FEDERAL UNIVERSITY ONE EKITI

DEPARTMENT OF INDUSTRIAL CHEMISTRY

CHM 101: GENERAL CHEMISTRY TUTORIAL 2

INSTRUCTIONS:

1. Fill in your personal data in the spaces provided below
2. Answer ALL questions.
3. Do all calculations in the answer sheet provided.
4. Fill in the correct answers in the spaces provided for each question on the this paper
5. Answers to all theoretical questions must be written in the spaces provided on the this paper.

Section 1

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| CANDIDATE NO:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ DEPARTMENT: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ M/F: \_\_\_\_\_\_\_\_\_\_ |

1. (a) The table below gives numbers of electron, protons and neutrons in atoms or ions of a number of elements.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Atom or ion of element | A | B | C | D | E | F |
| Number of electrons | 5 | 10 | 18 | 28 | 36 | 9 |
| Number of protons | 5 | 7 | 19 | 30 | 35 | 9 |
| Number of neutrons | 5 | 7 | 20 | 36 | 46 | 10 |

1. Which of these species are neutral? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. which are negatively charged? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. which are positively charged? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. what are the conventional symbols for all the species? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(b) Ordinary silver is a mixture of two isotopes107Ag with a mass of 106.9041 a.m.u. and 109Ag with a mass of 108.9047 a.m.u. The average atomic mass of silver is 107.868 a.m.u. What are the relative abundance expressed as percent of these two silver isotopes? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(c) An organic compound was synthesized and a sample of it was analyzed and found to contain only C.H.N.O and Cl. It was observed that when a 0.150g sample of the compound was burned. It produced 0.138g C02 and 0.566g H20. All the nitrogen in a different 0.200g sample of the compound was converted to NH3 which was found to weigh 0.0238g. finally, the chlorine in a 0.125g sample of the compound was converted to Cl and by reacting it with AgNo3 all the chlorine was reconverted as AgCl. The AgCl when dried was found to weigh 0.251g.

(i) Calculate the weight percent of each element in the compound.

C: \_\_\_\_\_\_\_\_\_\_\_ H: \_\_\_\_\_\_\_\_\_\_\_\_ N: \_\_\_\_\_\_\_\_\_\_\_\_\_ O: \_\_\_\_\_\_\_\_\_\_\_ Cl: \_\_\_\_\_\_\_\_\_\_\_\_\_

(ii) Determine the empirical formula for the compound: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(d) Contrast the Thompson and Rutherford model of the atom.

(i) J.J. Thompson Model: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(ii) Ernest Rutherford Model:

(α) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(β) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(γ) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(e) (i) Distinguish between nuclear fission and fusion. Write an equation to illustrate each one.

(α) Nuclear Fission: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Equation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(β) Nuclear fusion: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Equation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(ii) What are the advantages of fusion over fission? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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(iii) Calculate the binding energy and the binding energy per nucleon of Fe given: isotopic mass of iron is 55.93493

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amu, that of proton is 1.00783 amu, and neutron is 1.00867 amu.

(α) Binding energy: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(β) Binding energy per nucleon: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What is the difference between nuclear reaction and the usual chemical reactions? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Arrange the following in order of the increasing mass:

(i) 16 water molecules (ii) 2 atoms of lead (iii)5.1 x 10-25 mole of Helium

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ State the postulates of Daltons atomic theory.

(α) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(β) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(γ) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(δ) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(a) in a sample of the compound MnO.4.00g of oxygen is combine with 13.7g of manganese. How many grams of oxygen would be combined with 7.85g of manganese in the compound MnO2? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(b) (i) what is the energy in joules of an electron in hydrogen for n=4 and for n=2? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(ii) Calculate the difference between these two energy levels. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(iii) how many joules does an electron lose if it falls from the third to the second energy level in a hydrogen atom? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(iv) what is the frequency (in hertz) of the proton that is emitted? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(v) what is the wavelength of this proton in namometers? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(vi) what colour is the light that is given off? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(c) spectral lines of the Lyman and Balmer series do not overlap. Verify this statement by calculating the wavelength of the first line associated with the Lyman series and the wavelength of the last time associated with the Balmer series (in nm).

(i) λ FIRST LINE (Lyman series)= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (ii) λ LAST LINE (Balmer Series)= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(d) (i) Write out the electron configuration for the elements 34 Se and 14Si. How many unpaired electrons are in the 14Si atom?

