

Assignment3

EE24BTECH11007 - Arnav Makarand Yadnopavit

In a one-dimensional harmonic oscillator, φ_0 , φ_1 and φ_2 are respectively the ground, first, and the second excited states. These three states are normalized and are orthogonal to one another.

ψ_1 and ψ_2 are two states defined by

$$\psi_1 = \varphi_0 - 2\varphi_1 + \varphi_2$$

$$\psi_2 = \varphi_0 - \varphi_1 + \alpha\varphi_2$$

where α is a constant.

1) The value of α for which ψ_2 is orthogonal to ψ_1 is

- a) 2 b) 1 c) -1 d) -2

2) For the value α determined Q.1, expectation value of energy of oscillator in the state ψ_2 is

- a) $\hbar\omega$ b) $3\hbar\omega/2$ c) $3\hbar\omega$ d) $9\hbar\omega/2$

A plane electromagnetic wave has the magnetic field given by

$$\vec{B}(x, y, z, t) = B_o \sin \left[(x + y) \frac{k}{\sqrt{2}} + \omega t \right] \hat{k}$$

where k is the wave number and \hat{i} , \hat{j} , \hat{k} are the Cartesian unit vectors in x , y , and z directions, respectively.

3) The electric field $\vec{E}(x, y, z, t)$ corresponding to the above wave is given by:

- a) $cB_o \sin \left[(x + y) \frac{k}{\sqrt{2}} + \omega t \right] \frac{\hat{i} - \hat{j}}{\sqrt{2}}$ c) $cB_o \sin \left[(x + y) \frac{k}{\sqrt{2}} + \omega t \right] \hat{i}$
b) $cB_o \sin \left[(x + y) \frac{k}{\sqrt{2}} + \omega t \right] \frac{\hat{i} + \hat{j}}{\sqrt{2}}$ d) $cB_o \sin \left[(x + y) \frac{k}{\sqrt{2}} + \omega t \right] \hat{j}$

4) The average Poynting vector is given by:

- a) $\frac{cB_o^2}{2\mu_o} \frac{(\hat{i} - \hat{j})}{\sqrt{2}}$ c) $\frac{cB_o^2}{2\mu_o} \frac{(\hat{i} + \hat{j})}{\sqrt{2}}$
b) $-\frac{cB_o^2}{2\mu_o} \frac{(\hat{i} - \hat{j})}{\sqrt{2}}$ d) $-\frac{cB_o^2}{2\mu_o} \frac{(\hat{i} + \hat{j})}{\sqrt{2}}$

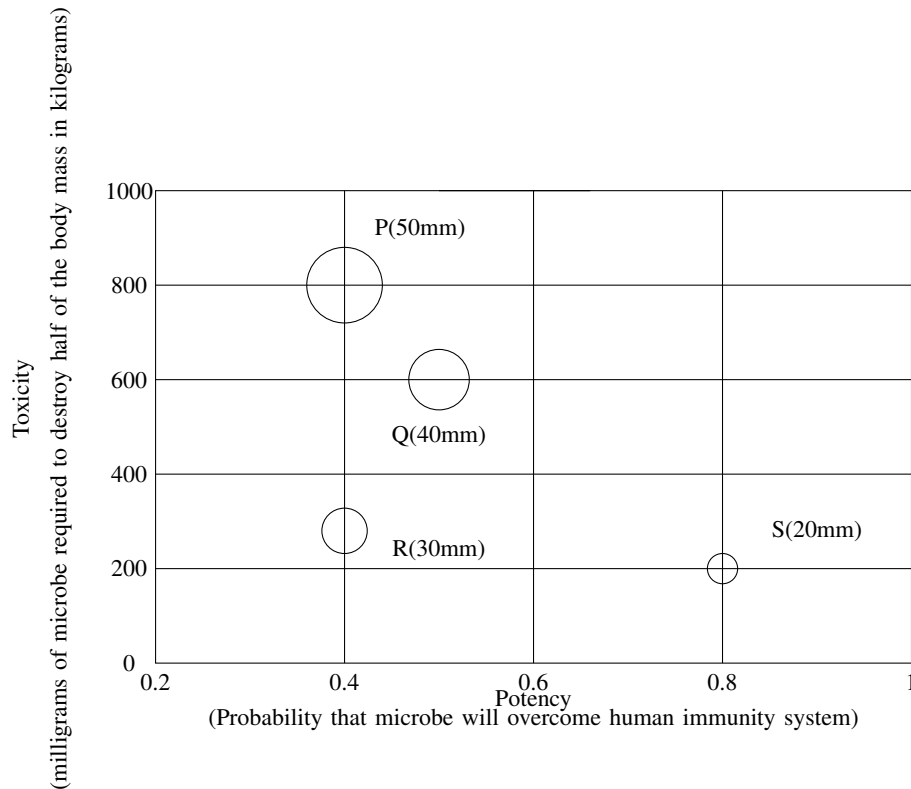
5) Choose the most appropriate word from the options given below to complete the following sentence:

If you are trying to make a strong impression on your audience, you cannot do so by being understated, tentative or _____.

- a) hyperbolic
b) restrained
c) argumentative
d) indifferent

6) Choose the most appropriate word(s) from the options given below to complete the following sentence:

I contemplated _____ Singapore for my vacation but decided against it.



A pharmaceutical company is contemplating the development of a vaccine against the most dangerous microbe. Which microbe should the company target in its first attempt?

- a) P b) Q c) R d) S

- 13) **Few school curricula include a unit on how to deal with bereavement and grief, and yet all students at some point in their lives suffer from losses through death and parting.**

Based on the above passage which topic would not be included in a unit on bereavement?

- a) how to write a letter of condolence
 b) what emotional stages are passed through in the healing process
 c) what the leading causes of death are
 d) how to give support to a grieving friend

- 14) A container originally contains 10 litres of pure spirit. From this container 1 litre of spirit is replaced with 1 litre of water. Subsequently, 1 litre of the mixture is again replaced with 1 litre of water and this process is repeated one more time. How much spirit is now left in the container?

- a) 7.58 litres c) 7 litres
 b) 7.84 litres d) 7.29 litres