

Physics 512 Quiz – 01

Name:

Time: 12 Min

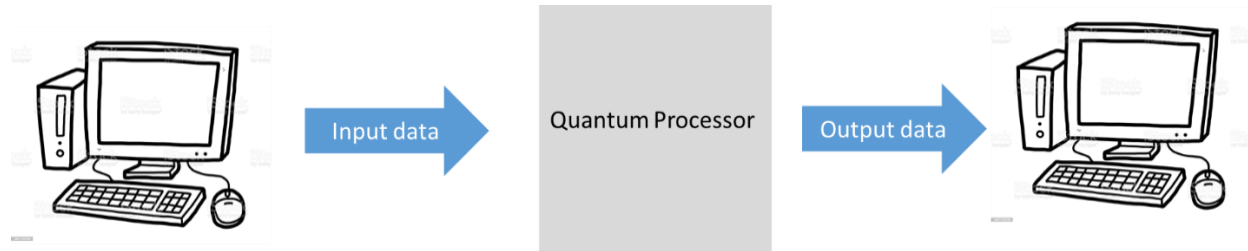
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Marks: 14

Show all steps clearly, if required, No marks for ONLY answer.

Q.1

Circle the region on following figure where we cannot measure the data/state of hardware. [1]



Q.2 Write the ‘quantum state’ of the following ‘classical state’. (Do not write the state in terms of $\alpha, \beta, \gamma, \dots$, use real/complex numbers. [2]

$$|Classical\ state\rangle = \frac{1}{4}|HH\rangle + \frac{1}{4}|HT\rangle + \frac{1}{4}|TH\rangle + \frac{1}{4}|TT\rangle$$

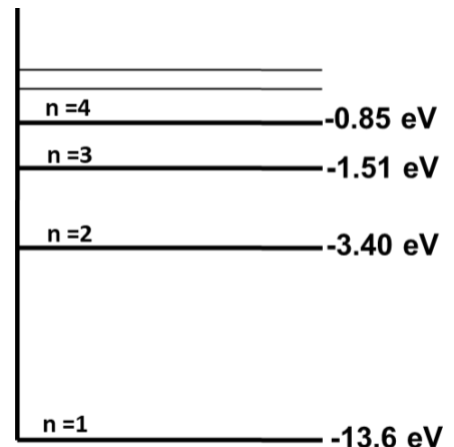
$|Quantum\ state\rangle = \dots$

Q.3 Following diagram show the energy level of electron in a hydrogen atom [3]

a) Assume electron is in $n=1$ state

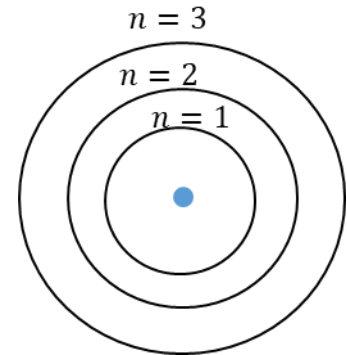
1) How much energy is required to move it in $n=2$ state

2) How much energy is required to move it in $n=4$ state



b) Assume electron is in $n=1$ state, if you provide 12.2 eV of energy to this electron, where you can find the electron (i.e. in $n=1$ or $n=2$ or $n=3$ state(s)) after it has been exposed to this ‘quanta of energy’

Q.4 In the following Figure the electron's orbits around the nucleus. Quantum mechanically the probability of finding the electron in states $n=1$, $n=2$, and $n=3$ is 70 %, 25 % and 5 % respectively. Write down the 'quantum state' of the electron around the nucleus. [3]