(α) Electron configuration of 34Se \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(β) Electronic configuration of 14Si \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(γ) No of unpaired electrons in 14Si atom \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(ii) State which of the following sets of quantum numbers would be possible and which would be impossible for an electron in an atom

(α), n=0, l=0,ml=0,ms= +1/2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(β), n=1, l=1, ml =0, ms =+1/2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(γ), n=2, l=0, ml = 0, ms = -1/2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(δ), n = 2, l =1, ml = -2, ms = +1/2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(ε), n = 2, l = 1, ml = 0, ms = + ½ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(e) Draw orbital diagrams for atoms with the following electron configuration in the spaces provided below:

(i) 1s2 2s2 2p6 3p

(ii) 1s2 2s2 2p6 3s2 3p6 4s2 3d5

(f) (i) complete the following transmutation equations:

27 4 1

(α) Al + He + n

13 2 0

238 1 239

(β) H + n U +

9 0 92

24 1 24 24

(γ) Na + n Na + Mg +

11 0 11 12

(g) (i) state the law of radioactive decay. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(ii) The atomic mass of a radioactive element, X, is 226g and its disintegrate constant is 1.36 x 10-11 sec calculate

(α) the half-life of x in years: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(β) the number of atoms which 1g of X will produce in 1 second. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(iii) the half-life of 51Cr is 27.72 days. What is the rate constant (λ) for decay of 51Cr in units of S-1? \_\_\_\_\_\_\_\_\_\_

(h) (i) State the modern version of the periodic law. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(ii) Explain briefly why elements in any given group exhibit similar properties.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(i) Give a one sentence definition for each of the following:

(α) Ionization energy: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(β) Electron Affinity: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Provide concise answers to the following:

(a) Why is mass (instead of weight) used to specify the amount of matter in an object? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(b) Why did Rutherford (1911) conclude that the positive charge of an atom must be concentrated in the very dense nucleus within it? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(c) Explain why the atomic masses of some elements are not whole numbers \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(d) What is the maximum number of electrons that can be placed in the M shell of an atom? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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(e) Why is C employed in radio-active dating? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

6

(f) Why do the isotopes of an element have the same chemical properties? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(g) State 5 principal uses of hydrogen

(α) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(β) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(γ) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(ε) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(g) Give three uses of helium

(α) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(β) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(γ) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(i) Write balanced nuclear equations for the following reactions

27 25

(α) Al (d, α) Mg \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

13 11

249 18 263

(β) Cf O, 4n Xe \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

98 8 226

226

(γ) Alpha Emission Ra \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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(δ) Beta Emission by Bi \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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3. (i) A sample of oxygen has a mass of 5.00g and is contained in a flask with a capacity of 6.0L at 35. Assuming ideal-gas behavior for the oxygen, calculate the pressure of the gas in mmHg (R = 0.0821 atm K-1 mol-1) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(ii) A sample of Co2 gas at 328mmHg and 262 occupies a volume of 168ml, assuming ideal gas behavior determine the number of moles of Co2 present. (R = 0.0821 atm K-1 mol -1) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(b) in a laboratory experiment, concentrated hydrochloric acid was reacted with aluminum. Hydrogen gas was evolved and collected over water at 25 ; it had a volume of 355cm3 at a total pressure of 750mmgHg. The vapour pressure of water at 25 is 24mmHg. (R = 0.0821 atm K-1 mol-1).

(i) What was the partial pressure of hydrogen in the sample? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(ii) How many moles of hydrogen were collected? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(c) Use (i) the ideal-gas law and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(ii) the van der waals equation \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

To calculate the pressure in atmosphere exerted by 10.og methane (CH4), enclosed in a 1.00L container at 25 (Van der waals constants for methane: a=2.25L2 atm mol-2, b= 0.0428 L mol-1) (R= 0.0821 L atm K-1 mol-1).

(d) (i) Give the Lewis structures of the following in the spaces provided below:

(α) Cl02 (β) N02 (γ) P034

(e) (i) State the principle with which the shape of simple molecules can be explained in terms of electron pair repulsions.

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(ii) What are the geometrics of the following kinds of hybrid orbitals?

