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Quiz #2 Phys304 T152

Name: ----------ID#----------

Q#1: A box contains a total of 10,000 small metallic spheres, of which 2000 are painted white and the rest are painted black. A person removes 100 spheres from the box one at a time at random. What is the probability that 10 of these spheres are white?

Probability of picking one white sphere $= P_w = \frac{2000}{10,000} = 0.2$

$$P_b(n,x,p) = \frac{n!}{x!(n-x)!} \cdot P_w^x (1-P_w)^{n-x}$$

$$= \frac{100!}{10!(100-10)!} (0.2)^{10} (1-0.2)^{90} = 0.00336$$

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Q#2: In a counting experiment an average counting rate of 6.5 counts/s was observed for a one second counting interval. What is the probability of observing a count rate of 11.0 counts/s for a one second counting interval?

$$P_p(\mu,x) = \frac{\mu^x}{x!} e^{-\mu} = \frac{6.5^{11}}{(11)!} e^{-6.5} = 0.033$$

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Q#3: The measurements of certain distance x are distributed normally with $\mu=10$ and $\sigma=2$. What is the probability that any measurement of x will lie between x=7 and x=13?

$x_i = 7, \mu = 10, Z_- = \frac{|x_i - \mu|}{\sigma} = \frac{3}{2} = 1.5$

$x_f = 13, \mu = 10, Z_+ = \frac{|x_f - \mu|}{\sigma} = \frac{3}{2} = 1.5$

Area between -1.5σ to $+1.5\sigma$ $= 0.866 = 86.60\%$

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Q#4: i) What is the value of a measurement x (in terms of μ and σ) which exceed the confidence level of 99.4 % ?

For $Z = 2.75$ it is 99.40%. Then $Z = \frac{|x-\mu|}{\sigma}$, $x = \mu \pm Z\sigma$

$\Rightarrow x = \mu \pm 2.75\sigma$

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ii) If two similar measurements of x has a discrepancy of 0.1 %, is it significant?

No it is not !!

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$x = \mu \pm 2.75\sigma$