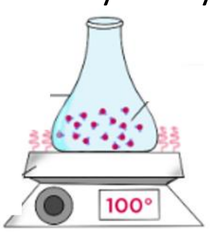
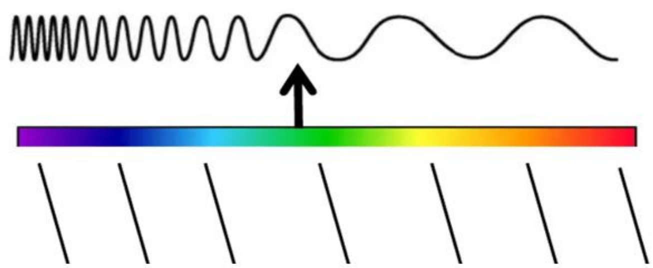
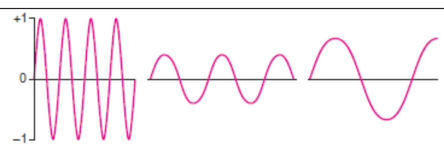
G10 EoT1 Exam Chemistry Practice Questions

<table>
<tr><th>No.</th><th>Example</th><th>Page</th></tr>
<tr><td>1.</td><td>Define these terms: system, surroundings, open system, closed system, isolated system, thermal energy, chemical energy, potential energy, kinetic energy, law of conservation of energy.
Questions & Problems Section: Q 6.1</td><td>33</td></tr>
<tr><td>2.</td><td>A pressure cooker is an example of which of the following?
a) Closed System
b) Open System
c) Isolated System
d) None of the mentioned</td><td>pdf</td></tr>
<tr><td>3.</td><td>Example(s) of an open system is/are<table><tr><td>I</td><td>A human body that is alive and functioning</td></tr><tr><td>II</td><td>A coffee machine</td></tr><tr><td>III</td><td>A computer</td></tr></table>A. I only
B. II only
C. III only
D. I, II, and III</td><td>pdf</td></tr>
<tr><td>4.</td><td>Define the term: system, surroundings</td><td>pdf</td></tr>
<tr><td>5.</td><td>Identify the system, surrounding and boundary in the diagram below.

</td><td>pdf</td></tr>
<tr><td>6.</td><td>Energy that is due to the motion of an object is ......
A. kinetic energy
B. potential energy
C. gravitational potential energy
D. elastic potential energy</td><td>pdf</td></tr>
<tr><td>7.</td><td>The main difference between kinetic energy and potential energy is that _____ .
A. kinetic energy involves position, and potential energy involves motion
B. kinetic energy involves motion, and potential energy involves position
C. although both energies involve motion, only kinetic energy involves position
D. although both energies involve position, only potential energy involves motion</td><td>pdf</td></tr>
<tr><td>8.</td><td>Define these terms: thermochemistry, exothermic process, endothermic process.</td><td>33</td></tr>
</table>

	Questions & Problems Section: Q 6.7	
9.	Describe two exothermic processes and two endothermic processes. Questions & Problems Section: Q 6.9	**33**
10.	For exothermic reactions, what is the heat of reaction? a) Positive b) Negative c) Zero d) Cannot Say $\Delta H = (-)$ why?? because energy released $H_p < H_r$ $\Delta H = H_p - H_r$ $= 2 - 3 = (-1)$	**pdf**
11.	What is kinetic energy? ○ The energy that an object gains from some outer source. ○ The energy that is released from an object. ○ The energy that is created by water. ○ The energy that an object possesses due to its motion.	**pdf**
12.	What is potential energy? ○ The stored energy of an object because of its position or condition. ○ The energy an object has due to its motion. ○ The energy an object might have if it existed. ○ All of these chemical energy	**pdf**
13.	(a) Briefly describe Bohr's theory of the hydrogen atom and how it explains the appearance of an emission spectrum. Questions & Problems Section: Q 7.24	**88**
14.	(a) What is an energy level? Explain the difference between ground state and excited state. (b) What are emission spectra? How do line spectra differ from continuous spectra? Questions & Problems Section: Q 7.23	**88**
15.	On what law is the first law of thermodynamics based? Explain the sign conventions in the equation $\Delta U = q + w$. Questions & Problems Section: Q 6.11	**33**
16.	Explain the first law of thermodynamics.	**pdf**