(α) sp \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (β) sp2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(γ) sp3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (δ) sp d \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(a) Define the following terms:

(α) Crystalline solids: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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(β) Amorphous solids: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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(γ) Crystal lattice: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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(b) identify these two xenon fluorides from the following data:

(i) 0.0369g of the fluorides yield 0.0135g of fluorine on decomposition \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(ii) 409mg of xenon reacted with fluorine to form 785mg of the second fluoride \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(F = 19; Xe = 131

1. Name the subatomic particles and name their charge units.

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1. Determine the number of neutrons in the nucleus of the following atoms:

10Ne20: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 10Ar40: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

36Kr84: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 54Xe132: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Determine the ratio of neutrons to protons in the nucleus of each atom in (2) above

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1. What general trend do you discover in the way this ratio changes with increasing atomic mass?

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1. Naturally occurring lead is composed of four isotopes. Their abundances and masses are given below. Calculate the average atomic mass of lead.

Isotope Mass (a.m.u) Abundance ()

204 Pb 1.48

206 Pb 205.9745 23.6

207 Pb 206.9759 22.6

208 Pb 207.9766 52.3

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. The density of water is 1.00g/ml at 4. How many water molecules are present in 2.56ml of water at this temperature? (H = 1.0; O = 16.0; N = 6.02 X 1023)

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1. A 1.500G sample of a compound composed of chromium and chlorine was dissolved in water and allowed to react with AgN03. This converted all the chlorine in this original sample into AgCl, which was collected and found to weigh 4.072g. What is the empirical formula of the chromium-chlorine compound?

(Cl = 35.5; Cr = 52.0; Ag = 108.0)

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1. When coal containing iron pyrites, FeS2 is burnt, all the sulphur is converted to the air pollutant, sulphur dioxide, S02. How many moles of FeS2 would have to react to produce 1.00kg of S02? (0 = 16.0; S = 32.0; Fe = 56.0).

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1. A 4.25g of a compound that contains only carbon, hydrogen and oxygen was burnt in an atmosphere of pure 02. This produces 9.34g of CO2 and 5.09g of H2O. What is the empirical formula of the compound described?

(H = 1.0; C = 12.0; O = 16.0).

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Section 2

1. Explain Aufbau building up principlewith an example

1. Fluorine forms two compounds with Xenon. In one of them, 0.624g of F is combined with 2.16g of Xe; in the other compound, 0.825g of F is combined with 1.472g of Xe. Prove that the data are consistent with the law of multiple proportions.

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1. List the subshells and the orbitals associated with the principal quantum number n=2.

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1. Beryllium has atomic number 4. Write the quantum numbers for each of the electrons of beryllium.

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1. Given the electronic configuration of A+ and B+

A+: 1S2 2S2 2P6 3S2 3P6 4S1

B+: 1S2 2S2 2P6 3S2 3P6 4S2 3D4

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1. Determine the atomic numbers and the number of unpaired electrons in neutral atoms A and B in question 13 above.

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1. Write the electronic configuration of the elements Cd. State the magnetic property of the atom.

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1. What is the energy in joules of an electron in hydrogen for n = 4 and for n = 2?

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1. Use Rydberg equation to calculate the wavelength of the third line in the Paschen series of the hydrogen spectrum. Give your answer in nm. (Rµ = 2.18 X 10-18J, h = 6.63 x 10-34 Js, c = 3.00 x 108 m/s).

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. What is the frequency of the photon that is emitted if an electron falls from the fourth to the third energy level in a hydrogen atom?.

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1. List the values of n and ML for the orbitals in the 4d subshell.

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1. State whether the following combination of quantum numbers are permitted or not permitted.

(i) (3, 1, 1, + 1/2) (ii) (5, 3, -3, -1/2)

(iii) (4, 2, 0, + 1/2) (iv) (3, -1, 1, + 1/2)

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1. What are the geometries of the following kinds of hybrid orbitals?

(i) sp (ii) sp2 (iii) sp3 (iv) sp3d

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1. What angles exist between the orbitals in

(i) sp3 (ii) sp2 (iii) sp (iv) sp3d?

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1. Sketch a sigma bond and a pi-bond.
2. On the basis of the electronic structure of the central atom, suggest what kind of hybrid orbitals would be involved in the bonding in each of the following:

(i) BeH2 (Be = 4) (ii) SF4 (S = 16)

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25. Predict the shapes of the following molecules.

(i) PO4-3 (ii) SiCl4

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26. A certain quantity of an ideal gas is maintained at constant temperature in a Boyles’s Law apparatus. Its volume

Was 100cm3 at a pressure of 5 atm. If the pressure of the gas is increased to 2o atm. By reducing its volume, what

Is the final volume?

