

Group Number :	Surname :	Signature
List Number :	Name :	
Student Number :	e-mail :	

1	1 H 1,008	2																18 He 4,003
2	3 Li 6,94	4 Be 9,012										5 B 10,81	6 C 12,01	7 N 14,01	8 O 16,00	9 F 19,00	10 Ne 20,18	
3	11 Na 22,99	12 Mg 24,31	3	4	5	6	7	8	9	10	11	12	13 Al 26,98	14 Si 28,09	15 P 30,97	16 S 32,06	17 Cl 35,45	18 Ar 39,95
4	19 K 39,10	20 Ca 40,08	21 Sc 44,96	22 Ti 47,87	23 V 50,94	24 Cr 52,00	25 Mn 54,94	26 Fe 55,85	27 Co 58,93	28 Ni 58,69	29 Cu 63,55	30 Zn 65,38	31 Ga 69,72	32 Ge 72,63	33 As 74,92	34 Se 78,97	35 Br 79,90	36 Kr 83,80
5	37 Rb 85,47	38 Sr 87,62	39 Y 88,91	40 Zr 91,22	41 Nb 92,91	42 Mo 95,95	43 Tc	44 Ru 101,1	45 Rh 102,9	46 Pd 106,4	47 Ag 107,9	48 Cd 112,4	49 In 114,8	50 Sn 118,7	51 Sb 121,8	52 Te 127,6	53 I 126,9	54 Xe 131,3
6	55 Cs 132,9	56 Ba 137,3	57-71	72 Hf 178,5	73 Ta 180,9	74 W 183,8	75 Re 186,2	76 Os 190,2	77 Ir 192,2	78 Pt 195,1	79 Au 197,0	80 Hg 200,6	81 Tl 204,4	82 Pb 207,2	83 Bi 209,0	84 Po	85 At	86 Rn
7	87 Fr	88 Ra	89-103	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Nh	114 Fl	115 Mc	116 Lv	117 Ts	118 Og
				57 La 138,9	58 Ce 140,1	59 Pr 140,9	60 Nd 144,2	61 Pm	62 Sm 150,4	63 Eu 152,0	64 Gd 157,3	65 Tb 158,9	66 Dy 162,5	67 Ho 164,9	68 Er 167,3	69 Tm 168,9	70 Yb 173,0	71 Lu 175,0
				89 Ac	90 Th 232,0	91 Pa 231,0	92 U 238,0	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

$$c = 2.998 \times 10^8 \text{ m s}^{-1} \quad g = 9.8 \text{ m s}^{-2} \quad h = 6.626 \times 10^{-34} \text{ J s} \quad R_H = 2.179 \times 10^{-18} \text{ J} \quad 0^\circ\text{C} = 273 \text{ K}$$

$$N_A = 6.02 \times 10^{23} \quad 1 \text{ cal} = 4.184 \text{ J} \quad 1 \text{ m} = 10^9 \text{ nm} = 10^{10} \text{ \AA} = 10^{12} \text{ pm} \quad 1 \text{ g} = 10^3 \text{ mg} = 10^6 \text{ \mu g}$$

$$1 \text{ atm} = 760 \text{ mmHg} = 760 \text{ torr} = 101325 \text{ Pa} = 101.325 \text{ kPa} = 1.01325 \text{ bar}$$

$$R = 0.08206 \text{ L atm mol}^{-1} \text{ K}^{-1} = 0.08314 \text{ L bar mol}^{-1} \text{ K}^{-1} = 8.314 \text{ J mol}^{-1} \text{ K}^{-1} = 8.314 \text{ L kPa mol}^{-1} \text{ K}^{-1}$$

$$\text{For water: } c = 4.184 \text{ J g}^{-1} \text{ K}^{-1} \quad K_f = 1.86 \text{ K kg mol}^{-1} \quad K_b = 0.512 \text{ K kg mol}^{-1}$$

$$1 \text{ Newton (N)} = 1 \text{ kg m s}^{-2} \quad 1 \text{ Joule (J)} = 1 \text{ N m} = 1 \text{ kg m}^2 \text{ s}^{-2} \quad 1 \text{ Watt (W)} = 1 \text{ J s}^{-1}$$

- 1) A jewelry alloy has a density of 12.412 g/cm^3 and is 75.0% gold by mass. If 522 g of gold is available, what is the volume of this alloy that can be produced?
- A) $8.64 \times 10^3 \text{ cm}^3$
 B) 31.5 cm^3
 C) $4.86 \times 10^3 \text{ cm}^3$
 D) 335 cm^3
 E) 56.1 cm^3
- 2) Which of the following is INCORRECT?
- A) Matter is made of tiny units called atoms.
 B) An element is a substance made of one type of atom.
 C) A compound contains regions that are unlike other regions of the same compound.
 D) Homogeneous mixtures are solutions.
 E) Elements and compounds are substances.
- 3) The two naturally occurring isotopes of nitrogen have masses of 14.0031 and 15.0001 amu, respectively. Determine the percentage of ^{15}N atoms in nitrogen. The average mass of nitrogen is 14.0067 amu.
- A) 0.4% B) 0.04% C) 99.6% D) 9.6% E) 4%

