water and 0.265 mol of a nonvolatile nonelectrolyte?

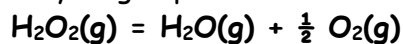
Must Show Work for Full Credit

_____ mm Hg

Question 8

10 Points

The gas phase decomposition of hydrogen peroxide at 400°C is **second order** in H₂O₂.



In one experiment, when the initial concentration of H₂O₂ was 5.50×10⁻² M, the concentration of H₂O₂ dropped to 1.29×10⁻² M after 59.6 seconds had passed. Based on this data, the **rate constant (k)** for the reaction is:

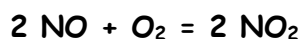
Must Show Work for Full Credit

_____ M⁻¹.s⁻¹

Question 9

12 Points

The following **initial rate data** are for the oxidation of nitrogen monoxide by oxygen at 25°C:



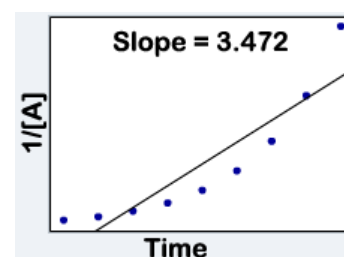
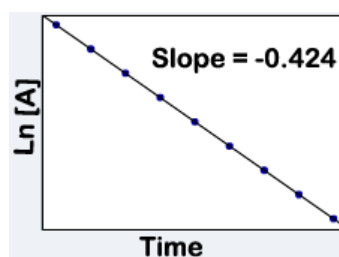
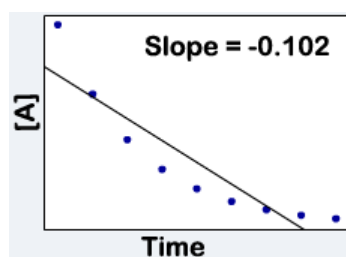
Experiment	[NO] ₀ M	[O ₂] ₀ M	Initial Rate, M.s ⁻¹
1	9.10×10 ⁻³	5.61×10 ⁻⁴	4.20×10 ⁻⁴
2	1.82×10 ⁻²	5.61×10 ⁻⁴	1.68×10 ⁻³
3	9.10×10 ⁻³	1.12×10 ⁻³	8.38×10 ⁻⁴

- a) What is the **order of the reaction with respect to NO**? _____
- b) What is the **order of the reaction with respect to O₂**? _____
- c) What is the **rate constant (k)**? _____

Question 10

8 Points

The following plots pertain to the reaction **A = B** in which the **concentration of A** was monitored over 8 minutes



From these plots the it can be determined that the **Rate** = _____ [A]_____

Question 11

10 Points

Chromium-51 is a radioisotope that is used to assess the lifetime of red blood cells. The half-life of chromium-51 is 27.7 days. If you begin with 41.7 mg of this isotope, what mass remains after 77.6 days have passed? Since the decomposition is a radioactive decay reaction, it is first order.

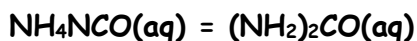
Must Show Work for Full Credit

_____ mg

Question 12

9 Points

In a study of the rearrangement of ammonium cyanate to urea in aqueous solution at 50°C



the concentration of NH_4NCO was followed as a function of time.

It was found that a graph of $1/[\text{NH}_4\text{NCO}]$ versus time in minutes gave a straight line with a slope of $1.47 \times 10^{-2} \text{ M}^{-1}\text{min}^{-1}$ and a y-intercept of 2.65 M^{-1} .

Based on this plot the:

- a) the reaction is _____ order in NH_4NCO
b) and the rate constant for the reaction is: _____ (units)

Do Not Write Below This Line

Exam I Score