

# Honour Chemistry (*Distant Learning*) Unit 4 Outline: Thermochemistry and Nuclear Chemistry

**\*\*Only do Even-Numbered HW Questions**

*Green Fonts - \*Asynchronous*

*Blue Fonts - \*\*Optional Video Lessons*

## Chapter 6: Energy Relationships in Chemical Reactions

Wk/Class	Topics	Suggested Reading	✓	Assignments	✓
March 1 / Day 2	Energy, Radiant Energy, Thermal Energy, Chemical Potential Energy, Potential Energy, Thermochemistry, Open System, Closed System, Isolated System, Law of Conservation of Energy (First Law of Thermodynamics), Heat ( $q$ ), Work ( $w$ ), Reaction Pathway, State Function (Property), Systems versus Surroundings, Exothermic versus Endothermic, Internal Energy ( $E$ ), $\Delta E = q + w$ , $w = -P\Delta V$ (only conceptual understanding – no calculations)	6.1: The Nature of Energy and Types of Energy (pg. 172) 6.2: Energy Changes in Chemical Reactions (pg. 173 to 174) 6.3: Introduction to Thermodynamics (pg. 174 to 180) <i>[6-1 to 6-3 Video Lesson – 44:40]</i>		pg. 198 #1 to 3, 6 to 11	
March 8 / Day 1	Enthalpy ( $H = E + PV$ and $H = n\Delta H_{\text{rxn}}$ ), Change in Enthalpy ( $\Delta H = q$ ) Energy Diagram, Endothermic and Exothermic Change in Enthalpy ( $\Delta H < 0$ Exothermic, $\Delta H > 0$ Endothermic)	6.4 Enthalpy of Chemical Reactions (pg. 180 to 185) <i>[6-4 Video Lesson – 27:11]</i>		pg 199 #21 to 26	
March 15 / Day 1	Heating Curve, Potential Energy (Phase Changes, $q = n\Delta H_{\text{fus}}$ , $q = n\Delta H_{\text{vap}}$ and $q = n\Delta H_{\text{sub}}$ where $\Delta H_{\text{sub}} = \Delta H_{\text{fus}} + \Delta H_{\text{vap}}$ ), Kinetic Energy (Temperature Change, Specific Heat, $q = mc\Delta T$ , Heat Capacity $q = C\Delta T$ ), Molar Enthalpy of Solution ( $\Delta H_{\text{sol}}$ ), Molar Enthalpy of Combustion ( $\Delta H_{\text{comb}}$ ), Physical and Chemical Calorimetry (Heat Gained = Heat Lost) using Constant-Volume Calorimeter (Bomb Calorimeter) or Constant-Pressure Calorimeter (Styrofoam Calorimeter)	12.6 Phase Changes (pg. 412 to 415)  6.5: Calorimetry (pg. 185 to 191) <i>[12-6 &amp; 6-5 Video Lesson – 95:04]</i>		pg. 421–423 #61, 69, 71, 72, 78, 112  pg. 199–200 #29 to 38	
March 15 / Day 2	Molar Heat of Formation ( $\Delta H_f$ ), Theoretical Molar Enthalpy of Reaction ( $\Delta H_{\text{rxn}} = \Sigma H_{\text{products}} - \Sigma H_{\text{reactants}}$ ), Hess's Law (Adding $\Delta H$ ), Fossil Fuels (Natural Gas, Petroleum, and Coal), Complete and Incomplete Combustions, Fractional Distillation, Cracking and Reforming, Greenhouse Effect (Global Warming), Deforestation, Hydrogen as Fuel, Other Energy Alternatives	6.6: Standard Enthalpy of Formation and Reaction (pg. 191 to 197) <i>[6-6A Video Lesson – 49:33]</i> <i>[6-6B Video Lesson – 52:40]</i> 6.7: Present Sources of Energy and New Energy Sources (extra notes)		pg. 200–202 #39 to 42, 45 to 49, 51, 52, 54 to 56, 58, 60 to 64, 67, 68, 74, 76, 80, 81	
March 22 / Day 1	<b>Lab #7: Heat of Solution and Molar Heat of Fusion &amp; Lab #8: Heat of Combustion (B &amp; D Blocks: March 22, Monday)</b>	Lab #7 Handout <i>[Lab #6 Video – 34:17]</i> Lab #8 Handout <i>[Lab #6 Video – 28:05]</i>		<b>Lab Reports #7 &amp; #8 Due: (B &amp; D Blocks: March 31, Wed)</b>	
	<b>Chapter 6 Take-Home Quiz (B &amp; D Blocks: March 25, Thursday)</b>	<b>Chapter 6 Homework Due (B &amp; D Blocks: March 25, Thursday)</b>		<b>Chapter 6 Take-Home Quiz Due: (B &amp; D Blocks: March 29, Mon)</b>	