Booklet A

- 4) When a solid mixture consisting of 10.500 g of calcium hydroxide and 11.125 g ammonium chloride is heated, gaseous products are evolved and 14.336 g of a solid residue remains. When the gaseous products are passed into 62.316 g of water, what is the mass of the resulting solution?
A) 69.605 g B) 83.941 g C) 28.914 g D) 76.652 g E) 35.961 g
- 5) What is the approximate mass-to-charge ratio value (m/e) in coulombs per gram for the ion $^{32}\text{S}^{2-}$? ($e = 1.602 \times 10^{-19}$ C and the mass of a proton or neutron is 1.67×10^{-24} g)
A) 1.67×10^{-4} B) 3.35×10^{-4} C) 4.17×10^{-5} D) 1.85×10^{-5} E) 5.99×10^{-4}
- 6) An isotope with atomic number 64 and mass number 158 is found to have a mass ratio of 13.16034 relative to that of carbon-12. What is the atomic mass of this isotope relative to oxygen-16? The atomic mass of ^{16}O is 15.9949 amu.
A) 7.9780 B) 10.1216 C) 9.8734 D) 12.0060 E) 14.9897
- 7) Without detailed calculations, which of the following electromagnetic radiations has the greatest energy per photon?
A) 662 nm B) 2.1×10^{-5} cm C) 3.58 μm D) 4.1×10^{-6} m E) 0.22 mm
- 8) In the following system, which of the following possible values is the missing quantum number?
 $n = 3$, $\ell = ?$, $m_\ell = 2$, and $m_s = +1/2$
A) 0 B) 1 C) 2 D) 3 E) -1/2
- 9) Which of the following atoms should have the smallest polarizability?
A) S B) Si C) Te D) At E) Cs
- 10) The electron configuration of elements A, B, and C are $[\text{He}]2s^1$, $[\text{Ne}]3s^1$, and $[\text{Ar}]4s^1$ respectively. Which of the following orders is correct for the first ionization energies (in kJ/mol) of A, B, and C?
A) $C > B > A$ B) $B > C > A$ C) $C > A > B$ D) $A > B > C$ E) $A > C > B$
- 11) What is the wavelength of the light (in nm) emitted when the electron in a hydrogen atom moves from an energy level characterized by $n = 4$ to another energy level with $n = 2$?
A) 567 nm B) 728 nm C) 486 nm D) 364 nm E) 243 nm
- 12) The speed of the electron in the hydrogen atom is one-137th of the speed of light. Calculate the de Broglie wavelength in picometers for this electron. The mass of the electron is 9.11×10^{-31} kg.
A) 194 pm B) 332 pm C) 33.2 pm D) 43.6 pm E) 436 pm
- 13) Calculate the mass in grams for a single carbon dioxide, CO_2 , molecule.
A) 6.8×10^{-23} g B) 7.3×10^{-23} g C) 8.1×10^{-23} g D) 9.4×10^{-23} g E) 10.8×10^{-23} g
- 14) In which of the following are the oxidation stages of the labeled atoms in the molecules below given correctly, in order?
 K_2CrO_4 , $[\text{PtCl}_6]^{2-}$, O_3 , H_2O_2 , HClO_3
A) 6+, 4+, 2-, 1-, 5+
B) 4+, 4+, 2-, 1-, 5+
C) 4+, 4+, 0, 1-, 5+
D) 6+, 4+, 0, 2-, 5+
E) 6+, 4+, 0, 1-, 5+
- 15) What is the empirical formula of a compound containing 0.130 g of nitrogen and 0.370 g of oxygen?
A) NO_2 B) NO_3 C) N_2O_4 D) N_2O_5 E) N_3O_5
- 16) What is the mass percentage of NH_3 in the compound $\text{Co}(\text{NH}_3)_6\text{Cl}_3$?
A) 29.5 B) 34.6 C) 38.2 D) 45.7 E) 49.1

Booklet A

- 17) What is the sum of the coefficients of all species in the balanced reaction equation for the complete combustion of malonic acid, a compound with 34.62% C, 3.88% H, and 61.50% O, by mass with oxygen?
A) 10 B) 9 C) 6 D) 7 E) 8
- 18) PCl_3 is used as an insecticide. When the reaction shown below occurred with 80% yields, 274.6 g of PCl_3 was obtained. If an excess Cl_2 was used in the reaction, how many grams of P_4 were used in the beginning of the reaction?
 $\text{P}_4(\text{s}) + \text{Cl}_2(\text{g}) \rightarrow \text{PCl}_3(\text{s})$ (unbalanced)
A) 77.4 g B) 124.0 g C) 62.0 g D) 248.0 g E) 89.0 g
- 19) Rank the concentrations of the following solutions from highest to lowest.
I) 125 mL solution containing 2.25×10^{-2} mol NaOH
II) 1.25 L solution containing 57.5 g KCl
III) Solution prepared by adding 18.5 mL glycerin, $\text{C}_3\text{H}_5(\text{OH})_3$, with a density of 1.26 g/mL to 575 mL.
A) I > II > III B) II > I > III C) II > III > I D) III > I > II E) III > II > I
- 20) To prepare 250 mL of 0.425 M AgNO_3 solution, how many mL of 1.5 M AgNO_3 solution should be taken and diluted with water?
A) 141.5 mL B) 70.8 mL C) 283.2 mL D) 35.4 mL E) 17.7 mL

Answer Key

Testname: MIDTERM-1_EN-A

- 1) E
- 2) C
- 3) A
- 4) A
- 5) A
- 6) C
- 7) B
- 8) C
- 9) A
- 10) D
- 11) C
- 12) B
- 13) B
- 14) E
- 15) D
- 16) C
- 17) E
- 18) A
- 19) C
- 20) B