17.	List the types of electromagnetic radiation, starting with the radiation having the longest wavelength and ending with the radiation having the shortest wavelength. Questions & Problems Section: Q 7.3	**87**
18.	Gamma rays have very short wavelengths while microwaves have relatively long wavelengths. Compare the two types of radiation in terms of frequency and energy. a. Gamma rays have higher frequency and lower energy than microwaves. b. Gamma rays have higher frequency and higher energy than microwaves. c. Gamma rays have lower frequency and lower energy than microwaves. d. Gamma rays have lower frequency and higher energy than microwaves.	**pdf**
19.	A researcher is performing a photoelectric experiment in which she uses an ultraviolet radiation source and focuses its energy on a solid sample of aluminum. Gamma rays have very short wavelengths while microwaves have relatively long wavelengths. Compare the two types of radiation in terms of frequency and energy. A. Gamma rays have higher frequency and lower energy than microwaves. B. Gamma rays have higher frequency and higher energy than microwaves. C. Gamma rays have lower frequency and lower energy than microwaves. D. Gamma rays have lower frequency and higher energy than microwave.	**pdf**
20.	On what basis is the classification of electromagnetic waves done? a) Electromagnetic spectrum b) Electric field c) Magnetic field d) Propagation constant	**pdf**
21.	Pick out the correct increasing order of energy of electromagnetic waves from the following. a) $E_{infrared} < E_{micro} < E_{visible} < E_{ultraviolet} < E_{gamma}$ b) $E_{micro} < E_{infrared} < E_{visible} < E_{ultraviolet} < E_{gamma}$ c) $E_{micro} < E_{infrared} < E_{visible} < E_{gamma} < E_{ultraviolet}$ d) $E_{micro} < E_{infrared} < E_{ultraviolet} < E_{visible} < E_{gamma}$	**pdf**
22.	Which of the following choices lists electromagnetic waves from lower to higher frequencies? a. radio waves, infrared light, microwaves b. ultraviolet light, infrared light, X rays c. infrared light, ultraviolet light, gamma rays d. visible light, microwaves, ultraviolet light	**pdf**

23.	Look **carefully** at the electromagnetic spectrum shown below paying attention to the wavelengths and frequencies indicated. The visible portion of the electromagnetic spectrum has been enlarged below the spectrum. Fill in the blanks with the correct colors from the visible spectrum according to their wavelength, frequency and energy. 	**pdf**
24.	What is a wave? Explain the following terms associated with waves: *wavelength, frequency, amplitude*. Questions & Problems Section: Q 7.1	**87**
25.	What are the units for wavelength and frequency of electromagnetic waves? What is the speed of light in meters per second and miles per hour? Questions & Problems Section: Q 7.2	**87**
26.	Which of these wavelengths will produce a wave with the lowest frequency? (A) 5.2×10^{2} nm (B) 4.0×10^{-6} m (C) 3.5×10^{-5} cm (D) 1.3 Å (1 Å = 1×10^{-10} m)	**pdf**
27.	 Which wave shown above has the highest energy? (A) Wave 1 (B) Wave 2 (C) Wave 3 (D) All have the same energy.	**pdf**
28.	**A short-wavelength indicates that the frequency will be _____.** a. **Zero** b. **Lesser** c. **Higher** d. **None of the above options**	**pdf**
29.	A clean metal surface is irradiated with light of three different wavelengths λ_1, λ_2, and λ_3. The kinetic energies of the ejected electrons are as follows: λ_1: 2.9×10^{-20} J; λ_2: approximately zero; λ_3: 4.2×10^{-19} J. Which light has the shortest wavelength and which has the longest wavelength? Review of Concepts	**53**

30.	In a photoelectric experiment a student uses a light source whose frequency is greater than that needed to eject electrons from a certain metal. However, after continuously shining the light on the same area of the metal for a long period of time the student notices that the maximum kinetic energy of ejected electrons begins to decrease, even though the frequency of the light is held constant. How would you account for this behavior? Questions & Problems Section: Q 7.101	**91**
31.	Emission of electron from the surface of metal when radiation of appropriate frequency is allowed to incident on it is called : 1. Nuclear fission 2. Compton effect 3. Photoelectric effect	**pdf**
32.	Which radiations will be most effective for the emission of electrons from a metallic surface? a) Microwaves b) X rays c) Ultraviolet d) Infrared	**pdf**
33.	A piece of silver of mass 362 g has a heat capacity of 85.7 J/°C. What is the specific heat of silver? Questions & Problems Section: Q 6.32	**34**
34.	A 6.22-kg piece of copper metal is heated from 20.5°C to 324.3°C. Calculate the heat absorbed (in kJ) by the metal. Questions & Problems Section: Q 6.33	**34**
35.	Consider this reaction: $2CH_3OH(l) + 3O_2(g) \longrightarrow 4H_2O(l) + 2CO_2(g)$ $\Delta H = -1452.8$ kJ/mol What is the value of ΔH if (a) the equation is multiplied throughout by 2, (b) the direction of the reaction is reversed so that the products become the reactants and vice versa, (c) water vapor instead of liquid water is formed as the product? Questions & Problems Section: Q 6.24	**34**
36.	Given the thermochemical equations: $Br_2(l) + F_2(g) \longrightarrow 2BrF(g)$ $\Delta H° = -188$ kJ/mol $Br_2(l) + 3F_2(g) \longrightarrow 2BrF_3(g)$ $\Delta H° = -768$ kJ/mol calculate the $\Delta H°_{rxn}$ for the reaction $BrF(g) + F_2(g) \longrightarrow BrF_3(g)$ Questions & Problems Section: Q 6.74	**36**

