Quiz 1 10/1/14

Quiz Q-1 – Consider a function such that $F(x_0) = -1.1$ for some fixed, real value of x_0. Which of the following could be true?

A. $F(x) = \sin x$
B. $F(x) = \sinh x$
C. $F(x) = \cos x$
D. $F(x) = \cosh x$
E. None of the above.

10/1/14

Quiz Q-1 – Consider a function such that $F(x_0) = -1.1$ for some fixed, real value of x_0. Which of the following could be true?

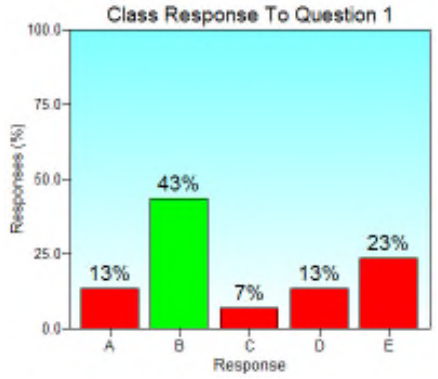
A. F(x) = sin x

B. F(x) = sinh x ($x_0 = -0.950$)

C. F(x) = cos x

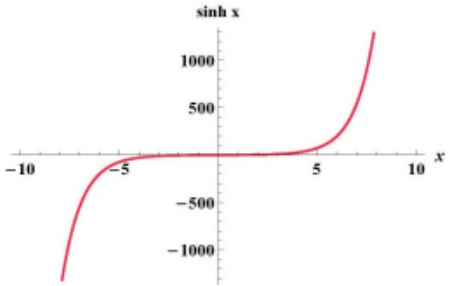
D. F(x) = cosh x

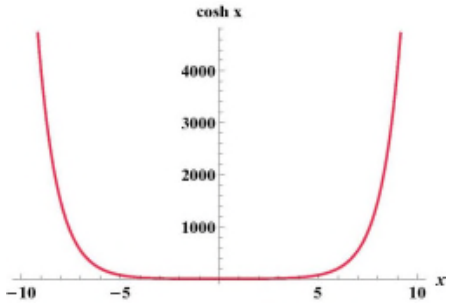
E. None of the above.

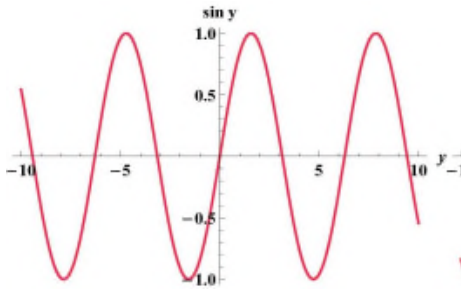


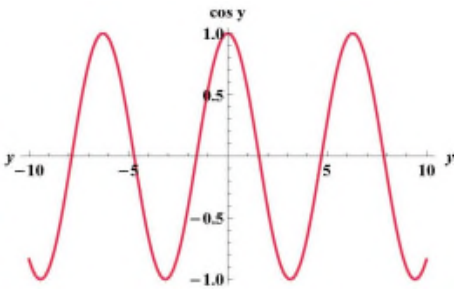
10/1/14

Plots


sinh x
1000
500
−500
−1000
−10
−5
5
10
x


cosh x
4000
3000
2000
1000
−10
−5
5
10
x


sin y
1.0
0.5
−0.5
−1.0
−10
−5
5
10
y


cos y
1.0
0.5
−0.5
−1.0
−10
−5
5
10
y

Quiz Q-2 – Consider a function such that $F(0) = 0.0$ and $F(x)=F(x+2\pi)$. Which of the following could be true?

A. $F(x) = \sin x$
B. $F(x) = \sinh x$
C. $F(x) = \cos x$
D. $F(x) = \cosh x$
E. None of the above.

10/1/14

Quiz Q-2 – Consider a function such that F(0) = 0.0 and F(x)=F(x+2π). Which of the following could be true?

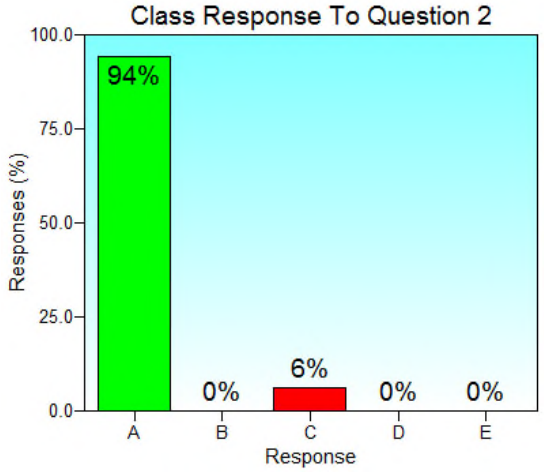
A. F(x) = sin x

B. F(x) = sinh x

C. F(x) = cos x

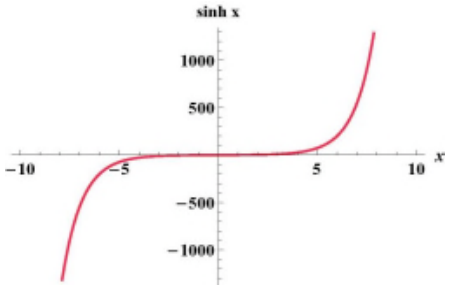
D. F(x) = cosh x

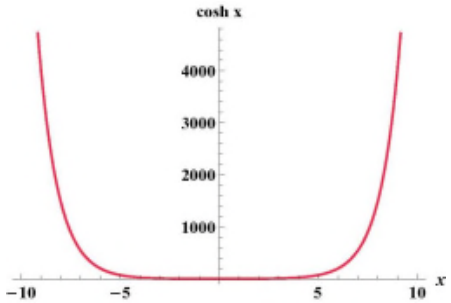
E. None of the above.

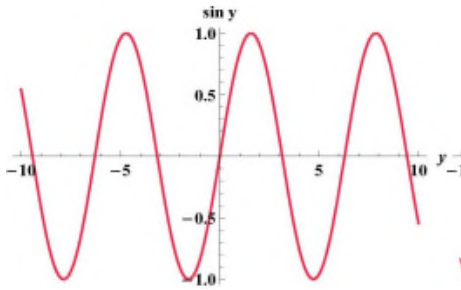


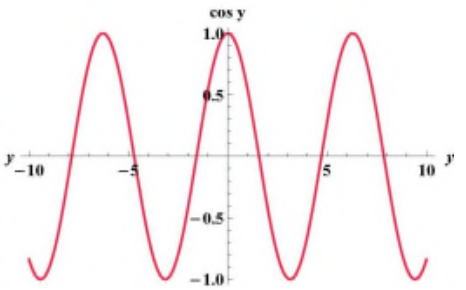
10/1/14

Plots


sinh x
1000
500
−500
−1000
−10
−5
5
10
x


cosh x
4000
3000
2000
1000
−10
−5
5
10
x


sin y
1.0
0.5
−0.5
−1.0
−10
−5
5
10
y


cos y
1.0
0.5
−0.5
−1.0
−10
−5
5
10
y

Quiz Q-3 – Which statement is true?
Galilean relativity

A. refers to any relative of Galileo.
B. is a property of Newton's laws of motion in 3-D.
C. is a grunge band.
D. refers to variation of laws of motion under a change of reference frame.
E. applies to light.

10/1/14

Quiz Q-3 – Which statement is true?
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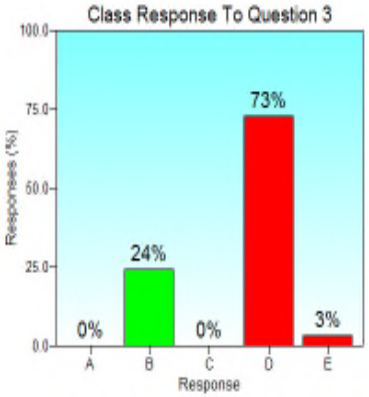


A. refers to any relative of Galileo.

B. is a property of Newton's laws of motion in 3-D.

C. is a grunge band.

D. refers to variation of laws of motion under a change of reference frame.

E. applies to light.

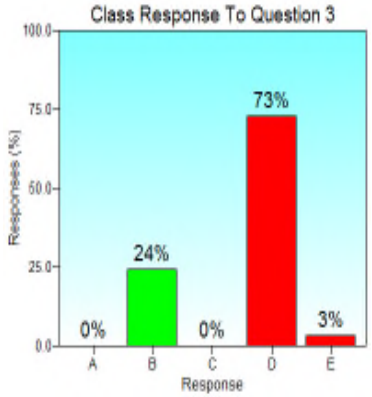
10/1/14

Quiz Q-3 – Which statement is true?

Galilean relativity

D. refers to variation of laws of motion under a change of reference frame.

Would be correct if said: refers to INvariance of laws of motion under a change of reference frame.



10/1/14

Quiz Q -4 Which statement is a postulate of special relativity?

A. The speed of light is the same in all inertial reference frames.
B. The speed of light is the same in any reference frame.
C. $E = mc^2$
D. There is always a preferred reference frame.
E. Particle velocities are less than *c* no more than 95% of the time.

10/1/14

Quiz Q -4 Which statement is a postulate of special relativity?

A. The speed of light is the same in all inertial reference frames.
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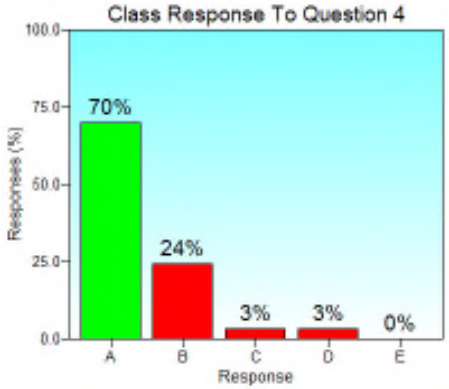
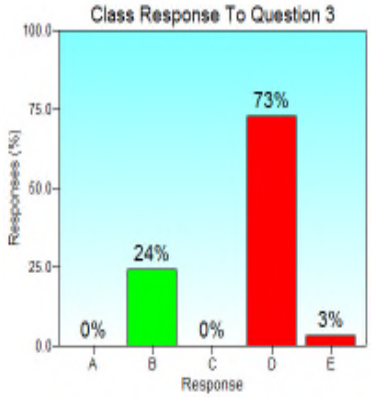


10/1/14

Quiz 2 10/6/14

Last week -Quiz Q-3 – Which statement is true? Galilean relativity



A. refers to any relative of Galileo.

B. is a property of Newton's laws of motion in 3-D.

C. is a grunge band.

D. refers to variation of laws of motion under a change of reference frame.

E. applies to light.

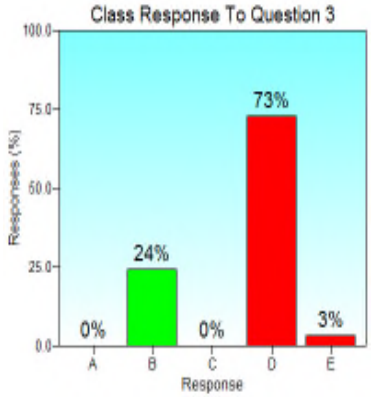
10/1/14

Quiz Q-3 – Which statement is true?

Galilean relativity

D. refers to variation of laws of motion under a change of reference frame.

Would be correct if said: refers to INvariance of laws of motion under a change of reference frame.



10/1/14

Quiz 2 Q -1 Which statement is incorrect?

A. The speed of light is approximately 3×10^8 m/s.
B. The speed of light is approximately 3×10^{10} cm/s.
C. $E = mc^2$ (at rest).
D. There is always a preferred inertial reference frame.
E. Particle velocities have never been correctly observed to exceed *c* .

