60

4) No, it's only possible to measure 1 projection, while 2 others are arbitrary. It is an uncertainty principle consequence.

Proofs ?

2

17) M = ħ*sqrt(L(L+1))   (1)

M_z = m* ħ

If we need the minimal possible angle between M and M_z, then M_z should be maximal, thus:

M_z = L* ħ

Cosα = M_z/M = L / sqrt(L(L+1))

$M_{classical}$ = I*w = m*0.5*(r^2) * 2*π*1hz = π*10^(-12)

(1) ==> sqrt(L(L+1)) = π*10^(-12) / ħ

Because of the fact that L is going to be quite large we can round left side of expression:

L = π*10^(-12) / ħ = 2,98 * 10^22

Cosα = L / sqrt (L (L + 1)) = 1 / sqrt (1 + 1 / L)) ≈ 1 (my calculator isn't capable enough)

α ≈ 0 ° but >0 This is what is important !!!

18

α ≈ 0°

25) electron in hydrogen atom has energy:

E_n = -R* ħ / n^2,   R = 2,07 * 10^16 s^{-1}

20

In ground state n = 1 ==> E_n = -R* ħ

To ionize an electron means to remove it from atom for an infinitely long distance, so

n = ∞,

E_n = -R* ħ / n^2 = 0

Energy required to ionize an electron from ground state:

A = E_1 – E_{inf} = R* ħ = 2,18 * 10^(-18) J

34) Pauli principle states that an atom can only have electrons with unique set of quantum numbers:

n: 0, 1, 2, ...

l: 0, 1, 2, ..., n-1

20

m: -l, ..., l

s: ±0.5

Thus, electrons are divided into layers with different principal quantum number n:

K, n=1, 2 electrons

L, n=2, 8 electrons

M, n=3, 18 electrons

N, n=4, 32 electrons

...

And are also divided into groups with different orbital quantum numbers(s,p,d,f,...)

N (natrium): $1s^2 2s^2 2p^3$

Cl: $1s^2 2s^2 2p^6 3s^2 3p^5$

K (kalium): $1s^2 2s^2 2p^6 3s^2 3p^6 4s$

43 ?????