Short notes-atomic structure essay

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Short Notes On Atomic Structure * Atom is the smallest particle of an element- All 117 elements has atoms * Bohr model: – Planetary model (see Figure 1 below) 1. Sun (proton & neutron= nucleus) 2. Planets (electrons) 3. Orbit (shell) Figure 1: Bohr model * Each type of atoms has a certain number of electrons and protons that differentiate it from the atoms of other elements Example: 1 proton 1 electron= Hydrogen (1 type elements) 2 proton, 2 neutron, 2 electron= Helium (other types elements) * There are many types of elements and it depends on the number of proton, neutron, and electron.

ATOMIC NUMBER * Elements are arranged in the periodic table (Jadual berkala) * Atomic number = Number of proton in Nucleus. (No of proton= No of electrons) Example: 1 proton, 1 electron = Hydrogen (Atomic Number 1) in neutral (neutral) state (pada keadaan asal) 2 proton, 2 neutron, 2 electron= Helium (Atomic Number 2) in normal (neutral) state (pada keadaan asal) * All atoms of an element have the same number of electrons as protons * The Positive charge (Protons +ve) cancels the negative charges (Electron -ve). ELECTRON SHELLS (Petala) and ORBITS Electron orbits the nucleus (proton & neutron) of an atom at certain distance. (Elekton berpusing sekeliling nucleus dalam jarak tertentu) Figure 2: Electrons energy increases as it is father from the nukleus * Elektrons near the nucleus have less energy than those in more distant orbits (Shell). * Based on Figure 2 above. The values of each electrons energy are Label as E. Notice as the electrons distance from the nucleas, its energy level increases (J). * In an atom, the orbits are grouped into energy band knows as SHELLs. * Atoms has fixed number of shells.

Each shell has a fixed maximum number of electrons at a certain energy level. * The differences in energy levels within a shell are much smaller than the diffrence in energy between shells. * The shells (n) are in numbers n= 1, 2, 3, 4, 5…. n.. * Shell no 1 (n= 1) is the nearest to the nucleus and valence shell is the farthers. * The number of electrons in each shell. * The maximum number of electrons (Ne) that can exist in each stage of shell of an atom is Ne= 2n2 n= shell no, i. e. n= 1, 2, 3, 4,…n Number of electrons in shell 1, n= 1, Ne= 2(1)2= 2 Number of electrons in shell 2, n= 2, Ne= 2(2)2= 8

Number of electrons in shell 3, n= 3, Ne= 2(3)2= 18 Number of electrons in shell 4, n= 4, Ne= 2(4)2= 32 * The atomic number, Z, should not be confused with the mass number, A, which is the total number of protons and neutrons in the nucleus of an atom. * The number of neutrons, N, is known as the neutron number of the atom; thus, A = Z + N. * Since protons and neutrons have approximately the same mass (and the mass of the electrons is negligible for many purposes), the atomic mass of an atom is roughly equal to A. Figure 3: Energy Band Based on above Figure 3, it shows the Energy band concept, the 1st shell with one energy level and the 2nd shell with 2 energy level. Aditional shells may exist in other types of atoms, depending on the elements. VALENCE ELECTRONS * Outermost shell is knows as valence shell and electrons in this shell are called velence electrons. * Electrons that are in valence shell from the nucleus have higher energy but are less tightly bond to the atom than those closer to the nucleus as shown in Figure 4. Valence Shell Valence Electron Less bonded because electron are the farthest from the nucleus, less pull from the nucleus

Figure 4: Electron which are the farthest is not tightly bonded with the nucleus * This is because the force of attraction (tarikan diantara)positively charged protons and negatively charged electrons decreases with increasing distance from nucleus. * Electrons with the highest energy level exist in the outermost shell (Valence electron) of an atom and are relatively loosely bound to the atom. * These valence electrons contribute to chemical reactions and bonding within the structure of a material and determine its electrical properties. IONIZATION When an atom absorbs energy from a heat source or from light, the energy level of the electrons are raised. * The valence electrons possess more energy and are more loosely(tarikan yg lemah) bounded to the nukleus than the inner electrons, so they can easily jump to higher orbits within the valence shell when external energy is absorbed. * The departure of valence electron a previously neutral atom with an excess of positive charge because protons are more than electrons now (misalnya Keadaan asal(neutral) 2 proton, 2 electron dan selepas 1 elektron keluar ia jadi 2 proton, 1 elektron proton> elektron) . Process of losing a valence electron is known as ionization and resulting in positively charged atom called positive ion. * Example chemical symbol for hydrogen is H and when losses an electron it becomes H+ . The escaped electron is called a free electron (elektron bebas). * When a free electron losses its energy and falls into outer shell of a neutral hydrogen atom, the atoms becomes negatively charged (More electrons than protons) and is called negative ion. H- SEMICONDUCTORS, CONDUCTORS AND INSULATORS * Electronic devices such as diodes, transistors and integrated circuits are made of a semiconductive material.

Conductors * A meterial that easily conducts electrical current. * Best conductor are copper, silver, gold , aluminium which has one valence electron and very losely bound to the atom and thus has lot of free electrons. Insulators * Insulator is a material that does not conduct electrical current under normal conditions. * Valence electron are tightly bounded to the atoms. * Very very few free electrons. Semiconductors * Semiconductor materials are the foundation of modern electronics, including radio, computers, telephones, and many other devices. A semiconductor is a substance, usually a solid chemical element or compound, that can conduct electricity under some conditions but not others, making it a good medium for the control of electrical current. * .. is a material that is between conductors and insulators in its ability to conduct electrical current. * A semiconductors in its pure state is neither a good conductor a good insulator. * Most used Semi conductor is Silicon, germanium, Gallium Arsenide (GaAs) 1. Ge – First discovered. Used as Diode in 1939, transistor in 1947.

Sensitive to changes in temperature – suffer reliability problem. 2. Si – Introduced in 1954 (as transistor), less sensitive to temperature. Abundant materials on earth. Over the time – its sensitive to issue of speed. 3. GaAs – in 1970 (transistor), 5x speed faster than Si. Problem – difficult to manufacture, expensive, had little design support at the early stage. * Usualy atoms with 4 valence electron. ENERGY BAND * When the electron gets additional energy, it can leave the valence shell and becomes free electrons * Free Electrons exist as conductor band The diffrence in energy between valence band and conduction band is called an energy gap (Eg)

Shown in Figure 5 Figure 5: Energy diagram for the three types of materials. * There is a the amount of energy that a valence electron must have in order to jump from the valence band (VB) to conduction band(CB). * Once in the CB the electron is free to move throughout the material and is not tied to any atom. * Figure 5 shows energy diagram for conductor(metals) semiconductors and Insulators. * Notice a the conductors ilustrates the energy band overlaps. As for the semiconductors, it have much narrow Eg. This gap permits sme valence electrons to jump into the CB and becomes free electrons. * And finally for insulator, the Energy gap is way much bigger. Valence electrons do not jump into the CB except under breakdown condition where extremely high voltages are applied across the material. PREPARED BY: GOMESH NAIR DMT 121 ELECTRONIC DEVICES OFFICE: ELECTRICAL ENERGY & INDUSTRIAL ELECTRONIC SYSTEM RESEARCH CLUSTER, UNIVERSITI MALAYSIA PERLIS TAMAN PENGKALAM INDAH JALAN PENGKALAM ASSAM 01000, KANGAR, PERLIS Email: edu. my