10/6/14

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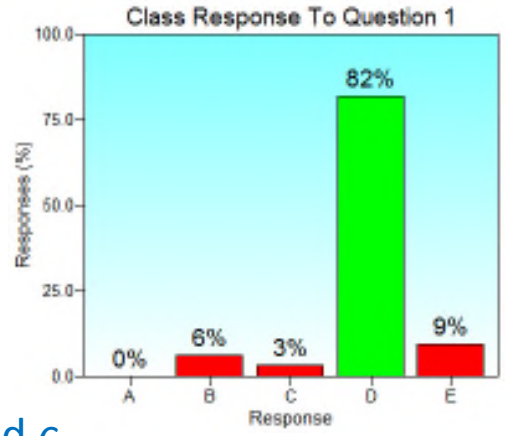

10/6/14

Quiz 2 Q - 2 Consider the time interval between 2 events occurring at the *same* spatial point in a given inertial frame.

A. This is not a proper time interval.
B. This time interval is shorter in other inertial frames moving wrt the given frame.
C. This time interval is longer in other inertial frames moving wrt the given frame.
D. None of the above.

10/6/14

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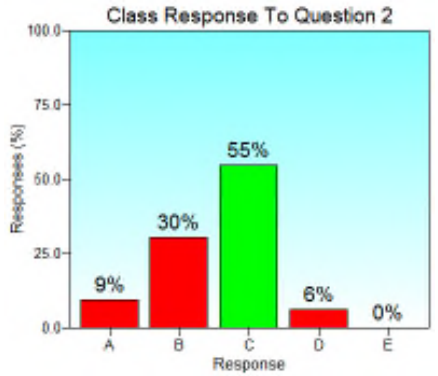

10/6/14

Quiz 2 Q - 3 Consider the length of an object measured at a given time in the inertial rest frame of the object.

A. This is not a proper length.
B. This length is shorter in other inertial frames moving wrt the given frame.
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10/6/14

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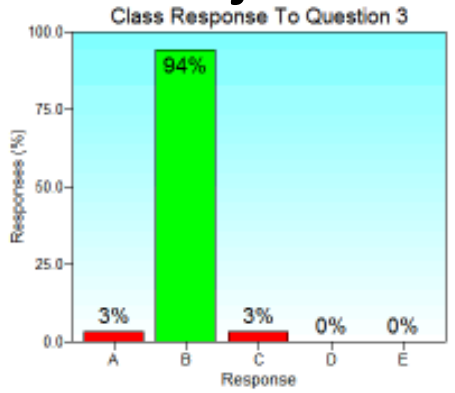

10/6/14

Quiz 2 Q - 4 An *inertial* reference frame is defined by which property?

A. Observers have inertia.
B. No observer sits still.
C. All particles have inertia.
D. Accelerating particles have straight worldlines.
E. Non-accelerating particles have straight worldlines.

10/6/14

Quiz 2 Q - 4 An *inertial* reference frame is defined by which property?

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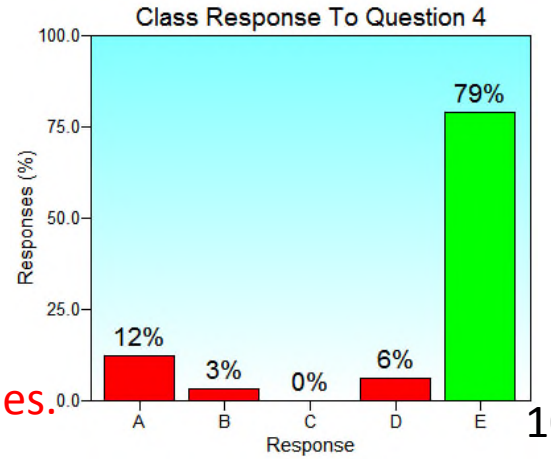

Quiz 3 10/8/14

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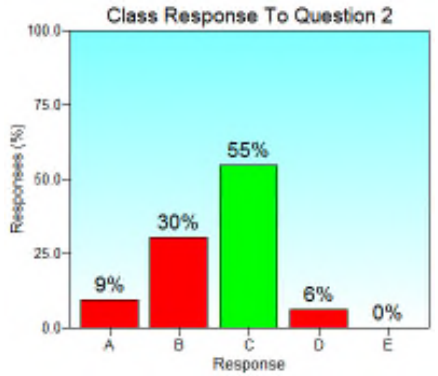

10/6/14

Quiz 3 Q - 1 In a given inertial reference frame uniformly moving clocks

A. remain synchronized with stationary clocks.
B. run faster than stationary clocks.
C. are at rest.
D. run slower than stationary clocks.
E. Accelerate up to $v = c$.

10/8/14

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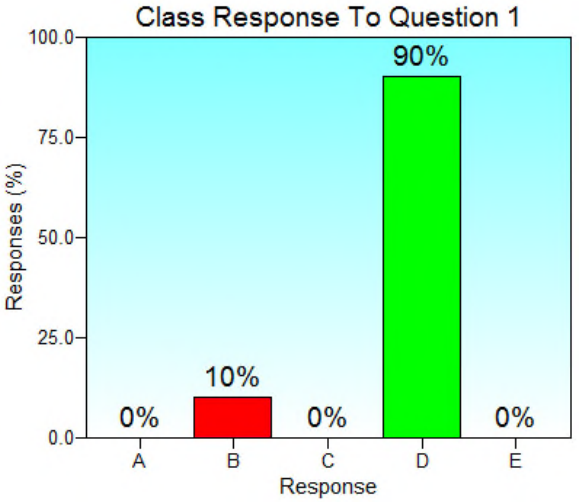

10/8/14

Quiz 3 Q - 2 The transformation matrix indicated is ($1/\gamma=[1-(u/c)^2]^{0.5}$, $0<u<c$)

A. is not a boost.
B. a boost in the $+x^1$ direction.
C. a boost in the $-x^1$ direction.
D. a boost in the $-x^2$ direction.
E. a boost in the $-x^3$ direction.

$$\begin{pmatrix} \gamma & 0 & 0 & -\gamma(u/c) \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ -\gamma(u/c) & 0 & 0 & \gamma \end{pmatrix}$$

10/8/14

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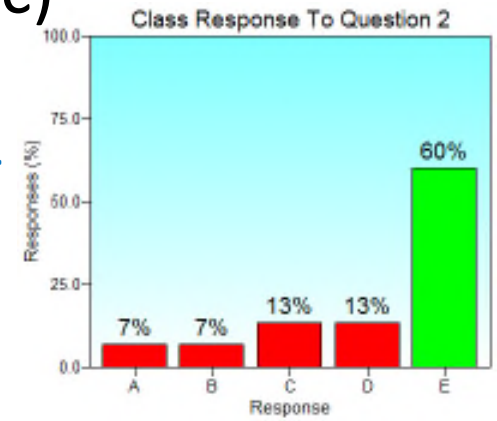

$$\begin{pmatrix} \gamma & 0 & 0 & -\gamma(u/c) \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ -\gamma(u/c) & 0 & 0 & \gamma \end{pmatrix}$$

10/8/14

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D. a boost in the $-x^2$ direction.
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$$\begin{pmatrix} \gamma & 0 & 0 & \gamma(u/c) \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ -\gamma(u/c) & 0 & 0 & \gamma \end{pmatrix}$$

10/8/14

Quiz 3 Q - 3 The matrix indicated is $(1/\gamma=[1-(u/c)^2]^{0.5}, 0<u<c)$

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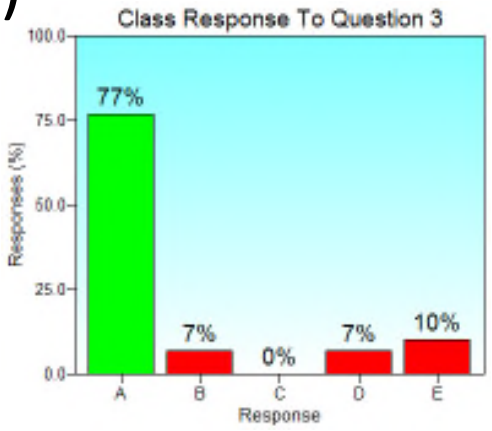

$$\begin{pmatrix} \gamma & 0 & 0 & \gamma(u/c) \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ -\gamma(u/c) & 0 & 0 & \gamma \end{pmatrix}$$

10/8/14

Quiz 3 Q - 4 The rapidity y is defined by $\tanh y = v/c$. As y varies from $-\infty$ to $+\infty$, the velocity v varies from

A. $-\infty$ to $+\infty$.
B. $-c$ to $+c$.
C. 0 to $+\infty$.
D. 0 to $+c$.
E. $+c$ to $-c$.

10/8/14

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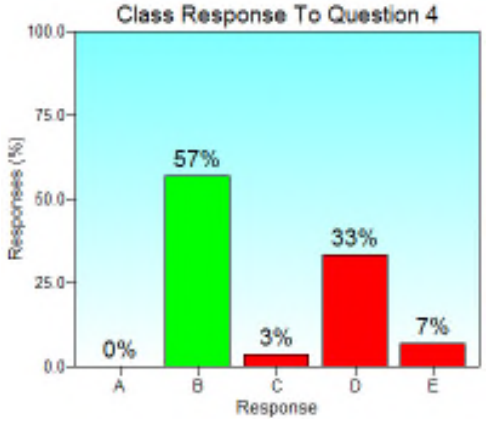

10/8/14

Quiz 4 10/10/14

Quiz 4 Q - 1 Consider the two 4-vectors $a^{\mu} = (1,0,0,1)$ and $b^{\mu} = (1,0,1,-1)$. The scalar product $a^{\mu}b_{\mu}$ has value

A. -2.
B. -1.
C. 0.
D. +1.
E. +2.

10/10/14

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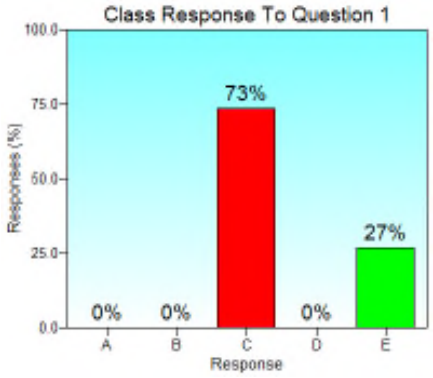


10/10/14

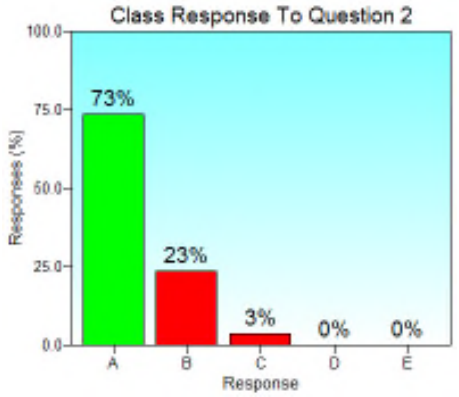
Quiz 4 Q - 2 Consider event A with spacetime location $x_A^{\mu} = (1,0,0,-2)$. The separation between A and the origin is

A. spacelike.
B. timelike.
C. lightlike.
D. too late.
E. Too bad.

10/10/14

Quiz 4 Q - 2 Consider event A with spacetime location $x_A^{\mu} = (1,0,0,-2)$. The separation between A and the origin is

A. spacelike. ($x^2 = 1 - 4 = -3 < 0$)
B. timelike.
C. lightlike.
D. too late.
E. Too bad.



10/10/14

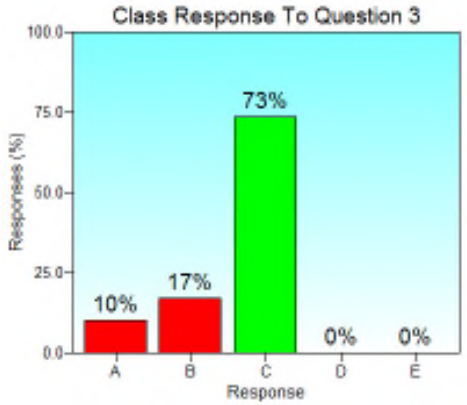
Quiz 4 Q - 3 Consider event A with spacetime location $x_A^{\mu} = (3,2,1,-2)$. The separation between A and the origin is