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27. A sample of an ideal gas is maintained at constant temperature had a pressure of 400mmHg and a volume of

10ml. the gas is expanded by increasing the volume of it’s container. If the final volume is 50ml, what is its final

Pressure?

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28. A sample of an ideal gas occupies a volume of 2L at 27. If the temperature is increased to 327 at constant

Pressure, what is the new volume of the gas?

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29. Suppose that 2.65L of an ideal gas at 25 and 1.00atm is warmed and compressed until the final temperature is

75 and the final pressure is 2.00atm. What is the final volume?

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30. A sample of an ideal gas consists of 0.17mol and occupies 8.64L at a pressure of 0.432atm. Calculate the

Temperature of the gas (R = 0.0821L atm. K-1 mol-1)

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31. A quantity of a certain gas has a mass of 0.157g and a measured pressure of 0.949 atm. If the volume of the gas is

135ml, what is the molecular mass of the gas? (R = 0.0821L atm. K-1 mol-1)

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32. Use the ideal gas law to calculate the pressure in atmospheres exerted by 10.0g of methane enclosed in a 1.0L

Container at 25. (R = 0.0821L atm. K-1 mol-1)

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33. The rate of effusion of an unknown gas X through a certain pinhole is 4 times the rate of effusion of oxygen through

The same pinhole under the same conditions. What is the molecular mass of X? (O = 16.00)

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34. Calculate the number of moles of CO2 produced when 5.60g of glucose is used up in the reaction:

C6H12O6 + 6O2 6CO2 + 6H2O

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35. Calculate the volume of CO2 produced at 37 and 1.00 atm when 5.60g of glucose is used up in the reaction in

Question 34 above? (R = 0.0821L atm. K-1 mol-1)

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36. From the following hydrides, LiH, BeH2, B2H6, CH4, NH3, H2O, HF

(i) Write out one ionic hydride. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(ii) Which of these hydrides will be basic in water? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

37. Arrange the following elements in order of increasing electronegativity. Li, Be, O, F, N, C.

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38. Write out the electronic configuration and name the group in the table to which the element with atomic number 10

Belongs.

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39. The oxides of the elements in the period 3 of the periodic table are listed below: Na2O, MgO, Al2O3, SiO4, P4O10,

SO3, Cl2O7. From these oxides, write down;

(i) The two most reactive basic oxides\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(ii) Two ionic oxides. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

40. (i) Which atom should have a smaller first ionization energy; oxygen or sulphur? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(ii) Which atom should have a higher second ionization energy, lithium or beryllium? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

41. Balance the following equations:

Al2O3 + 6HCl ? +

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CaH2 + 2H2O ? +

USE THE FOLLOWING INFORMATION TO ANSWER QUESTIONS 42 AND 43

41. A sample of 90Sr with a half-life of 19.9 years has an activity of 0.5Mc. The Avogadro’s number is 6.02 x 1023

42. What is the mass of 90Sr in gramme?

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43. What is the activity of the sample after 30 years?

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44. If a piece of metal sheet contains only 15% of the 59Fe it had when the sheet was made at the foundry, how

Long ago was the sheet manufactured given that the half-life of 59Fe is 45 days?

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45. Balance the equations for the nuclear reactions:

28Ni58 + 11H ? = 2He4

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42Mo95 + ? 13Te95 + 0H1

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46. Calculate the quantity of energy released in the radioactive decay of 21081Po by alpha decay. The masses of Po,

20582Pb and 42He are 209.98288, 205.97447 and 4.002603 amu respectively. Given 1amu = 931.5MeV.

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47. Calculate the binding energy and the energy per nucleon of 26Fe56. The masses of 56Fe, proton and neutron

Are 55434937, 1.007325 and 1.008665 respectively.

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48. State the effect each of alpha, positron n gatron and gamma decay process on the mass number of a

Radionuclide.

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49. Give any four example of naturally occurring radioactive nuclides.

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50. Write an equation each to illustrate fission and fusion processes.

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Section 3

GIVEN DATA

Atomic masses: H = 1.0; He = 4.0; C = 12.0; N = 14.0; O = 16.0; S = 32.0.

Mass of Proton, (11H) = 1.007825a.m.u.

Mass of Neutron, n = 1.008665a.m.u.

1kg = 6.022x1026a.m.u : 1J = 1kgm2s-2

Avogadro’s number, NA = 6.02x1023.

