Chemistry P **Name: _____**
Final Review **Period: _____**

(1) A sample of helium has a volume of 400 mL at 1.20 atm. What will the volume be at 1.50 atm?

(2) A balloon has a volume of 8.00 L at 47 °C. At what temperature will the balloon have a volume of 7.60 L?

(3) A gas cylinder has a pressure reading of 7.0×10^4 Pa at 350 K. What will the pressure read at 400 K?

(4) A sample of gas has a volume of 500 mL at 3.00 atm and 200 K. What will the pressure be if the sample is expanded to 600 mL at 300 K?

(5) How many moles of carbon dioxide are found in 5.6 L at STP? What is the mass of the carbon dioxide?

(6) How many moles of helium occupy 400 mL at 3.4 atm and 60 ºC? What is the mass of helium?

(7) Methane (CH_4) gas reacts with oxygen to form carbon dioxide gas and water vapour.
(a) Write a balanced chemical equation for this reaction.
(b) If 448 mL of methane are present at STP, what mass and volume of oxygen are required in the reaction?
(c) What is the volume and mass of each of the products? (Give mass to two decimal places)

(8) Determine the concentration of a solution containing 0.500 mol hydrochloric acid in 800 mL.

(9) What is the volume if a 0.15 M solution contains 0.24 mol of sodium chloride?

(10) Determine the final concentration if 40 mL of water are **added** to 60 mL of 0.25 M silver nitrate solution.

(11) Write a dissociation equation and determine the concentration of each ion in the solution.
(a) 0.036 M Na_2SO_4 (b) 0.40 M $AlCl_3$

(12) Determine if the following compounds are soluble or insoluble in water.
(a) AgI (b) SrS (c) $Ca(OH)_2$ (e) Na_2SO_3

(13) Write the formula equation, complete ionic equation, and net ionic equation for the reaction between NaI and $Pb(NO_3)_2$.

(14) 150 mL of 0.200 M strontium chloride solution are reacted with 200 mL of silver nitrate solution.
(a) Write a balanced chemical equation for this reaction.
(b) What is the concentration of the silver nitrate solution?
(c) What is the mass of each of the products? (Give two decimal places)

(15) List three properties of acids and three properties of bases.

(16) Complete the following table.

$[H^+]$	**pH**	**pOH**	**$[OH^-]$**	**acidic or basic?**
		3.15		
$3.2x10^{-4}$ M				
			$2.8x10^{-6}$ M	
	5.05			

(17) Write a balanced equation for each of the following reactions. Classify the reactions.
(a) nitric acid + barium hydroxide → (b) sulphuric acid + potassium hydroxide.

(18) Calculate the amount of energy released when 15.0 g of acetic acid freezes.

(19) Calculate the mass of methane that can be boiled by 2044 J of energy.

(20) Calculate the heat energy required to increase the temperature of 100 g of air from 20.0 °C to 80.0 °C.

(21) Calculate the final temperature if 65 J of heat energy is added to 25 g of lead at 45 °C.

(22) (a) How much energy is required to heat 20 g of ice from –12 °C to 0 °C?

(b) How much energy is required to turn 20 g of ice into water?

(c) How much energy is required to heat 20 g of water from 0 °C to 100 °C?

(23) Classify each reaction as endothermic or exothermic and determine ΔH.

____ (a) $CO\ (g) + SiO_2\ (s) + 590.2\ kJ/mol \rightarrow SiO\ (g) + CO_2\ (g)$; ΔH = _____ kJ/mol

____ (b) $2ZnS\ (s) + 3O_2\ (g) \rightarrow 2ZnO\ (s) + 2SO_2\ (g) + 878.3\ kJ/mol$; ΔH = _____ kJ/mol

(24) (a) Use the heats of formation to calculate the heat of the following reaction:

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

(b) How much heat would be released by the combustion of 10 mol of propane (C_3H_8)?

(25) Write the nuclide symbol for each isotope. State the number of protons, electrons, and neutrons for each isotope.

(a) Tellurium–120 (b) Lanthanum–139 (c) Vanadium–50

(26) For each of the following statements, state which type(s) or radiation (alpha, beta, or gamma) they describe.

(a) has the highest penetrating power

(b) has the same structure as an electron

(c) has the same structure as a helium nucleus

(d) can be stopped by a piece of paper

(e) can be stopped by aluminum foil

(f) can result in a transmutation

(g) is energy released from an excited atom

(h) is a type of particle

(27) Complete each of the following nuclear reactions.

(a) $^{66}_{29}\text{Cu} \rightarrow {}^{66}_{30}\text{Zn} + \_\_\_\_$

(b) $^{185}_{79}\text{Au} \rightarrow {}^{181}_{77}\text{Ir} + \_\_\_\_$

(c) $^{209}_{84}\text{Po}^{*} \rightarrow {}^{209}_{84}\text{Po} + \_\_\_\_$

(d) $^{235}_{92}\text{U} + {}^{1}_{0}\text{n} \rightarrow {}^{94}_{36}\text{Kr} + \_\_\_\_ + 3\,{}^{1}_{0}\text{n}$

(e) $^{39}_{17}\text{Cl} \rightarrow {}^{0}_{-1}\text{e} + \_\_\_\_$

(f) $^{100}_{41}\text{Nb} \rightarrow {}^{4}_{2}\text{He} + \_\_\_\_$

(28) The half–life of radium–224 is 3.66 days.