A. spacelike.
B. timelike.
C. lightlike.
D. too late.
E. Too bad.

10/10/14

Quiz 4 Q - 3 Consider event A with spacetime location $x_A^{\mu} = (3,2,1,-2)$. The separation between A and the origin is

A. spacelike.
B. timelike.
C. lightlike. ($x^2 = 9 - 4 - 1 - 4 = 0$)
D. too late.
E. too bad.



10/10/14

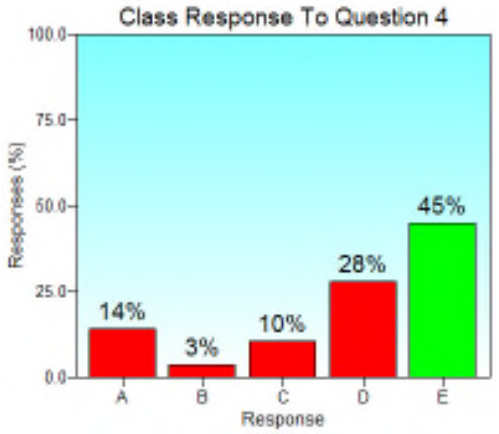
Quiz 4 Q - 4 Consider a 4-velocity defined by $u^{\mu} = \left(\frac{2}{\sqrt{3}} c, 0, 0, u^3 \right)$. The 3 component u^3 is equal to

A. +c.
B. -c.
C. 0.
D. +2c/√3.
E. -c/√3.

10/10/14

Quiz 4 Q - 4 Consider a 4-velocity defined by $u^{\mu} = \left(\frac{2}{\sqrt{3}} c, 0, 0, u^3 \right)$. The 3 component u^3 is equal to

A. +c.
B. -c.
C. 0.
D. +2c/√3.
E. -c/√3. ($u^2 = c^2 = (4/3)c^2 - (u^3)^2$)



10/10/14

Quiz 5 10/13/14

Quiz 5 Q - 1 Consider the two 4-vectors $a^{\mu} = (1,0,0,1)$ and $b^{\mu} = (1,0,1,2)$. The scalar product $a^{\mu}b_{\mu}$ has value

A. -2.
B. -1.
C. 0.
D. +1.
E. +2.

10/13/14

Quiz 5 Q - 1 Consider the two 4-vectors $a^{\mu} = (1,0,0,1)$ and $b^{\mu} = (1,0,1,2)$. The scalar product $a^{\mu}b_{\mu}$ has value

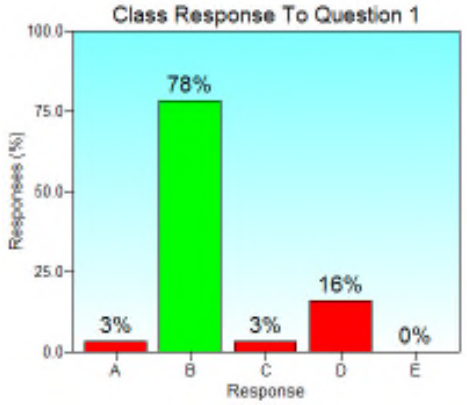
A. -2.

B. -1. ($a \bullet b = 1 - 2 = -1$)

C. 0.

D. +1.

E. +2.



10/13/14

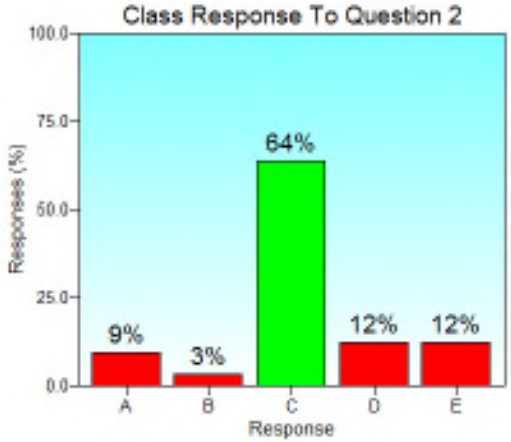
Quiz 5 Q - 2 Consider a 4-velocity defined by $u^{\mu} = \left(c, 0, 0, u^3\right)$.
The 3 component u^3 is equal to

A. +c.
B. -c.
C. 0.
D. +2c/√3.
E. -c/√3.

10/13/14

Quiz 5 Q - 2 Consider a 4-velocity defined by $u^{\mu} = \left(c, 0, 0, u^3\right)$.
The 3 component u^3 is equal to

A. +c.
B. -c.
C. 0. ($c^2 = c^2 - (u^3)^2$)
D. +2c/√3.
E. -c/√3.



10/13/14

Quiz 5 Q - 3 For a moving particle of (rest) mass *m*, velocity *v* ($\gamma = (1 - v^2/c^2)^{-1/2}$), which is true of the (total) energy E?

A. $E = mc^2$
B. $E = \gamma mc^2$
C. $E = mc^2/\gamma$
D. $E = ((mvc)^2 - (mc^2)^2)^{1/2}$
E. $E = ((mc^2)^2 - (mvc)^2)^{1/2}$

10/13/14

Quiz 5 Q - 3 For a moving particle of (rest) mass *m*, velocity *v* ($\gamma = (1 - v^2/c^2)^{-1/2}$), which is true of the (total) energy E?

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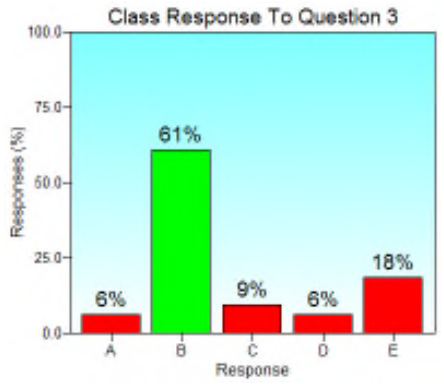

10/13/14

Quiz 5 Q - 4 For a moving particle of (rest) mass *m*, velocity *v* ($\gamma = (1 - v^2/c^2)^{-1/2}$), the magnitude of the spatial momentum p is?

A. $p = mv$
B. $p = mv/\gamma$
C. $p = (E/v^2)c$
D. $p = ((E/c)^2 - (mc)^2)^{1/2}$
E. $p = ((E/c)^2 + (mc)^2)^{1/2}$

10/13/14

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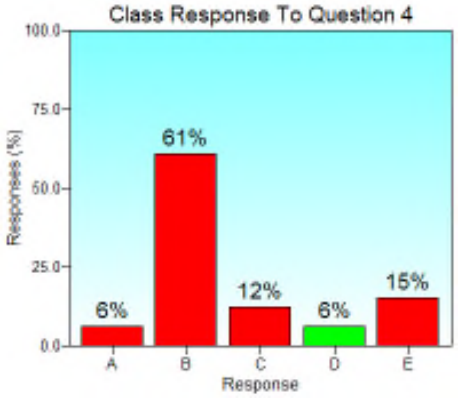
B. $p = mv/\gamma$
C. $p = (E/v^2)c$
D. $p = ((E/c)^2 - (mc)^2)^{1/2}$ $(=\gamma mv)$
E. $p = ((E/c)^2 + (mc)^2)^{1/2}$



10/13/14

Quiz 6 10/15/14

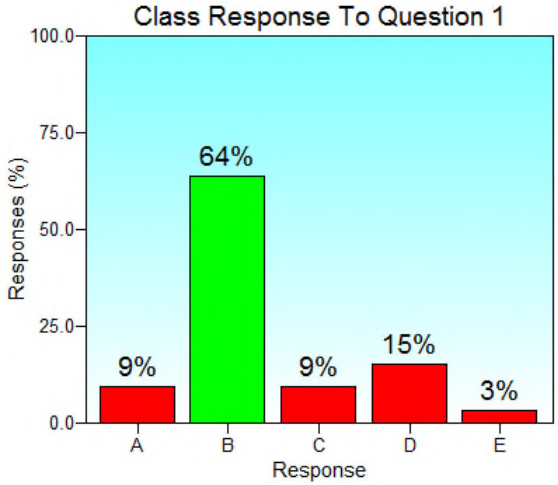
Quiz 6 Q - 1 A wave has 4-D wavevector k = (10,0,0,k^3) GHz/c. The 3 component k^3 is equal to

A. +1.
B. -10.
C. 0.
D. +5.
E. -5.

10/15/14

Quiz 6 Q - 1 A wave has 4-D wavevector k = (10,0,0,k^3) GHz/c. The 3 component k^3 is equal to

A. +1.
B. -10. ($k^2 = (k^0)^2 - (k^3)^2 = 0$)
C. 0.
D. +5.
E. -5.



10/15/14

Quiz 6 Q - 2 For a moving particle of (rest) mass *m*, velocity *v* ($\gamma = (1 - v^2/c^2)^{-1/2}$), the magnitude of the spatial momentum p is?

A. $p = mv$
B. $p = mv\gamma$
C. $p = (E/v^2)c$
D. $p = ((E/c)^2 - (mc)^2)$
E. $p = ((E/c)^2 + (mc)^2)^{1/2}$

10/15/14

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A. $p = mv$
B. $p = mv\gamma\ (= ((E/c)^2 - (mc)^2)^{1/2})$
C. $p = (E/v^2)c$
D. $p = ((E/c)^2 - (mc)^2)$
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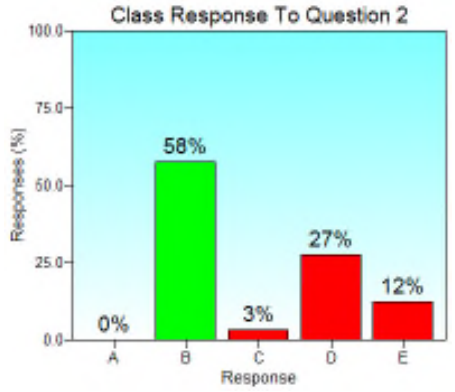


10/15/14

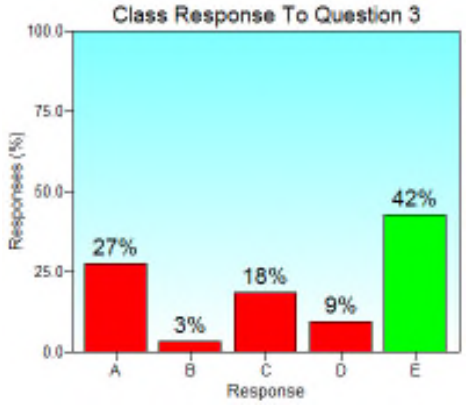
Quiz 6 Q - 3 A wave with 4-D wavevector k = (10,0,0,10) GHz/c is detected by an observer with 4-velocity u = (3,2,0,-2) c. The observed frequency is?

A. 10 GHz
B. 20 GHz
C. 30 GHz
D. 40 GHz
E. 50 GHz

10/15/14

Quiz 6 Q - 3 A wave with 4-D wavevector k = (10,0,0,10) GHz/c is detected by an observer with 4-velocity u = (3,2,0,-2) c. The observed frequency is?

A. 10 GHz
B. 20 GHz
C. 30 GHz
D. 40 GHz
E. 50 GHz (k•u = 30 – (-20) = 50 GHz)



10/15/14

Quiz 6 Q - 4 A scattering process takes place free from external forces. The total 4-momentum for the process is

A. conserved in the Laboratory frame only.
B. conserved in the CM frame only.
C. conserved in all inertial frames.
D. not conserved in any frame.
E. None of the above.