Velocity of Light, c = 3.00x108ms-1

Molar gas constant, R = 0.0821atm Lk-1. Mol-1

Rydberg’s constant, Ru = 2.18x10-18J

Planek’s constant, h = 6.63x10-34JS

1. (a) Describe the experimental basis for believing that the nucleus occupies a very small fraction of the volume of the atom.

(b) For the noble gases (the group 8A element).

4 20 84 132

He Ne Kr Xe

2 10 36 54

(i) Determine the number of protons and neutrons in the nucleus of each atom and

(ii) Determine the ratio of neutrons to protons in the nucleus of each atom.

Describe any general trend you discover in the way this ratio changes with increasing atomic number.

(c) An organic compound was synthesized and a sample of it was analyzed and found to contain only C, H, N, O, and Cl. It was observed that when a 0.150g sample of the compound was burned, it produced 0.138g CO2 and 0.0566g H2O. all the nitrogen in a different 0.200g sample of the compound was converted to NH3, which was found to weigh 0.0238g. finally, the chlorine in a 0.125g sample of the compound was converted to Cl- and by reacting it with AgNO3 , all the chlorine was reconverted as AgCl. The AgCl, when dried, was found to weigh 0.251g.

(i) Calculate the weight percent of each element in the compound.

(ii) Determine the empirical formula for the compound.

(d) Two compounds are formed between phosphorus and oxygen. A 1.50g sample of one compound was found to contain 0.845g of phosphorus, while a 2.50g sample of the other contained 1.09g of phosphorus. Show that these data are constant with the law of multiple proportions.

(e) Spectra lines of the Lyman and Balmer series do not overlap. Verify this statement by calculating the longest wavelength associated with Lyman series and the shortest wavelength associated with the Balmer series (in nm).

(f) Which of the following sample contain the largest number of atoms?

(i) 2.5mol CH4 (iv) 1.8mol S8

(ii) 10.0mol He, (v) 3.0mol NH3

(iii) 4.0mol SO2,

2. (a) Naturally occurring chromium is composed of four isotopes. Their abundance and masses are given below. Calculate the average atomic mass of chromium.

|  |  |  |
| --- | --- | --- |
| Isotope | Mass (a.m.u) | Abundance % |
| 50Cr | 49.9461 | 4.35 |
| 52Cr | 51.9405 | 83.79 |
| 53Cr | 52.9407 | 9.50 |
| 54Cr | 53.9389 | 2.36 |

(b) (i) Distinguish between nuclear fission and fusion. The radioactive potassium – 40 isotope decays to argon – 40 with a half life of 1.2x109 years.

(ii) Write a balanced equation for the reaction.

(iii) A sample of moon rock is found to contain 18 percent potassium -40 and 82 percent argon by mass. Calculate the age of the rock in years.

(c) (i) predict the electronic configuration of element 106.

(ii) the atomic number of an element is 73. Are the atoms of this element diamagnetic or paramagnetic?

(d) The electronic configuration of a neutral atom is 1s2 2s2 2p6 3s2. Write a complete set of quantum numbers for each of the electrons. Name the element.

(e) What would you anticipate for the order of increasing nuclear stability for the following nuclides?

3 40 116 13 192

He Ca Sn C Ir

2 20 50 6 77

(f) Define the terms:

(i) “mass defect” and

(ii) “binding energy” of the nucleus

(iii) Calculate the nuclear binding energy in J/nucleon for the specie 20983Bi, given the isotopic mass of bismuth is 208.9804a.m.u.

3. (a) Define the following terms

(i) Hybridization

(ii) valence shell expansion

(iii) Oxidation number

(iv) Describe the relationship between oxides, peroxides

And super oxide.

(b) (i) describe the bonding XeF using hybrid orbital and predict the geometry of the compound.

(Xe (z = 54), F (z = 9) )

(ii) The fact that the volume occupied by a gas varies linearly with degrees Celsius can be expressed mathematically as ? = aibt. Where‘t’ is the temperature in degrees Celsius and ‘a’ and ‘b’ are constant that determine a straight line. Show that V = bt. T equals the temperature on the Kelvin scale. Define the law which the equation represents.

3. (b) (iii) Turnbull’s blue is a pigment with the formula Fe3(Fe(CN)6-2). This compound contains the Fe(CN)3-6 ion. What is the oxidation state of the other three iron atoms?