(a) What mass of a 10.0 g sample will remain after 7.32 days? (b) How long will it take for a 60.0 g sample to decay to 3.75 g?

(29) The half–life of radium–226 is 1599 years.

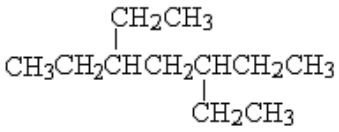
(a) What mass of a 15 g sample will remain after 6396 years? (b) How long will it take for an 80 g sample to decay to 0.625 g?

(30) Sulphur–35 has a half–life of 87.1 days.

(a) What mass of a 64 g sample will remain after 348.4 days? (b) How long will it take for a 1024 g sample to decay to 4.0 g?

(31) Name the following compounds.

(a)



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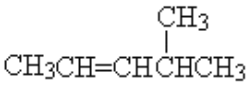

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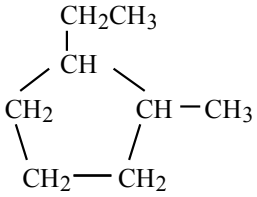

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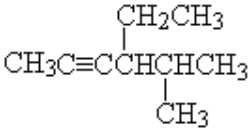


(32) Draw the following compounds

(a) 2,3–Dimethyloctane

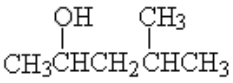
(c) 3–methyl–2–heptene

(b) 3,4–Diethylcyclohexene

(d) 5–Ethyl–2–nonyne

(33) Classify each of the compounds and match them with the correct name.

_____ (a)

#____ 

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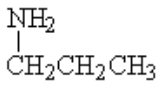
#____ 

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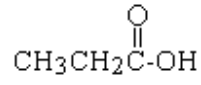
#____ 

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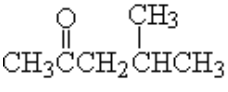
#____ 

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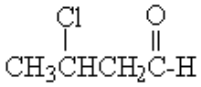
#____ 

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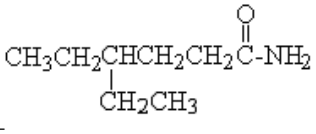
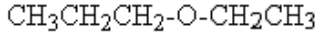
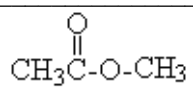
#____ 

_____ (g)

#____ 

_____ (h)

#____ 

(1) propanoic acid

(2) 3–chlorobutanal

(3) 1–aminopropane

(4) Ethyl propyl ether

(5) 4–Methyl–2–pentanone

(6) Methyl ethanoate

(7) 4–Methyl–2–pentanol

(8) 4–Ethylhexanamide

(34) Explain what would happen to $[C_5H_{11}N]$ for each of the following stresses.

$C_5H_5N\ (g) + 3H_2\ (g) + 1.4\ kJ/mol \rightleftharpoons C_5H_{11}N\ (g)$

(a) increase pressure (b) decrease temperature (c) increase volume (d) increase $[H_2]$

(35) Write a Keq expression for each of the following equilibria.

(a) $2CO\ (g) + O_2\ (g) \rightleftharpoons 2CO_2\ (g)$

(b) $4HCl\ (g) + O_2\ (g) \rightleftharpoons 2H_2O\ (l) + 2Cl_2\ (g)$

(36) Write a Keq expression for each of the following equilbria. Determine the value of Keq. Does the equilibrium favour the products or the reactants?

(a) $2H_2O\ (l) + 2F_2\ (g) \rightleftharpoons 4HF\ (g) + O_2\ (g)$

At equilibrium,
$[F_2] = 0.160$ M, $[HF] = 1.20$ M, and $[O_2] = 0.200$ M

(b) $2CH_4\ (g) \rightleftharpoons C_2H_2\ (g) + 3H_2\ (g)$

At equilibrium, a 10.0 L container holds
2.00 mol CH_4, 0.400 mol C_2H_2, and 6.00 mol H_2

Answers:

(1) 320 mL (2) 304 K (3) 8.0×10^4 Pa (4) 3.75 atm (4) 0.25 mol and 11 g (6) 0.050 mol and 0.20 g

(7) (a) $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ (b) 0.896 L and 1.28 g O_2 (c) 0.448 L and 0.88 g CO_2, 0.896 L and 0.72 g H_2O

(8) 0.625 M (9) 1.6 L (10) 0.15 M

(11) (a) $Na_2SO_4 \rightarrow 2Na^+ + SO_4^{2-}$, $[Na^+] = 0.072$ M, $[SO_4^{2-}] = 0.036$ M
(b) $AlCl_3 \rightarrow Al^{3+} + 3Cl^-$, $[Al^{3+}] = 0.40$ M, $[Cl^-] = 1.2$M