10/15/14

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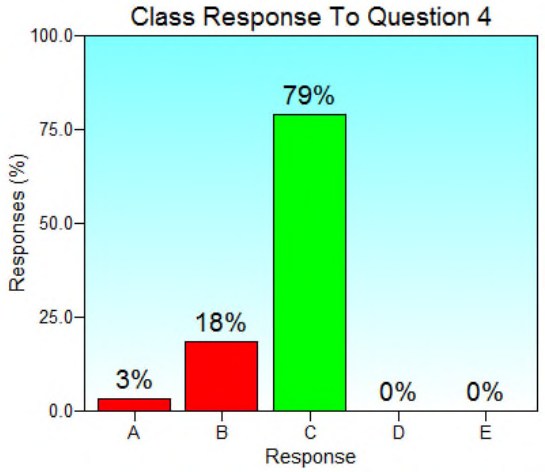

10/15/14

Quiz 7 10/22/14

Quiz 7 Q - 1 The commutator $[J_1,J_3]$ has value

A. $i J_3 \hbar$
B. $i J_2 \hbar$
C. $-i J_2 \hbar$
D. $i J_1 \hbar$
E. $-i J_1 \hbar$

10/22/14

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B. $i J_2 \hbar$
C. $-i J_2 \hbar$
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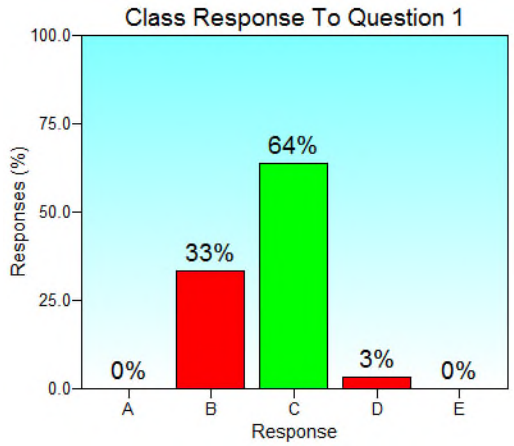

10/22/14

Quiz 7 Q - 2 Consider a spin 3/2 particle (s = 3/2). This particle provides of representation of SU(2) (or SO(3)) with how many distinct states?

A. 1
B. 2
C. 3
D. 4
E. 5

10/22/14

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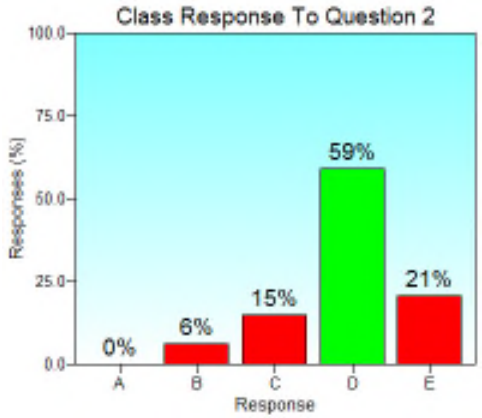
A. 1
B. 2
C. 3
D. 4 (2s+1 = 4)
E. 5



10/22/14

Quiz 7 Q - 3 The ladder operator S_- operating on the eigenstate $|s,m\rangle$

A. Raises the values of *s* and *m* by one unit
B. Lowers the values of *s* and *m* by one unit
C. Leaves *s* unchanged but raises *m* by one unit
D. Leaves *s* unchanged but lowers *m* by one unit
E. Leaves *m* unchanged but raises *s* by one unit

10/22/14

Quiz 7 Q - 3 The ladder operator S_- operating on the eigenstate $|s,m\rangle$

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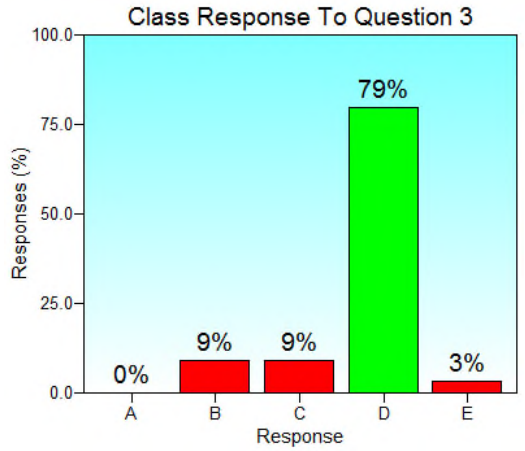


10/22/14

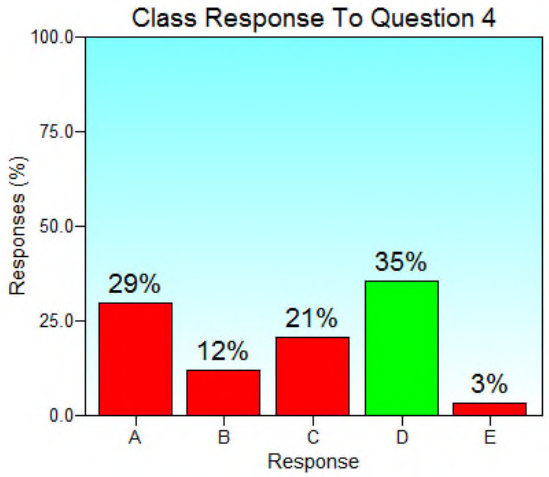
Quiz 7 Q - 4 An SU(2) transformation by 2π about the 1 axis transforms the state |1/2,1/2> into

A. |1/2,-1/2>
B. -|1/2,-1/2>
C. |1/2,1/2>
D. -|1/2,1/2>
E. None of the above

10/22/14

Quiz 7 Q - 4 An SU(2) transformation by 2π about the 1 axis transforms the state |1/2,1/2> into

A. |1/2,-1/2>
B. -|1/2,-1/2>
C. |1/2,1/2>
D. -|1/2,1/2> (for 2π about any axis!)
E. None of the above

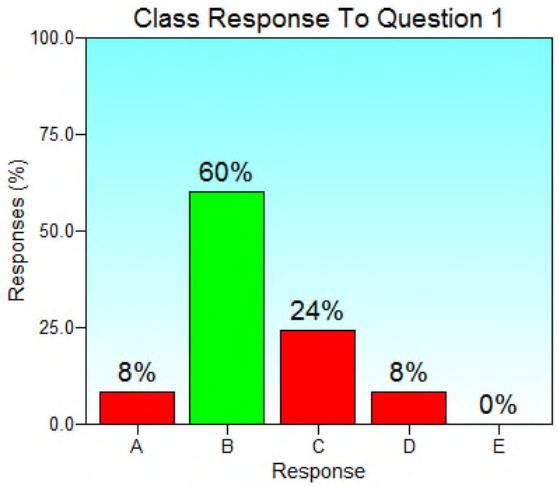


10/22/14

Quiz 8 10/24/14

Quiz 8 Q - 1 An SU(2) transformation by 2π about the 2 axis transforms the state |1/2,-1/2> into

A. |1/2,-1/2>
B. -|1/2,-1/2>
C. -|1/2,1/2>
D. |1/2,1/2>
E. None of the above



10/24/14

Quiz 8 Q – 2 Which is false? The (spatial) momentum *p* of a photon equals:

A. zero, because photons are massless
B. E/c
C. h/λ
D. hν/c
E. None of the above

10/24/14

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A. zero, because photons are massless
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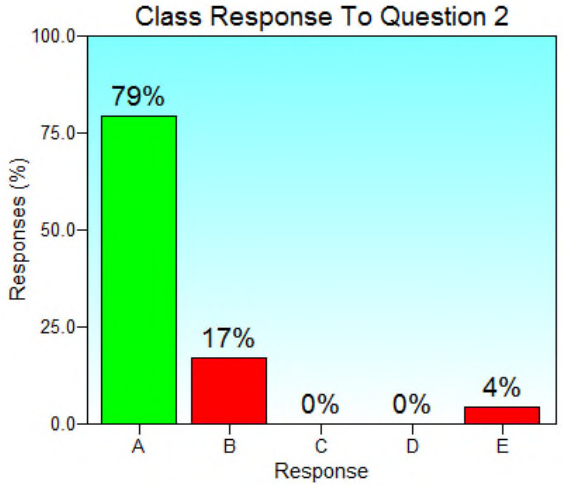


10/24/14

Quiz 8 Q - 3 Consider an alpha particle, which is a Helium nuclei. How many nucleons does it contain?

A. 0
B. 1
C. 2
D. 3
E. 4

10/24/14

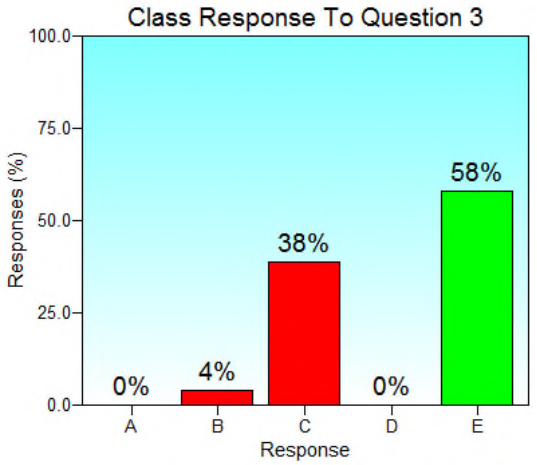
Quiz 8 Q - 1 An SU(2) transformation by 2π about the 2 axis transforms the state $|1/2,-1/2\rangle$ into

A. $|1/2,-1/2\rangle$
B. $-|1/2,-1/2\rangle$
C. $-|1/2,1/2\rangle$
D. $|1/2,1/2\rangle$
E. None of the above

10/24/14

Quiz 8 Q - 3 Consider an alpha particle, which is a Helium nuclei. How many nucleons does it contain?

A. 0
B. 1
C. 2
D. 3
E. 4 (2 neutrons and 2 protons)



10/24/14

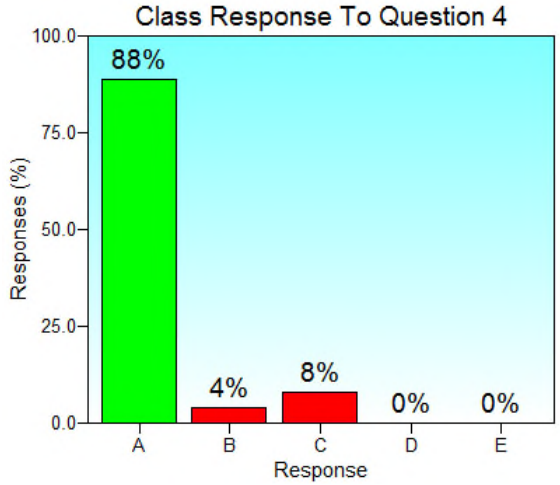
Quiz 8 Q - 4 Consider a beta particle, which is an electron. How many nucleons does it contain?

A. 0
B. 1
C. 2
D. 3
E. 4

10/24/14

Quiz 8 Q - 4 Consider a beta particle, which is an electron. How many nucleons does it contain?

A. 0
B. 1
C. 2
D. 3
E. 4



10/24/14

Quiz 9 10/27/14

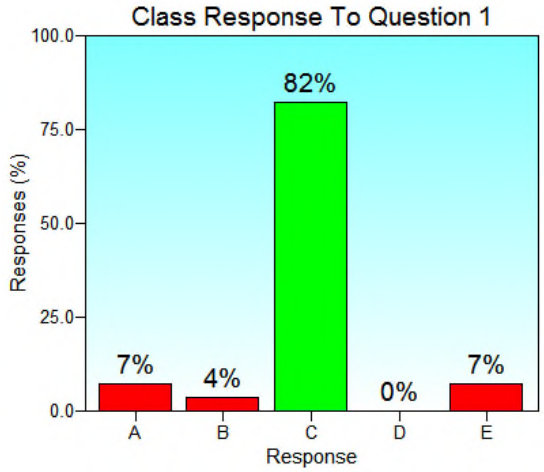
Quiz 9 Q - 1 Consider an alpha particle, which is a Helium nuclei. How many neutrons does it contain?

A. 0
B. 1
C. 2
D. 3
E. 4

10/27/14

Quiz 9 Q - 1 Consider an alpha particle, which is a Helium nuclei. How many neutrons does it contain?