37.	(a) What is the wavelength (in nm) of light having a frequency of 8.6×10^{13} Hz? (b) What is the frequency (in Hz) of light having a wavelength of 566 nm? Questions & Problems Section: Q 7.7	**87**
38.	(a) What is the frequency of light having a wavelength of 456 nm? (b) What is the wavelength (in nm) of radiation having a frequency of 2.45×10^9 Hz? (This is the type of radiation used in microwave ovens.) Questions & Problems Section: Q 7.8	**87**
39.	A beam of red light shining on a piece of gold metal for one second did not cause any electrons to be emitted from the metal. Which is the most probable reason? (A) The amplitude of the red light was too low. (B) The light was not shining on the piece of metal for a sufficient time period. (C) The red light had a wavelength that was too short to cause the photoelectric effect. (D) Red light does not have enough energy to remove an electron from the surface of gold.	**pdf**
40.	**Light from a bulb is falling on a wooden table but no photo electrons are emitted as** **A.** Work function of wood is less **B.** Work function of wood is more **C.** It depends on the frequency **D.** It is independent of work function	**pdf**
41.	50.0 mL of water cools from 100°C to 88°C. What is the correct description of the heat transfer? The specific heat capacity of water is 4.184 J/g·°C. (A) 600 joules are released (B) 600 joules are absorbed (C) 2510 joules are released (D) 2510 joules are absorbed	**pdf**
42.	6.23 Explain the meaning of this thermochemical equation: $4NH_3(g) + 5O_2(g) \longrightarrow 4NO(g) + 6H_2O(g)$ $\Delta H = -904$ kJ/mol Questions & Problems Section: Q 6.23	**34**
43.	Calculate the standard enthalpy of formation for diamond, given that $C(\text{graphite}) + O_2(g) \longrightarrow CO_2(g)$ $\Delta H° = -393.5$ kJ/mol $C(\text{diamond}) + O_2(g) \longrightarrow CO_2(g)$ $\Delta H° = -395.4$ kJ/mol Questions & Problems Section: Q 6.101	**38**

44.

Calculate the standard enthalpy change for the reaction

$$2Al(s) + Fe_2O_3(s) \longrightarrow 2Fe(s) + Al_2O_3(s)$$

given that

$$2Al(s) + \tfrac{3}{2}O_2(g) \longrightarrow Al_2O_3(s) \quad \Delta H^\circ_{rxn} = -1669.8 \text{ kJ/mol}$$

$$2Fe(s) + \tfrac{3}{2}O_2(g) \longrightarrow Fe_2O_3(s) \quad \Delta H^\circ_{rxn} = -822.2 \text{ kJ/mol}$$

Questions & Problems Section: Q 6.64

36

45.

$$2\,NO_2\,(g) \rightarrow N_2O_4\,(g)$$

What is the standard enthalpy change, ΔH°, of the reaction represented above?

The ΔH°_f of NO_2 = 34 kJ mol^{-1} and the ΔH°_f of N_2O_4 = 9.7 kJ mol^{-1}

(A) −24.3 kJ
(B) −58.3 kJ
(C) 24.3 kJ
(D) 58.3 kJ

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46.

Calculate the heat of decomposition for this process at constant pressure and 25°C:

$$CaCO_3(s) \longrightarrow CaO(s) + CO_2(g)$$

(Look up the standard enthalpy of formation of the reactant and products in Table 6.4.)