(c) (i) Use oxidation numbers to explain what happens in the following reactions which are used to prepare hydrogen gas

Ca(s) + 2H20(1) Ca2+(aq) + 2OH(Aq) + H2(g)

Zn(s) + 2HCl(aq) Zn2+(aq) + 2Cl(aq) + H2(g)

(ii) Which of the following reactions result in a compound in which hydrogen has an oxidation number of -1

Li + H2 ?

O2 + H2 ?

S8 + H2 ?

CH2 + H2 ?

Ca + H2 ?

(iii) Classify the following hydrides as ionic, covalent, non-polar and polar: LiH, BeH2, B2H6, CH4, NH3, H2O and HF which of these hydrides will be acidic and basic in water?

(iv) Lubricants used for watches usually consist of long chain hydrocarbons. Oxidation by air forms solid polymers that eventually destroy the effectiveness of the lubricants. It is believed that one of the initial steps in the oxidation is hydrogen abstraction. Suggest one way of slowing down the overall oxidation rate. Why?

(d) (i) Prove the following statement: The pressure of a given amount of gas at a fixed volume is proportional to the absolute temperature. This is sometimes called Amonton’s law.

(ii) Chemical analysis of a gaseous compound showed that it contained 33.0 percent silicon and 67.0 percent Fluorine by mass. At 35, 0.210L of the compound exerted a pressure of 1.70atm. if the mass of 0.210L of the compound was 2.38g, calculate the molecular formula (Si = 28.09, F = 19.00).

(iii) How many litres of chlorine gas can be obtained at 40 and 787mmHg from 9.41g of hydrogen chloride, HCl, according to the following equations:

2KMno4(s) + 16HCL(aq) 8H2O(ld) to 2KCl(aq) + 2MnC

(k = 39, Mn = 54.94, O = 16, H)

4. (a) (i) Two gaseous substances A and B are found volume V. The total pressure Pt. a collisions of both types with the 345g of the partial pressure P1, of the 1.09g related to the total pressure by p1 where Xi = mole fraction.

(a) (ii) The gas from a certain volcano has the following composition in mole percent (that is, mole fraction X 100): 5.0 CO2 25.0 H2O 5.1 HCl, 2.8 HF 1.7% SO2 and 0.1% H2O. What would be the partial pressure of each of these gases if the total pressure of volcanic gases were 760mmHg?

(iii) The first step in the industrial preparation of trioxonitrate (V) acid, HNO3, is the production of nitrogen (H) oxide, NO, from ammonia, NH3, and oxygen, O2:

4NH3(g) + 5O2 4NO(g) + 6H2O(g)

If 3.00L of NH3 at 802 and 1.30atm completely react with oxygen, how many litres of steam measured at 125 and 1.00atm. are formed? (N = 14, H = 1, O = 16).

(b) (i) Distinguish between the terms diffusion and effusion. Compare the effusion rates of helium, He, (Z = 4) and molecular oxygen (Z = 16) at the same temperature and pressure.

(ii) A flammable gas made up of only carbon and hydrogen is generated by certain anaerobic bacterium cultures in marsh lands and areas where sewage drains. A pure sample of this gas was found to effuse through a certain porous barrier in 1.50min. under identical conditions of temperature and pressure, it takes anequal volume of bromine gas (the molar mass of Br2 is 159.8g) 4.73min to effuse through the same barrier. Calculate the molar mass of the unknown gas, and suggest what this gas might be.

(iii) magnesium react with hydrogen gas to form which is a white solid at room temperature. It also react with hydrochloric acid to form gas B and an aqueous solution of compound C. identify the product of these reaction – A B and C and write balanced equation for each reaction.

(C) (i) Although D2 o chemically resembles H2 O in most respects. It is a toxic substance, why?

(ii) Classify the following oxides as acidic, basic or amphoteric Rb2O, BeO, As2O5. Give reasons.

(iii) In the periodic table, the element hydrogen is sometime grouped with the alkali metals and sometimes with the halogens. Explain why hydrogen can resemble the group 1A and group VIIA elements.

(iv) The ions Na+ and Mg2+ occur in chemical compounds, but ions Na2+ and Mg3+ do not. Explain.