A. 0
B. 1
C. 2
D. 3
E. 4



10/27/14

Quiz 9 Q – 2

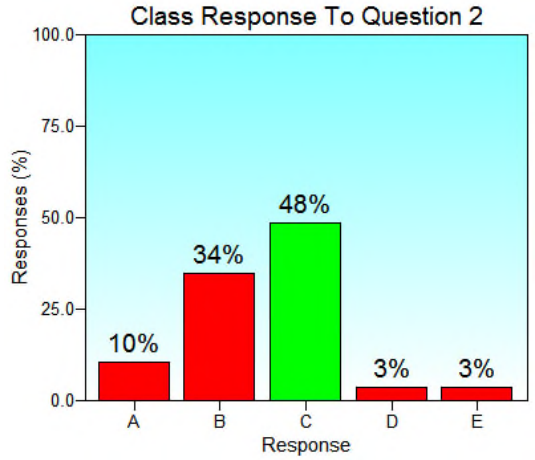
An isolated neutron decays into -

A. a proton and an electron
B. a proton and an electron and a neutrino
C. a proton and an electron and an anti-neutrino
D. a proton and a positron and a neutrino
E. a proton and a positron and an anti-neutrino

10/27/14

Quiz 9 Q - 2 An isolated neutron decays into -

A. a proton and an electron
B. a proton and an electron and a neutrino
C. a proton and an electron and an anti-neutrino
D. a proton and a positron and a neutrino
E. a proton and a positron and an anti-neutrino



10/27/14

Quiz 9 Q - 3 The heavy isotope of Boron, ${}^{14}_{5}B$, decays into Carbon ${}^{14}_{5}B \rightarrow {}^{14}_{6}C + X$. What is X?

A. A proton
B. A neutron
C. An electron and a neutrino
D. An electron and an antineutrino
E. A positron and a neutrino

10/27/14

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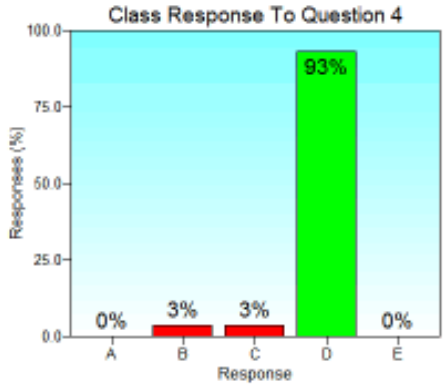
A. A proton
B. A neutron
C. An electron and a neutrino
D. An electron and an antineutrino $\left({}^{14}_{5}B \rightarrow {}^{14}_{6}C + e^{-} + \bar{\nu}_e\right)$
E. A positron and a neutrino



10/27/14

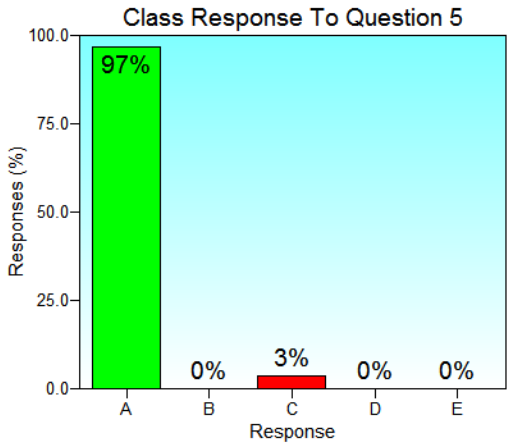
Quiz 9 Q - 4 The most massive (heaviest) lepton is -

A. The τ
B. The ν_τ
C. The μ
D. The ν_μ
E. None of the above

10/27/14

Quiz 9 Q - 4 The most massive (heaviest) lepton is -

A. The τ ($m_\tau = 1777\ MeV/c^2$)
B. The ν_τ
C. The μ
D. The ν_μ
E. None of the above



10/27/14

Quiz 10 10/31/14

Quiz 10 Q - 1 The 3 lightest (least massive) quarks are denoted -

A. a, b, c
B. u, d, c
C. u, c, s
D. d, u, s
E. d, b, t

10/31/14

Quiz 10 Q - 1

The 3 lightest (least massive) quarks are denoted -

A. a, b, c
B. u, d, c
C. u, c, s
D. d, u, s
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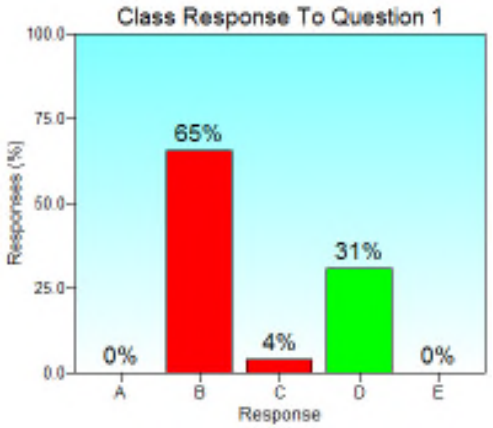

10/31/14

Quiz 10 Q - 2 Mesons are -

A. leptons
B. fermions
C. bound states of 2 quarks
D. bound states of 3 quarks
E. bound states of a quark and antiquark

10/31/14

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A. leptons
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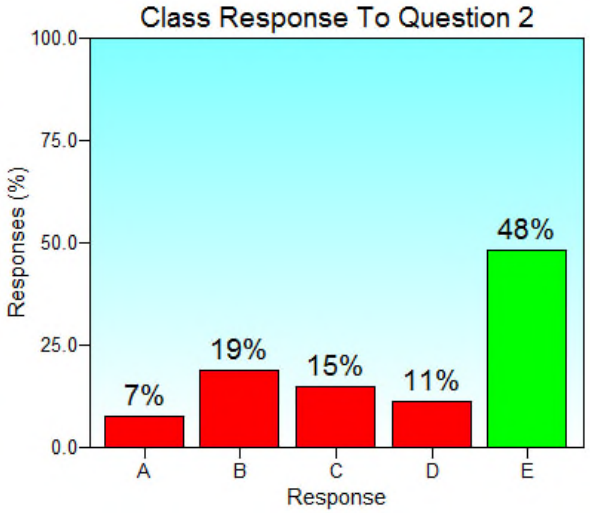


10/31/14

Quiz 10 Q - 3 The quark content of a π^- meson is -

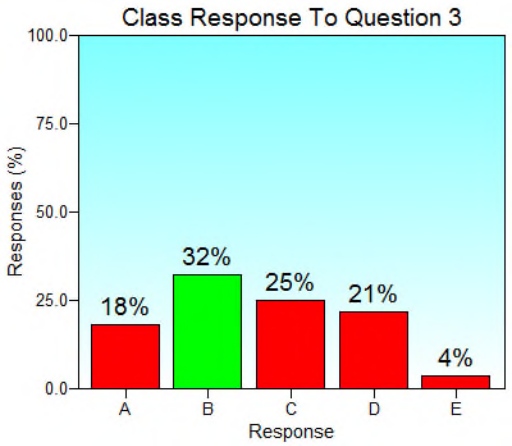
A. $u\bar{d}$
B. $d\bar{u}$
C. $u\bar{u}$
D. $s\bar{u}$
E. $u\bar{s}$

10/31/14

Quiz 10 Q - 3

The quark content of a π^- meson is -

A. $u\bar{d}$
B. $d\bar{u}$
C. $u\bar{u}$
D. $s\bar{u}$
E. $u\bar{s}$



10/31/14

Quiz 10 Q - 4 The quark content of a Ω^- baryon is -

A. *uuu*
B. *ddd*
C. *uus*
D. *ssd*
E. *sss*

10/31/14

Quiz 10 Q - 4 The quark content of a Ω^- baryon is -

A. *uuu*
B. *ddd*
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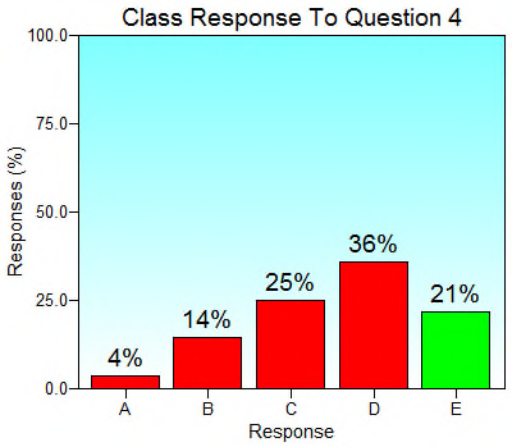
D. *ssd*
E. *sss*



10/31/14

Quiz 11 11/3/14

Quiz 11 Q - 1 The 3 lightest (least massive) quarks are denoted -

A. a, b, c
B. u, d, c
C. u, c, s
D. d, u, s
E. d, b, t

11/3/14

Quiz 11 Q - 1

The 3 lightest (least massive) quarks are denoted -

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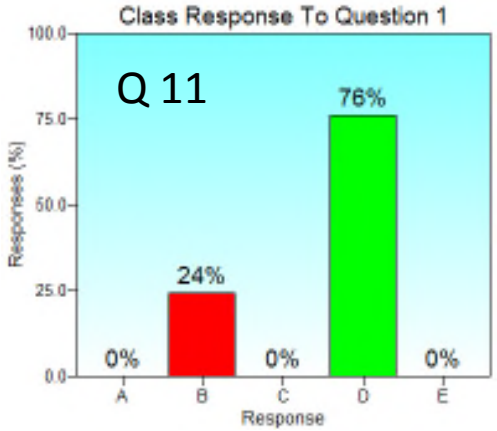
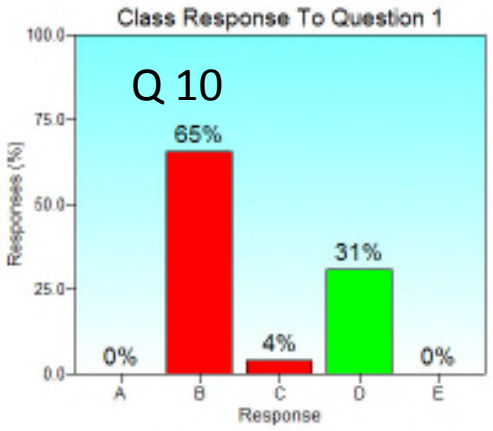
B. u, d, c
C. u, c, s
D. d, u, s
E. d, b, t





11/3/14

Quiz 11 Q - 2 The quark content of a Ω^- baryon is -

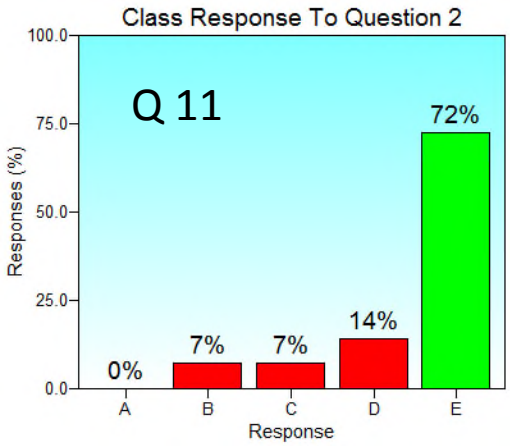
A. *uuu*
B. *ddd*
C. *uus*
D. *ssd*
E. *sss*

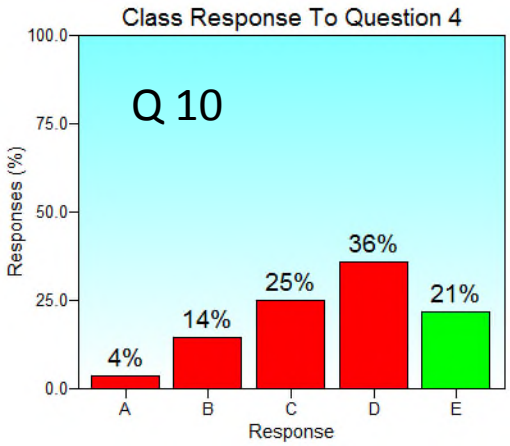
11/3/14

Quiz 11 Q - 2

The quark content of a Ω^- baryon is -

A. *uuu*
B. *ddd*
C. *uus*
D. *ssd*
E. *sss*





11/3/14

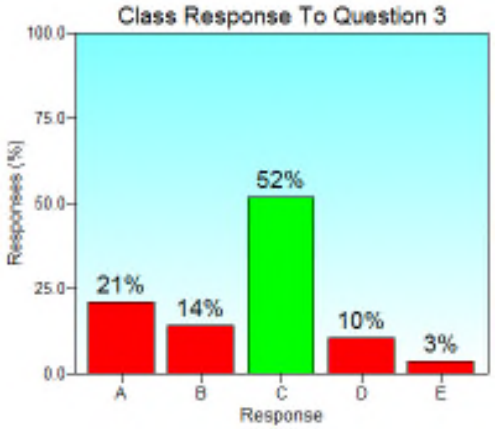
Quiz 11 Q - 3 The π^+ meson has **total** isospin -