## Chapter 21: Nuclear Chemistry

Wk/Class	Topics	Suggested Reading	✓	Assignments	✓
March 22 / Day 2	Nucleons (Neutrons and Protons), Nuclear Transmutation, Elementary Particles (proton ( ${}^1_1p$ or ${}^1_1H$ ), neutron ( ${}^1_0n$ ), electron or beta particle ( ${}^0_{-1}e$ or ${}^0_{-1}\beta$ ), positron ( ${}^0_{+1}e$ or ${}^0_{+1}\beta$ ), alpha particle ( ${}^4_2He$ or ${}^4_2\alpha$ ) and gamma ( $\gamma$ or ${}^0_0\gamma$ ) ray), Positron Emission and Electron Capture, Balancing Nuclear Equations, Strong Nuclear Force, Properties of Neutrons, Radioactive Decay, Neutron-to-Proton Ratio ( $n/p$ ), Zone of Stability, Thermodynamic Stability, Mass Defect ( $\Delta m$ ), Nuclear Binding Energy ( $\Delta E = \Delta mc^2$ )	21.1: The Nature of Nuclear Reactions (pg. 709 to 710)  21.2: Nuclear Stability (pg. 711 to 716) <i>[21-1 &amp; 21-2 Video Lesson – 81:29]</i>		pg. 734 #2, 4, 6; pg. 736 #55  pg. 734–735 #8, 12, 14, 18, 20; pg. 736 #56	
March 29 / Day 1	Radioactive Decay Series, Kinetics Stability, Rate of Decay, Rate Constant of Decay ( $k$ ), $\ln\left(\frac{N}{N_0}\right) = -kt$ , Half-Life ( $t_{1/2} = \frac{\ln 2}{k}$ ), Radioactive Dating (Carbon-14 Uranium-238 and Potassium-40 Dating)	21.3: Natural Radioactivity (pg. 716 to 720) <i>[21-3 Video Lesson – 37:56]</i>		pg. 735 #24, 25, 29; pg. 737 #66	
March 29 / Day 2	Transuranium Elements, Particle Accelerator (Cyclotrons and Linear Accelerators), Nuclear Fission, Spontaneous Fission, Nuclear Chain Reaction (Subcritical, Critical, and Supercritical), Critical Mass, Atomic Bomb, Nuclear Fission Reactors (Reactor Core, Moderator, and Control Rods) and their hazards, Light Water vs. Heavy Water Reactors, Breeder Reactors, Nuclear Fusion, Thermonuclear Reactions, Experimental Fusion Reactors, Hydrogen (Thermonuclear) Bomb	21.4: Nuclear Transmutation (pg. 720 to 722) 21.5 & 21.6: Nuclear Fission and Nuclear Fusion (pg. 722 to 729) <i>[21-4 to 21-6 Video Lesson – 35:37]</i>		pg. 735 #36  pg. 735–736 #38	
April 12 / Day 1	Radiotracers, Geiger-Müller (Geiger) Counter, Scintillation Counter, Measuring Radioactivity and Intensity ( $rad$ and $rem$ ), Natural and Man-made Radiations, Effects of Radiation (Somatic and Genetic Damages), Penetration ability and Ionization ability	21.7 & 21.8: Uses of Isotopes and Biological Effects of Radiation (pg. 729 to 732) <i>[21-7 &amp; 21-8 Video Lesson – 21:40]</i>		pg. 736 #50	
	<b>Unit 4 Test</b> <b>(covers Chapters 6 and 21)</b> <b>(B &amp; G Blocks: April 19, Monday)</b>	Unit 4 Practice Test		<b>Chapter 21 Homework Due</b> <b>(B &amp; D Blocks: April 19, Mon)</b>	