Hack the North Test Test [11]

Answer the following questions **in the box provided**. Complete solutions and sentences must be shown for full marks.

1. When $2x^4 + 3x^3 + ax^2 + bx + 7$ is divided by $x - 1$ the remainder is 15. When it is divided by $x + 2$ the remainder is -3. Determine the values of a and b. [5]

Let $f(x) = 2x^4 + 3x^3 + ax^2 + bx + 7$

$f(1) = 15$

$15 = 2(1)^4 + 3(1)^3 + a(1)^2 + b(1) + 7$

$15 = 12 + a + b$

① $3 = a + b$

$f(-2) = -3$

$-3 = 2(-2)^4 + 3(-2)^3 + a(-2)^2 + b(-2) + 7$

$-3 = 15 + 4a - 2b$

$-18 = 4a - 2b$

② $-9 = 2a - b$

① $3 = a + b$

② $-9 = 2a - b$

$-6 = 3a$

$-2 = a$

Sub $a = -2$ into ①

$3 = -2 + b$

$5 = b$

$\therefore a = -2, b = 5$

2. Give the full electron configuration of the selenium atom ($_{34}$Se). [1]

$_{34}Se: 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^4$

3. Give the full electron configuration of this ion and explain why this electron arrangement is stable. [2]

$_{34}Se^{2-}: 1s^2 2s^2 2p^6 3s^2 3p^6 \underline{4s^2} 3d^{10} \underline{4p^6}$

Full s and p valence subshells (like Nobel Gas: Kr) and also has octect valence electrons in outer most energy level, thus stable.

4. Explain, in terms of the energy of its molecules, why the temperature of a pure substance does not change during melting. [3]

During melting, all the energy supplied is absorbed and used to increase the potential energy (intermolecular forces) between the molecules, breaking apart the lattice structure and bonds in the solid while the kinetic energy is not affected.

Since temperature and average kinetic energy are directly proportional, no change in kinetic energy means no change in temperature.