A. 0
B. 1/2
C. 1
D. 3/2
E. 2

11/3/14

Quiz 11 Q - 3 The π^+ meson has **total** isospin -

A. 0
B. 1/2
C. 1
D. 3/2
E. 2



1/3/14

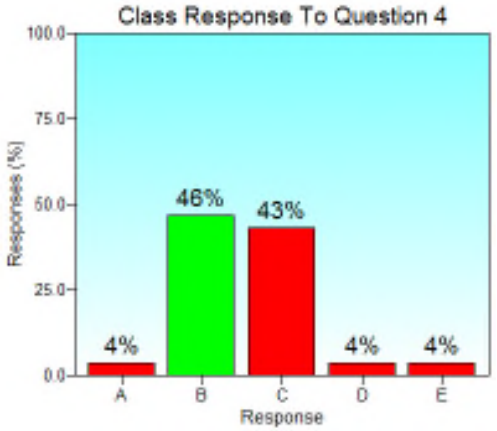
Quiz 11 Q - 4 The Δ^+ baryon has I_3 =

A. 0
B. 1/2
C. 3/2
D. -3/2
E. -1/2

11/3/14

Quiz 11 Q - 4 The Δ^+ baryon has I_3 =

A. 0
B. 1/2
C. 3/2
D. -3/2
E. -1/2



11/3/14

Quiz 12 11/10/14

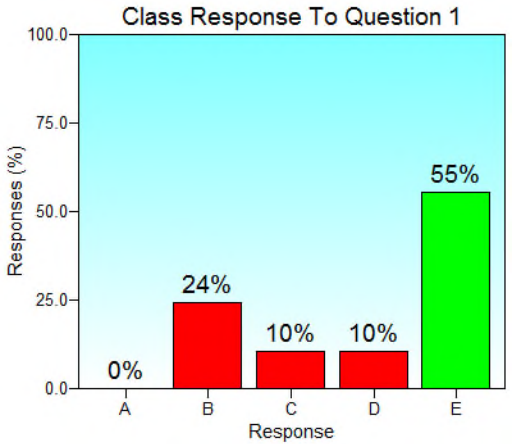
Quiz 12 Q - 1 The strong interactions do not conserve -

A. Energy
B. Isospin
C. Angular momentum
D. Quark flavor
E. None of the above

11/10/14

Quiz 12 Q - 1 The strong interactions do not conserve -

A. Energy
B. Isospin
C. Angular momentum
D. Quark flavor
E. None of the above (all conserved)



11/10/14

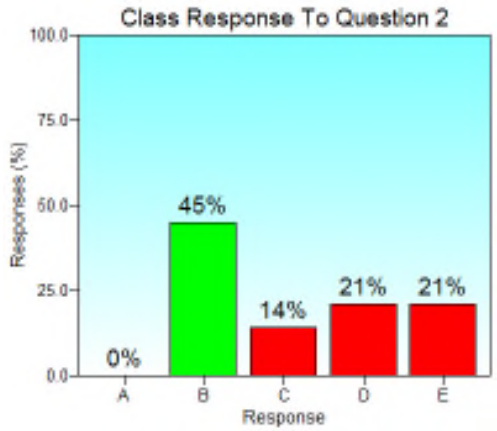
Quiz 12 Q - 2 The weak interactions do not conserve -

A. Energy
B. Quark flavor
C. Angular momentum
D. Electric charge
E. None of the above

11/10/14

Quiz 12 Q - 2 The weak interactions do not conserve -

A. Energy
B. Quark flavor
C. Angular momentum
D. Electric charge
E. None of the above



11/10/14

Quiz 12 Q - 3 The *amplitude* for the final state in the strong decay of the Q = +1 $\Delta(1232)$ (I = 3/2) baryon to a nucleon and a pion is -

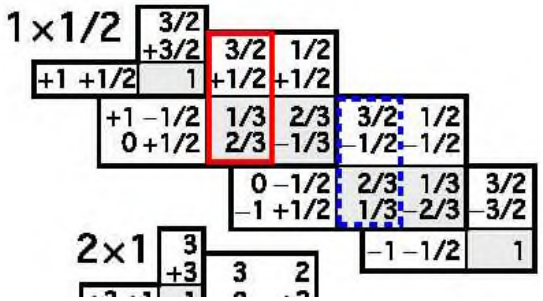
A. $\sqrt{2/3}\left|\pi^{+}n\right\rangle+\sqrt{1/3}\left|\pi^{0}p\right\rangle$

B. $(1/3)\left|\pi^{+}n\right\rangle+(2/3)\left|\pi^{0}p\right\rangle$

C. $\sqrt{2/3}\left|\pi^{+}n\right\rangle-\sqrt{1/3}\left|\pi^{0}p\right\rangle$

D. $\sqrt{1/3}\left|\pi^{+}n\right\rangle+\sqrt{2/3}\left|\pi^{0}p\right\rangle$

E. $(1/3)\left|\pi^{+}n\right\rangle-(2/3)\left|\pi^{0}p\right\rangle$



11/10/14

Quiz 12 Q - 3

The *amplitude* for the final state in the strong decay of the Q = +1 $\Delta(1232)$ (I = 3/2) baryon to a nucleon and a pion is -

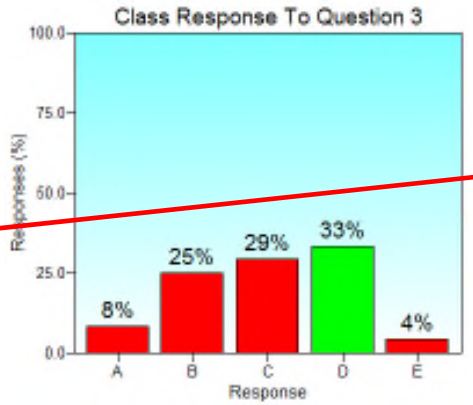
A. $\sqrt{2/3}\left|\pi^{+}n\right\rangle+\sqrt{1/3}\left|\pi^{0}p\right\rangle$

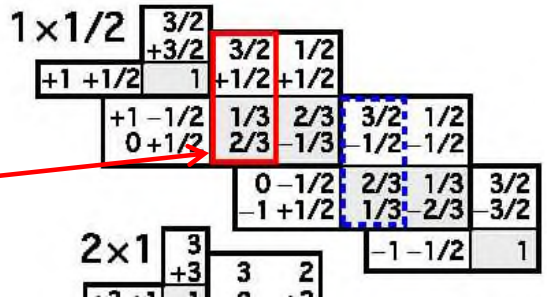
B. $(1/3)\left|\pi^{+}n\right\rangle+(2/3)\left|\pi^{0}p\right\rangle$

C. $\sqrt{2/3}\left|\pi^{+}n\right\rangle-\sqrt{1/3}\left|\pi^{0}p\right\rangle$

D. $\sqrt{1/3}\left|\pi^{+}n\right\rangle+\sqrt{2/3}\left|\pi^{0}p\right\rangle$

E. $(1/3)\left|\pi^{+}n\right\rangle-(2/3)\left|\pi^{0}p\right\rangle$





11/10/14

Quiz 12 Q - 4 The *amplitude* for the final state in the strong decay of the Q =+1 N(1440) (I = ½) excited nucleon to a nucleon and a pion is -

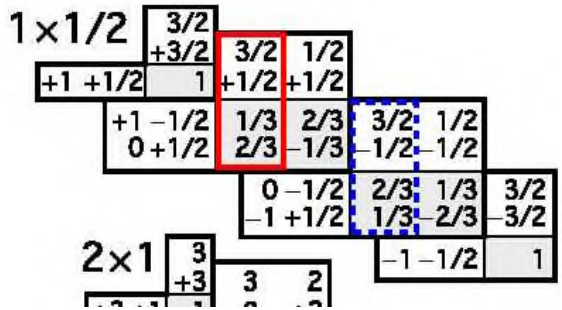
A. $\sqrt{2/3}\left|\pi^{+}n\right\rangle+\sqrt{1/3}\left|\pi^{0}p\right\rangle$

B. $(1/3)\left|\pi^{+}n\right\rangle+(2/3)\left|\pi^{0}p\right\rangle$

C. $\sqrt{2/3}\left|\pi^{+}n\right\rangle-\sqrt{1/3}\left|\pi^{0}p\right\rangle$

D. $\sqrt{1/3}\left|\pi^{+}n\right\rangle+\sqrt{2/3}\left|\pi^{0}p\right\rangle$

E. $(1/3)\left|\pi^{+}n\right\rangle-(2/3)\left|\pi^{0}p\right\rangle$



11/10/14

Quiz 12 Q - 4

The *amplitude* for the final state in the strong decay of the Q = +1 N(1440) (I = ½) excited nucleon to a nucleon and a pion is -

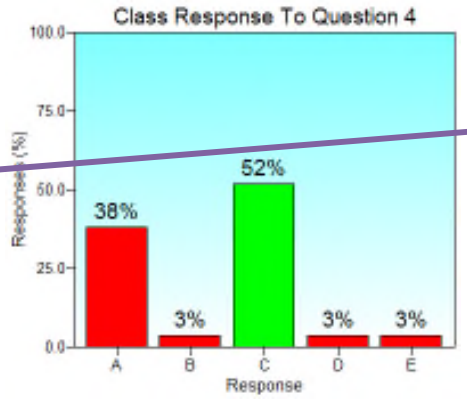
A. $\sqrt{2/3}\left|\pi^{+}n\right\rangle+\sqrt{1/3}\left|\pi^{0}p\right\rangle$

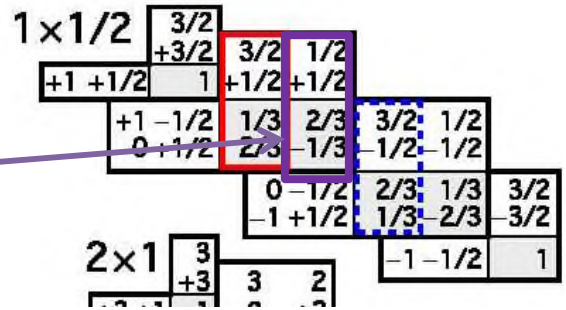
B. $(1/3)\left|\pi^{+}n\right\rangle+(2/3)\left|\pi^{0}p\right\rangle$

C. $\sqrt{2/3}\left|\pi^{+}n\right\rangle-\sqrt{1/3}\left|\pi^{0}p\right\rangle$

D. $\sqrt{1/3}\left|\pi^{+}n\right\rangle+\sqrt{2/3}\left|\pi^{0}p\right\rangle$

E. $(1/3)\left|\pi^{+}n\right\rangle-(2/3)\left|\pi^{0}p\right\rangle$





11/10/14

Quiz 13 11/14/14

Quiz 13 Q - 1 The *amplitude* for the final state in the strong decay of the Q = 0 $\Delta(1232)$ (I = 3/2) baryon to a nucleon and a pion is -

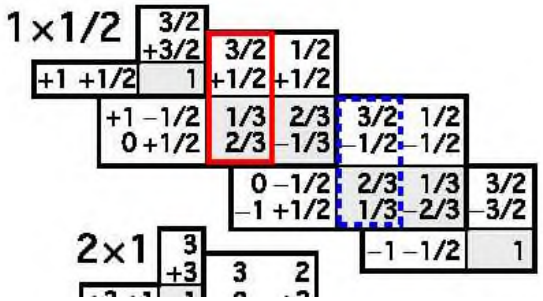
A. $\sqrt{2/3}\left|\pi^0 n\right\rangle + \sqrt{1/3}\left|\pi^- p\right\rangle$