Table 6.4 Standard Enthalpies of Formation of Some Inorganic Substances at 25°C

Substance	ΔH°_f (kJ/mol)	Substance	ΔH°_f (kJ/mol)
$Ag(s)$	0	$H_2O_2(l)$	−187.6
$AgCl(s)$	−127.0	$Hg(l)$	0
$Al(s)$	0	$I_2(s)$	0
$Al_2O_3(s)$	−1669.8	$HI(g)$	25.9
$Br_2(l)$	0	$Mg(s)$	0
$HBr(g)$	−36.2	$MgO(s)$	−601.8
C(graphite)	0	$MgCO_3(s)$	−1112.9
C(diamond)	1.90	$N_2(g)$	0
$CO(g)$	−110.5	$NH_3(g)$	−46.3
$CO_2(g)$	−393.5	$NO(g)$	90.4
$Ca(s)$	0	$NO_2(g)$	33.85
$CaO(s)$	−635.6	$N_2O(g)$	81.56
$CaCO_3(s)$	−1206.9	$N_2O_4(g)$	9.66
$Cl_2(g)$	0	$O(g)$	249.4
$HCl(g)$	−92.3	$O_2(g)$	0
$Cu(s)$	0	$O_3(g)$	142.2
$CuO(s)$	−155.2	S(rhombic)	0
$F_2(g)$	0	S(monoclinic)	0.30
$HF(g)$	−271.6	$SO_2(g)$	−296.1
$H(g)$	218.2	$SO_3(g)$	−395.2
$H_2(g)$	0	$H_2S(g)$	−20.15
$H_2O(g)$	−241.8	$Zn(s)$	0
$H_2O(l)$	−285.8	$ZnO(s)$	−348.0

Questions & Problems Section: Q 6.51

35

47.	$C_2H_5OH\ (l) + 3\ O_2\ (g) \rightarrow 2\ CO_2\ (g) + 3\ H_2O\ (l) \quad \Delta H_{rxn} = -1{,}367$ kJ Compound / ΔH°_f: $C_2H_5OH\ (l)$: –278 kJ $H_2O\ (l)$: –286 kJ $CO_2\ (g)$: ? The equation for the combustion of ethanol, $C_2H_5OH\ (l)$, and selected standard heats of formation (ΔH°_f) are shown above. The standard heat of formation of $CO_2\ (g)$ is closest to: (A) $-1{,}080$ kJ mol^{-1} (B) -540 kJ mol^{-1} (C) -510 kJ mol^{-1} (D) -390 kJ mol^{-1}	**pdf**
48.	**Calculate ΔH° for the reaction $4\ NH_3\ (g) + 5\ O_2\ (g) \rightarrow 4\ NO\ (g) + 6\ H_2O\ (g)$, from the following data.** $N_2\ (g) + O_2\ (g) \rightarrow 2\ NO\ (g)$ — $\Delta H^\circ = +180.5$ kJ $N_2\ (g) + 3\ H_2\ (g) \rightarrow 2\ NH_3\ (g)$ — $\Delta H^\circ = -91.8$ kJ $2\ H_2\ (g) + O_2\ (g) \rightarrow 2\ H_2O\ (g)$ — $\Delta H^\circ = -483.6$ kJ	**pdf**
49.	Using the Hess's law and the enthalpies of the given reactions, calculate the enthalpy of the following oxidation reaction between CuO and HCl: $2CuO(s) + 4HCl(g) \rightarrow 2CuCl(s) + Cl_2(g) + 2H_2O(g)$, $\boldsymbol{\Delta H} = ?$ 1) $CuO(s) + H_2(g) \rightarrow Cu(s) + H_2O(g)$, $\Delta H = -85$ kJ 2) $2Cu(s) + Cl_2(g) \rightarrow 2CuCl(s)$, $\Delta H = -274$ kJ 3) $H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$, $\Delta H = -184$ kJ	**pdf**
50.	Hydrazine, N_2H_4, decomposes according to the following reaction: $3N_2H_4(l) \longrightarrow 4NH_3(g) + N_2(g)$ (a) Given that the standard enthalpy of formation of hydrazine is 50.42 kJ/mol, calculate ΔH° for its decomposition. Questions & Problems Section: Q 6.76	**36**
51.	The standard enthalpy change ΔH° for the thermal decomposition of silver nitrate according to the following equation is +78.67 kJ: $AgNO_3(s) \longrightarrow AgNO_2(s) + \frac{1}{2}O_2(g)$ The standard enthalpy of formation of $AgNO_3(s)$ is -123.02 kJ/mol. Calculate the standard enthalpy of formation of $AgNO_2(s)$. Questions & Problems Section: Q 6.75	**36**
52.	Two solid chemical compounds are mixed together in a beaker. After one minute, ice crystals are observed on the outside of the beaker. What is the best description for the energy change occurring with the reaction inside the beaker? (A) endothermic because heat is being absorbed from the surroundings (B) endothermic because heat is being released to the surroundings (C) exothermic because heat is being absorbed from the surroundings (D) exothermic because heat is being released to the surroundings	**pdf**

