ANSWER KEY- Assignment 2

MCQ: 1. C 2. C 3. B 4. B 5. D 6. A 7. 8. B

ASSERTION AND REASON: 9. C 10. C 11. C 12. B

2 MARKS QUESTIONS

13. As BE/nuleon of the product nuclei is more than that of original nuclei. So more mass has been converted into energy. This would result in release of energy so it is exothermic

14. One atomic mass unit (1 a.m.u.) is defined as one twelfth 112 of the mass of an atom of carbon-12.

1 a.m.u. = 1.66×10^{-27}kg

According to Einstein's mass-energy equivalence relation,

$E = (\Delta m)c2$

So, we need to find energy equivalent of 1 a.m.u.

$E=(1.66\times10^{-27}\ kg)\times(3\times10^{8}\ m/s)2$

$=1.49\times10^{-10}$ joules

But 1 MeV = 1.6×10^{-13} J

$E=1.49\times10^{-10}$ x 1.6×10^{-13} MeV

=931.5 MeV

Thus, 1 amu of mass is equivalent to 931.5 MeV of energy.

3-MARKS QUESTIONS

15.Number of atoms in a 3g coin=$6.023\times10^{23}\times3/63=2.868\times10^{22}$

Each copper atom has 29 protons and 34 neutrons.

Mass of the copper nucleus = 62.92960

Thus, the mass defect of each atom is $29\times1.00783+34\times1.00867-62.92960=0.59225$u.

Total mass defect of all atoms = $0.59225u\times2.868\times10^{22}=1.6985\times10^{22}$u.

Thus, the nuclear energy required=$1.6985\times10^{22}\times931MeV=1.58\times10^{25}$ MeV.

16. Bismuth nucleus contains 83 protons

Number of neutrons=209−83=126 neutrons

Now, Mass of 83 protons=83 X 1.007825=83.649475amu

Mass of 126 neutrons=126X1.008665=127.091790amu

Therefore, total mass of nucleons=83.649475+127.091790=210.741260amu

Given, mass of nucleus=208.980388amu

Now, mass defect Δm =210.741260−208.980388=1.760872

Total binding energy=1.760872 X 931.5=1640.26MeV

Therefore, average binding energy per nucleon = 1640.26/ 209 =7.848Mev

17.It is given that The atomic mass of Fe = 55.93494.0 u

The atomic mass of Al = 27.98191 u

The Q value of this nuclear reaction is given as Q = [($m$ass of Fe) –(2 mass of Al)] c2

= [55.93494 – 2 × 27.9819119] c^2

Q = (−0.02888 c2) u

But we know that 1 u = 931.5 Mev/c2 QQ = −0.02888 × 931.5 = −26.902 MeV

The Q value of the fission is negative. Therefore, fission is not possible. For a possible fission reaction, the Q value should be positive

1) It was possible to obtain the size of the nucleus through Rutherford's experiment. We can calculate the size of the nucleus, by obtaining the point of closest approach of an alpha particle

If R is the radius of nucleus having mass number A, then $R = R_0 A^{1/3}$

Where R_0= 1.2 X 10^{-15} m which is the range of order of nuclear size and A is mass number