B. $(1/3)\left|\pi^0 n\right\rangle + (2/3)\left|\pi^- p\right\rangle$

C. $\sqrt{2/3}\left|\pi^0 n\right\rangle - \sqrt{1/3}\left|\pi^- p\right\rangle$

D. $\sqrt{1/3}\left|\pi^0 n\right\rangle + \sqrt{2/3}\left|\pi^- p\right\rangle$

E. $(1/3)\left|\pi^0 n\right\rangle - (2/3)\left|\pi^- p\right\rangle$



11/14/14

Quiz 13 Q - 1

The *amplitude* for the final state in the strong decay of the Q = 0 $\Delta(1232)$ (I = 3/2) baryon to a nucleon and a pion is -

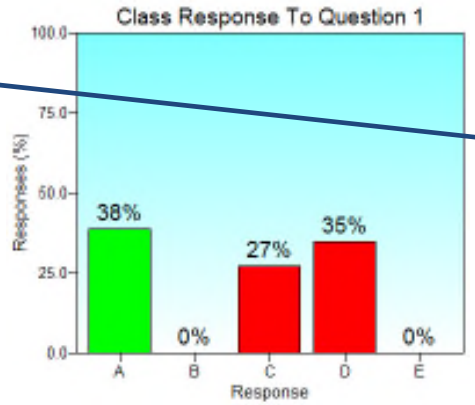
A. $\sqrt{2/3}\left|\pi^0 n\right\rangle + \sqrt{1/3}\left|\pi^- p\right\rangle$

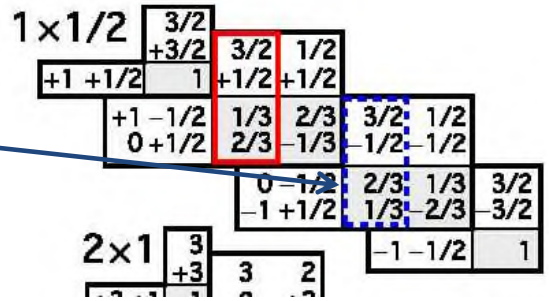
B. $(1/3)\left|\pi^0 n\right\rangle + (2/3)\left|\pi^- p\right\rangle$

C. $\sqrt{2/3}\left|\pi^0 n\right\rangle - \sqrt{1/3}\left|\pi^- p\right\rangle$

D. $\sqrt{1/3}\left|\pi^0 n\right\rangle + \sqrt{2/3}\left|\pi^- p\right\rangle$

E. $(1/3)\left|\pi^0 n\right\rangle - (2/3)\left|\pi^- p\right\rangle$





11/14/14

Quiz 13 Q - 2 The *amplitude* for the final state in the strong decay of the Q = 0 N(1440) (I = ½) excited nucleon to a nucleon and a pion is -

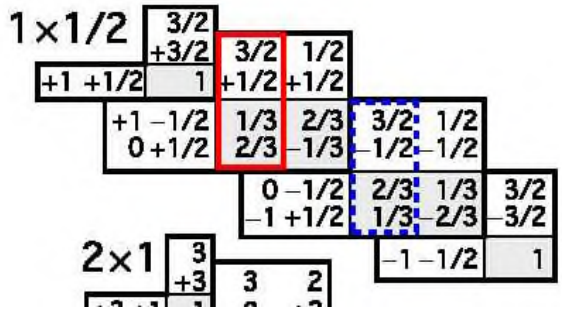
A. $\sqrt{2/3}\left|\pi^0 n\right\rangle + \sqrt{1/3}\left|\pi^- p\right\rangle$

B. $(1/3)\left|\pi^0 n\right\rangle + (2/3)\left|\pi^- p\right\rangle$

C. $\sqrt{2/3}\left|\pi^0 n\right\rangle - \sqrt{1/3}\left|\pi^- p\right\rangle$

D. $\sqrt{1/3}\left|\pi^0 n\right\rangle + \sqrt{2/3}\left|\pi^- p\right\rangle$

E. $(1/3)\left|\pi^0 n\right\rangle - (2/3)\left|\pi^- p\right\rangle$



11/14/14

Quiz 13 Q - 2

The *amplitude* for the final state in the strong decay of the Q = 0 N(1440) (I = ½) excited nucleon to a nucleon and a pion is -

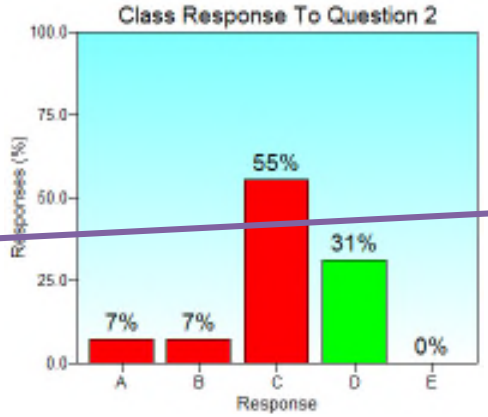
A. $\sqrt{2/3}\left|\pi^0 n\right\rangle + \sqrt{1/3}\left|\pi^- p\right\rangle$

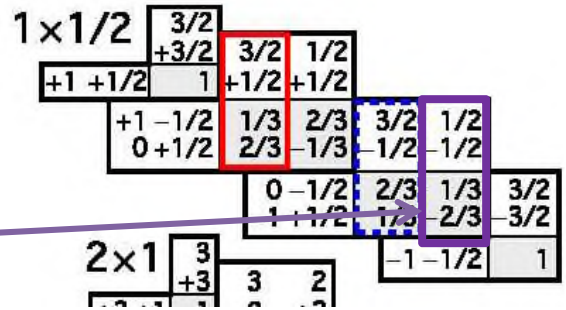
B. $(1/3)\left|\pi^0 n\right\rangle + (2/3)\left|\pi^- p\right\rangle$

C. $\sqrt{2/3}\left|\pi^0 n\right\rangle - \sqrt{1/3}\left|\pi^- p\right\rangle$

D. $\sqrt{1/3}\left|\pi^0 n\right\rangle - \sqrt{2/3}\left|\pi^- p\right\rangle$

E. $(1/3)\left|\pi^0 n\right\rangle - (2/3)\left|\pi^- p\right\rangle$





11/14/14

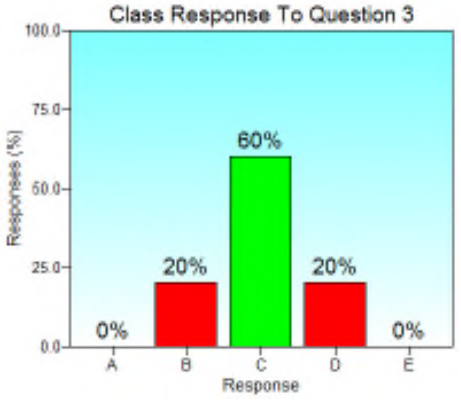
Quiz 13 Q - 3 The ρ^0 vector meson has total isospin 1 and decays via the strong interactions dominantly into how many pions -

A. 0
B. 1
C. 2
D. 3
E. 4

11/14/14

Quiz 13 Q - 3 The ρ^0 vector meson has total isospin 1 and decays via the strong interactions dominantly into how many pions -

A. 0
B. 1
C. 2 (G parity)
D. 3
E. 4



11/14/14

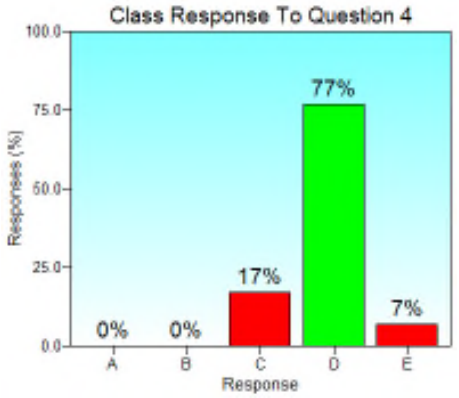
Quiz 13 Q - 4 The ω^0 vector meson has total isospin zero and decays via the strong interactions dominantly into how many pions -

A. 0
B. 1
C. 2
D. 3
E. 4

11/14/14

Quiz 13 Q - 4 The ω^0 vector meson has total isospin zero and decays via the strong interactions dominantly into how many pions -

A. 0
B. 1
C. 2
D. 3 (G parity)
E. 4



11/14/14

Quiz 14 11/17/14

Quiz 14 Q - 1 The *amplitude* for the final state in the strong decay of the Q = 0 N(1440) (I = ½) excited nucleon to a nucleon and a pion is -

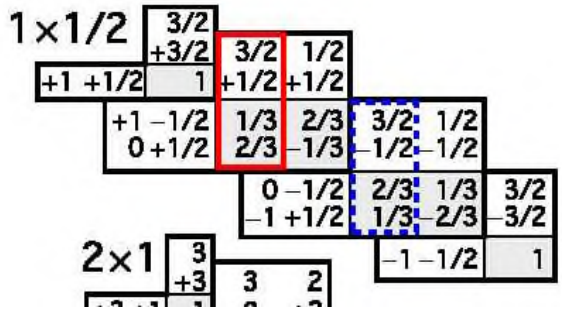
A. $\sqrt{2/3}\left|\pi^0 n\right\rangle + \sqrt{1/3}\left|\pi^- p\right\rangle$

B. $(1/3)\left|\pi^0 n\right\rangle + (2/3)\left|\pi^- p\right\rangle$

C. $\sqrt{2/3}\left|\pi^0 n\right\rangle - \sqrt{1/3}\left|\pi^- p\right\rangle$

D. $\sqrt{1/3}\left|\pi^0 n\right\rangle - \sqrt{2/3}\left|\pi^- p\right\rangle$

E. $(1/3)\left|\pi^0 n\right\rangle - (2/3)\left|\pi^- p\right\rangle$



11/17/14

Quiz 14 Q - 1

The *amplitude* for the final state in the strong decay of the Q = 0 N(1440) (I = ½) excited nucleon to a nucleon and a pion is -

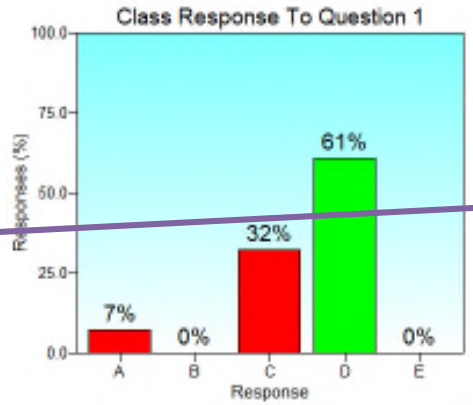
A. $\sqrt{2/3}\left|\pi^0 n\right\rangle + \sqrt{1/3}\left|\pi^- p\right\rangle$

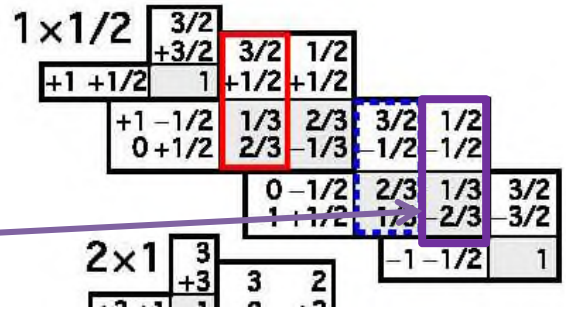
B. $(1/3)\left|\pi^0 n\right\rangle + (2/3)\left|\pi^- p\right\rangle$

C. $\sqrt{2/3}\left|\pi^0 n\right\rangle - \sqrt{1/3}\left|\pi^- p\right\rangle$

D. $\sqrt{1/3}\left|\pi^0 n\right\rangle - \sqrt{2/3}\left|\pi^- p\right\rangle$

E. $(1/3)\left|\pi^0 n\right\rangle - (2/3)\left|\pi^- p\right\rangle$





11/17/14

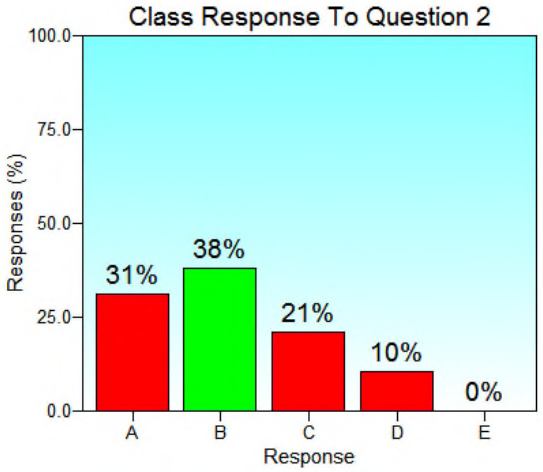
Quiz 14 Q - 2 The representation of SU(2) described by the Young diagram□□has how many elements?