53.	A student is holding a beaker in which a chemical reaction is occurring and the beaker begins to feel cold. Which of the following is a true *and* for the correct reason? (A) The reaction is endothermic; it absorbed heat from the environment. (B) The reaction is endothermic; it lost heat to the environment. (C) The reaction is exothermic; it lost heat to the environment. (D) The reaction is exothermic; it absorbed heat from the environment.	**pdf**
54.	**The change of enthalpy in an endothermic reaction is** (a) positive (b) negative (c) constant (d) any of the above	**pdf**
55.	$2\ CH_6N_2\ (l) + 5\ O_2\ (g) \rightarrow 2\ N_2\ (g) + 2\ CO_2\ (g) + 6\ H_2O\ (g)$ $\Delta H = -1{,}303\ kJ\ mol^{-1}\ CH_6N_2\ (l)$ The combustion of methylhydrazine, a common rocket fuel, is represented above. What would be the ΔH per mole $CH_6N_2\ (l)$ if the reaction produced $H_2O\ (l)$ instead of $H_2O\ (g)$? (The enthalpy change of the condensation of $H_2O\ (g)$ to $H_2O\ (l)$ is $-44\ kJ\ mol^{-1}$.) (A) −1,039 kJ (B) −1,179 kJ (C) −1,435 kJ (D) −1,567 kJ	**pdf**
56.	**Compound** | ΔH°_f (kJ mol^{-1}) $CO_2\ (g)$ | −393.5 $CaO\ (s)$ | −635.5 $CaCO_3\ (s)$ | −1,207.1 $CaCO_3\ (s) \rightarrow CaO\ (s) + CO_2\ (g)$ The decomposition of $CaCO_3\ (s)$ is shown in the equation above. Using the data in the table above the reaction, which of the following values is closest to the ΔH_{rxn} of the decomposition of $CaCO_3\ (s)$? (A) −2,240 kJ mol^{-1} (B) −180 kJ mol^{-1} (C) 180 kJ mol^{-1} (D) 2,240 kJ mol^{-1}	**pdf**
57.	Define the following terms: enthalpy of solution, heat of hydration, lattice energy, heat of dilution. Questions & Problems Section: Q 6.65	**36**

58.	Define these terms: *enthalpy, enthalpy of reaction*. Under what condition is the heat of a reaction equal to the enthalpy change of the same reaction? Questions & Problems Section: Q 6.21	**34**
59.	A student carried out an experiment to determine the enthalpy of neutralization of $KOH_{(s)}$ To determine the enthalpy of neutralization of $KOH_{(s)}$, the student used Hess's law. The student Collect data to determine ΔH_1 and ΔH_2. $KOH_{(s)} \longrightarrow KOH_{(aq)}$ ΔH_1 (eq.1) $KOH_{(aq)} + HCl_{(aq)} \longrightarrow KCl_{(aq)} + H_2O_{(l)}$ + heat ΔH_2 (eq.2) Given equations 1 and 2 above, use Hess law to determine the equation representing the enthalpy of neutralization of $KOH_{(s)}$. Label the enthalpy change as ΔH_3. The table below gives the data collected by the student to determine the ΔH_1 of $KOH_{(s)}$ Data table 1: Solvation of solid potassium hydroxide $KOH_{(s)}$ in water Mass of KOH in grams: 10.00 g Mass of water in grams: 200.00 g Initial temperature: 20.00 °C Final temperature: 31.69 °C ΔH_1: ? Using information in the table calculate ΔH_1.	**pdf**
60.	The table below gives the data collected by the student to determine the ΔH_2 for the neutralization of $KOH_{(aq)}$ Data table 2: Reaction of KOH(aq) with HCl(aq) Mass of KOH in grams: 50.0 g Mass of HNO_3 in grams: 50.0 g Initial temperature: 20.00 °C Final temperature: 23.41 °C ΔH_2: Using information in the table calculate ΔH_2.	**pdf**
61.	Using equation 3 and the values of ΔH_1 and ΔH_2 calculate the enthalpy of neutralization of $KOH_{(s)}$. ΔH_3.	**pdf**