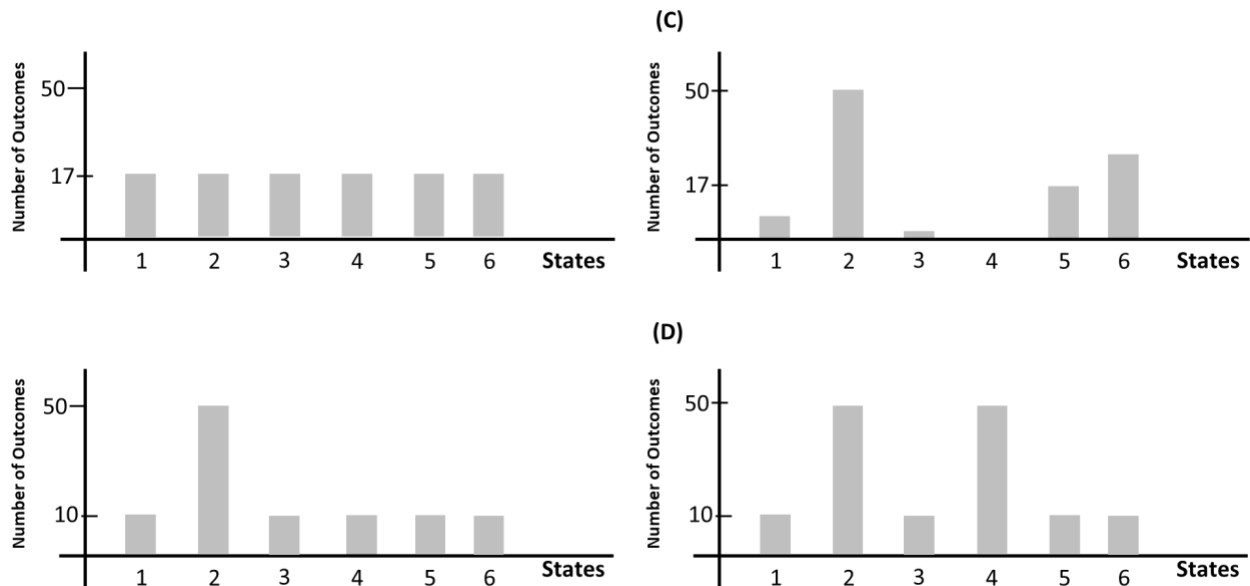


Q.5 The state $|\psi\rangle$ of six level quantum system is

$$|\psi\rangle = \alpha|1\rangle + \beta|2\rangle + \gamma|3\rangle + \delta|4\rangle + \kappa|5\rangle + \lambda|6\rangle$$

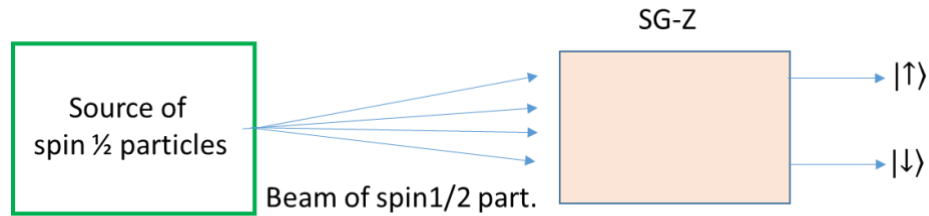
Where $\beta = \frac{1}{2} + \frac{i}{2}$

If you measure the state $|\psi\rangle$ 100 times (after preparing same state $|\psi\rangle$ again and again), which of the following is/are the possible histogram of the measurement out comes. (No need to do exact calculation, rough estimation is enough)



Q.6

- (a) If source produces 1000 spin-1/2 particles and after passing through SG-Z, 500 particles measured with $|\uparrow\rangle$ and 500 measured with $|\downarrow\rangle$. Write down the 'quantum state, $|\psi\rangle$ ' of the spin-1/2 particles from the source. [2]



$|\psi\rangle =$

- (b) Probabilities after each SG apparatus are given in the following diagram. Write down the quantum state $|\downarrow_z\rangle$ in terms of $|\downarrow_x\rangle$ and $|\uparrow_x\rangle$ [3]