1. State Graham’s Law of Diffusion. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. Complete the table below:

|  |  |  |
| --- | --- | --- |
| Hybrid | Geometry | Angles |
| Sp |  |  |
| Sp3d |  |  |
| Sp2 |  |  |
| Sp3d2 |  |  |
| Sp3 |  |  |

Give the Lewis structure of the following in the space provided.

|  |  |
| --- | --- |
| 3. SO42- | |
| 5. HCO2- |
|  |

|  |
| --- |
| 4. XeF4 |

6. Determine the hybridization state of the central underlined atom in each of the following molecules.

(a) HgCl2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (b) AL l3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (c)P F3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

7. Suppose that the ideal gas law were pV2 = Nr/T2. What would be the units of ‘R’ if ‘P’ is in atmosphere and ‘V’

In litres, T in Kelvin? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

8. Calculate the density of butane (C4 H10) at a pressure of 177.4pa and a temperature of 125

(R = 8.314 pa mol- K-1) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

9. Sketch the graph of Charles’ law

10. Sketch the graph of P (pressure) against ‘PV’ (pressure volume).

11. Use (i) the ideal gas law and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

And (ii) the Van der Waals wquation \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

To calculate the pressure in atmospheres exerted by 10.0g methane (CH4) enclosed in a 1.00L container at 23

(Van der Waals constant for methane: a = 2.25L2 atm mol-2; b = 0.0428L mol-1) (R=0.0821Latm K-1 mol-1)

12. Allicin is the compound responsible for the characteristic smell of garlic. An analysis of the compound gives the following percent composition by mass: C = 44.4% H = 6.21% S = 39.5% O = 9.86%. Calculate its empirical formula. What is its molecular formula given that its molar mass is 162g?

(a) Emprical Formula: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (b) Molecular Formula \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

13. Calculate the wavelength and the frequency of the lines in the Balmer series when (a) n = 3 (b) n2 = 4

(a) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (b) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Complete the following transmutation equation.

27 4 1

14. Al + He \_\_\_\_\_\_\_\_\_\_\_\_\_\_ + n

13 2 0

23 1 24 24

15 Na + n Na + \_\_\_\_\_\_\_\_\_\_ Mg + \_\_\_\_\_\_\_\_\_\_

11 0 11 12

238 1 239

16 U + n U + \_\_\_\_\_\_\_\_\_\_\_\_\_

92 0 92

47 135

17 Ca Xe

20 54

55 55

18 Co Fe + \_\_\_\_\_\_\_\_\_\_\_\_\_

27 26

220 216

19 Rn Po + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

86 42

20 In a laboratory experiment conc HCL acid was reacted with AL (aluminium). Hydrogen gas was evolved and collected over water at 25; it had a volume of 335cm3 at total pressure of 750mmHg. The vapour pressure of water at 25 is known to be about 24mmHg.

(a) What was the partial pressure of hydrogen in the sample? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(b) How many moles of hydrogen were collected? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

21. Sample of H2, O2 and H2 gases, each having a mass of 1.00g are placed in a 10.0L container at 125. Assuming ideal gas behavior and calculate the total pressure in atmosphere (Atomic masses H = 1.01; O = 16.0; N = 14.0). \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

22. State any five application of Radioactivity.

(a) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(b) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(c) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(d) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(e) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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23. Calculate the binding energy and the binding energy per nucleon of Fe given isotopic mass of iron is 55.93493 amu that of proton is 1.00783 amu and neutron is 1.00867 amu. 26

(a) Binding energy \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(b) Binding energy per nucleon \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

24. State the law of radioactive decay. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

25. The atomic mass of a radioactive element, X is 226g and its disintegration constant is 1.36 x 10-11 sec-1calculate

(a) The half-life of X in years. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(b) The number of atoms which 1g of X will produce in 1 second. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

26. The half-life of 51Cr is 27.72 days. What is the rate constant (λ) for the decay of 51Cr in units of s-1?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

27. A sample of oxygen has a mass of 5.00g and is contained in a flask with a capacity of 6.0L at 35. Assuming ideal-gas behavior for the oxygen. Calculate the pressure of the gas in mmHg. (R = 0.0821 atm K-1 mol-1).

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

28. A sample of CO2 gas at 328mmHg and 262 occupies a volume of 168ml. assuming ideal-gas behavior determine the number of moles of CO2 present. (R = 0.0821 atm K-1 mol-1) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

29. Starting with a 4.00mg sample how much 198Au remains in Mg after 7.0 days and 30 days? At what point in time does the amount of 198Au reach 0.40mg? give +1/2 of Au is 62.8 hrs.

(a) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (b) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (c) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_