(12) (a) insoluble (b) soluble (c) insoluble (d) soluble

(13) formula equation: $2NaI\ (aq) + Pb(NO_3)_2\ (aq) \rightarrow 2NaNO_3\ (aq) + PbI_2\ (s)$
complete ionic equation: $2Na^+\ (aq) + 2I^-\ (aq) + Pb^{2+}\ (aq) + 2NO_3^-\ (aq) \rightarrow 2Na^+\ (aq) + 2NO_3^-\ (aq) + PbI_2\ (s)$
net ionic equation: $Pb^{2+}\ (aq) + 2I^-\ (aq) \rightarrow PbI_2\ (s)$

(14) (a) (a) $SrCl_2 + 2AgNO_3 \rightarrow Sr(NO_3)_2 + 2AgCl$ (b) $[AgNO_3] = 0.30$ M (c) 6.35 g $Sr(NO_3)_2$ and 8.60 g AgCl

(15)

Acid	**Base**
dissociate to produce H^+ ions	dissociate to produce OH^- ions
pH<7.0	pH>7.0
taste sour	taste bitter
react with metals to produce hydrogen gas	feel slippery
pH paper turns red/orange	pH paper turns blue/green
phenolphthalein → colourless	phenolphthalein → pink
bromothymol blue → yellow	bromothymol blue → blue
cabbage juice → pink	cabbage juice → blue

(16)

$[H^+]$	**pH**	**pOH**	**$[OH^-]$**	**acidic or basic?**
1.4×10^{-11} M	10.85	3.15	7.1×10^{-4} M	basic
3.2×10^{-4} M	3.49	10.51	3.1×10^{-11} M	acidic
3.5×10^{-9} M	8.45	5.55	2.8×10^{-6} M	basic
8.9×10^{-6} M	5.05	8.95	1.1×10^{-9} M	acidic

(17) neutralization (a) $2HNO_3 + Ba(OH)_2 \rightarrow Ba(NO_3)_2 + 2H_2O$ (b) $H_2SO_4 + 2KOH \rightarrow K_2SO_4 + 2H_2O$

(18) 2880 J (19) 4 g (20) 5970 J (21) 65 °C (22) (a) 501.6 J (b) 6680 J (c) 8360 J

(23) (a) endo; $\Delta H = +590.2$ kJ/mol (b) exo, $\Delta H = -878.3$ kJ/mol (24) (a) –2043.8 kJ/mol (b) –20438 kJ

(25) (a) ${}^{120}_{52}\mathrm{Te}$ 52 p, 52 e, 68 n (b) ${}^{139}_{57}\mathrm{La}$ 57 p, 57 e, 82 n (c) ${}^{50}_{23}\mathrm{V}$ 23 p, 23 e, 27 n

(26) (a) gamma (b) beta (c) alpha (d) alpha (e) beta (f) alpha/beta (g) gamma (h) alpha/beta

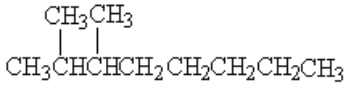
(27) (a) ${}^{0}_{-1}\mathrm{e}$ (b) ${}^{4}_{2}\mathrm{He}$ (c) ${}^{0}_{0}\gamma$ (d) ${}^{139}_{56}\mathrm{Ba}$ (e) ${}^{39}_{18}\mathrm{Ar}$ (f) ${}^{96}_{39}\mathrm{Y}$

(28) (a) 2.5 g (b) 14.64 days (29) (a) 0.9375 g (b) 11193 years (30) (a) 4.0 g (b) 696.8 days

(31) (a) 3,5–Diethylheptane (b) 4–Methyl–2–pentene (c) 1–Ethyl–2–methylcyclopentane (d) 4–Ethyl–5–methyl–2–hexyne

(32)

(a)



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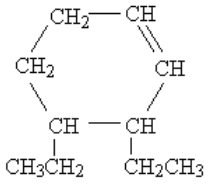

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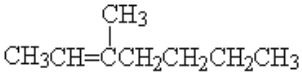

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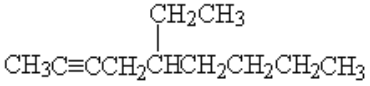

(33) (a) #7, alcohol (b) #3, amine (c) #1, carboxylic acid (d) #5, ketone
(e) #2, aldehyde and alkyl halide (f) #8, amide (g) #4, ether (h) #6, ester

(34)(a) S: increase pressure S: right: R: increase [$C_5H_{11}N$] (b) S: decrease temperature S: left R: decrease [$C_5H_{11}N$]
(c) S: increase volume S: left: R: decrease [$C_5H_{11}N$] (d) S: increase [H_2] S: right R: increase [$C_5H_{11}N$]

(35) (a) $Keq = \dfrac{[CO_2]^2}{[CO]^2[O_2]}$ (b) $Keq = \dfrac{[Cl_2]^2}{[HCl]^4[O_2]}$

(36) (a) $Keq = \dfrac{[HF]^4[O_2]}{[F_2]^2}$, Keq = 16.2, products (b) $Keq = \dfrac{[C_2H_2][H_2]^3}{[CH_4]^2}$ Keq= 0.216, reactants