A. 2
B. 3
C. 6
D. 8
E. 10

11/17/14

Quiz 14 Q - 2 The representation of SU(2) described by the Young diagram□□ has how many elements?

A. 2
B. 3 (□□ 2x3/2x1 = 3)
C. 6
D. 8
E. 10



10/17/14

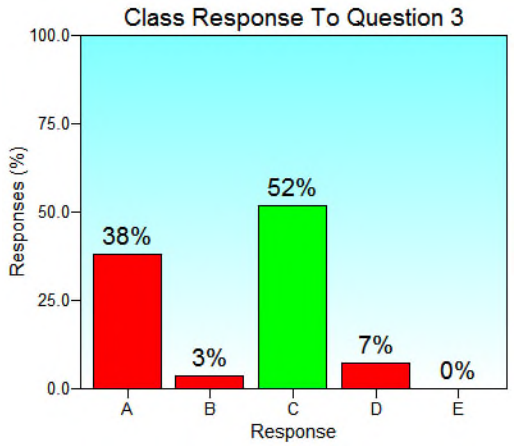
Quiz 14 Q - 3 The representation of SU(3) described by the Young diagram□□ has how many elements?

A. 2
B. 3
C. 6
D. 8
E. 10

11/17/14

Quiz 14 Q - 3 The representation of SU(3) described by the Young diagram□□ has how many elements?

A. 2
B. 3
C. 6 (□□ 3x4/2x1 = 6)
D. 8
E. 10



11/17/14

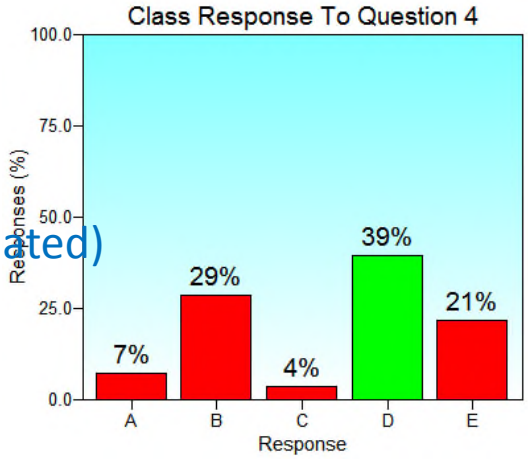
Quiz 14 Q - 4 The decay $\Sigma^+ \rightarrow \pi^+ + \pi^0$ violates which of the following?

A. Baryon number
B. Strangeness
C. Angular momentum
D. All of the above
E. None of the above

11/17/14

Quiz 14 Q - 4 The decay $\Sigma^+ \rightarrow \pi^+ + \pi^0$ violates which of the following?

A. Baryon number (baryon → mesons, violated)
B. Strangeness (strange → non-strange, violated)
C. Angular momentum (spin ½ → integer spin, violated)
D. All of the above
E. None of the above



11/17/14

Quiz 15 11/19/14

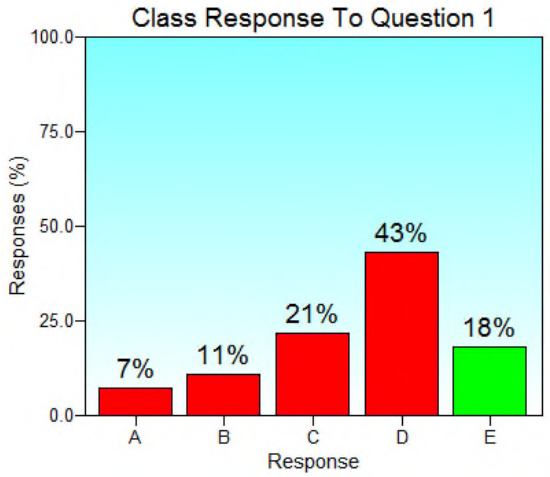
Quiz 15 Q - 1 The decay $\rho^+ \rightarrow \pi^+ + \pi^0$ violates which of the following?

A. Baryon number
B. Strangeness
C. Angular momentum
D. All of the above
E. None of the above

11/19/14

Quiz 15 Q - 1 The decay $\rho^+ \rightarrow \pi^+ + \pi^0$ violates which of the following?

A. Baryon number
B. Strangeness
C. Angular momentum
D. All of the above
E. None of the above (the dominant decay)



11/19/14

Quiz 15 Q - 2 The representation of SU(3) described by the Young diagram  has how many elements?

A. 2
B. 3
C. 6
D. 8
E. 10

11/19/14

Quiz 15 Q - 2 The representation of SU(3) described by the Young diagram $\begin{array}{|c|}\hline\ \\ \hline\ \\ \hline\end{array}$ has how many elements?

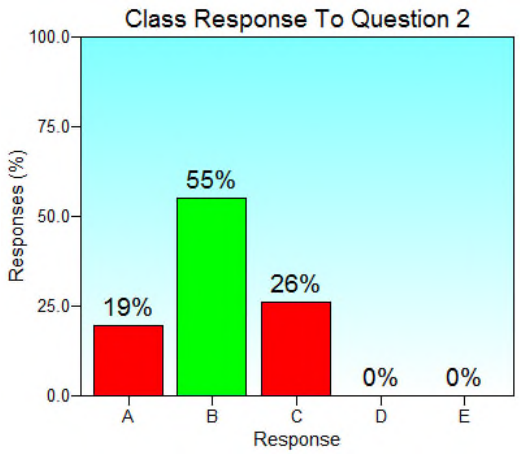
A. 2

B. 3 ($\begin{array}{|c|}\hline\ \\ \hline\ \\ \hline\end{array}$ = 3x2/2x1 = 3, the $\overline{3}$)

C. 6

D. 8

E. 10



11/19/14

Quiz 15 Q - 3 Which of the following decays conserve isospin?

A. $\Sigma^+ \rightarrow p\ \pi^0$
B. $\rho^+ \rightarrow \pi^+\ \pi^0$
C. $\Lambda \rightarrow p\ \ \pi^-$
D. None of the above
E. All of the above.

11/19/14

Quiz 15 Q - 3 Which of the following decays conserve isospin?

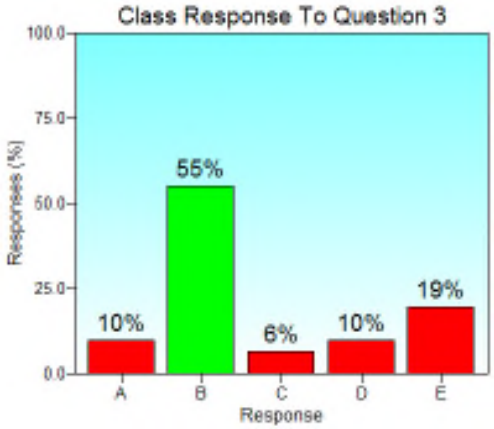
A. $\Sigma^+ \rightarrow p\ \pi^0$ (I = 1 goes to (I=1/2) + (I = 1), no, weak decay)

B. $\rho^+ \rightarrow \pi^+\ \pi^0$ (yes, strong decay)

C. $\Lambda \rightarrow p\ \pi^-$ (I = 0 goes to (I=1/2) + (I = 1), no, weak decay)

D. None of the above

E. All of the above.



11/19/14

Quiz 15 Q - 4 Which of the following are acceptable eigenvalues of the charge conjugation operator *C*, for self-conjugate states?

A. ± 1
B. $\pm i$
C. $\pm 1, \pm i$
D. $\pm 1/2$
E. ± 0

11/19/14

Quiz 15 Q - 4 Which of the following are acceptable eigenvalues of the charge conjugation operator C, for self-conjugate states?

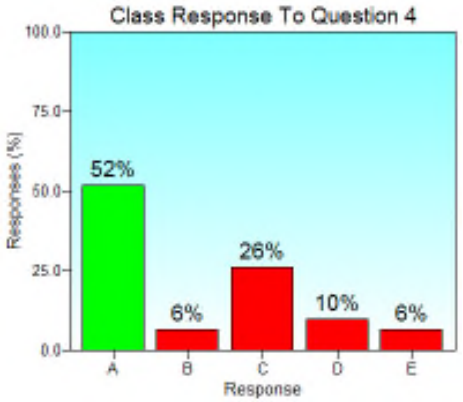
A. ± 1 (C^2 must be the unit operator)

B. $\pm i$

C. $\pm 1, \pm i$

D. $\pm 1/2$

E. ± 0



11/19/14

Quiz 16 11/24/14

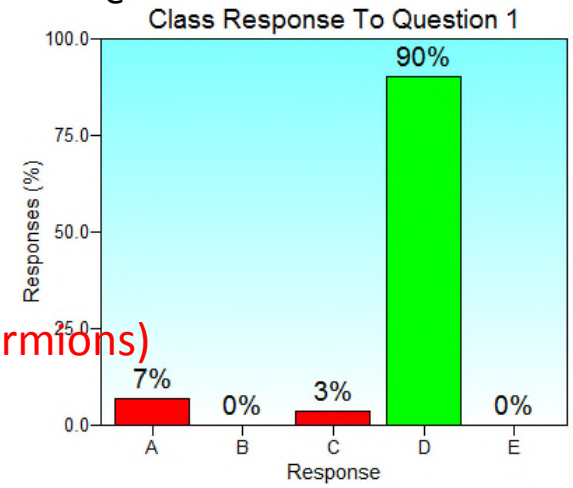
Quiz 16 Q - 1 The decay $\pi^0 \rightarrow \mu^+ + e^- + \nu_e$ violates which of the following?

A. Lepton number
B. Isospin
C. Angular momentum
D. All of the above
E. None of the above

11/24/14

Quiz 16 Q - 1 The decay $\pi^0 \rightarrow \mu^+ + e^- + \nu_e$ violates which of the following?

A. Lepton number
B. Isospin
C. Angular momentum
D. All of the above ($\Delta L = 1$, $\Delta I = -1$, boson $\rightarrow$3 fermions)
E. None of the above



11/24/14

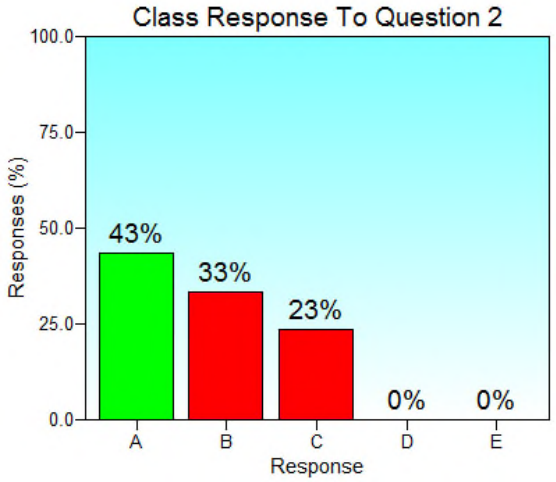
Quiz 16 Q - 2 The representation of SU(2) described by the Young diagram  has how many elements?

A. 1
B. 2
C. 3
D. 4
E. 5

11/24/14

Quiz 16 Q - 2 The representation of SU(2) described by the Young diagram $\square\!\square$ has how many elements?

A. 1 ($\square\!\square$ 2x1/2x1 = 1, the singlet)
B. 2
C. 3
D. 4
E. 5



11/24/14

Quiz 16 Q - 3 Which of the following decays conserve(s) isospin?

A. $\Sigma^- \rightarrow n\ \pi^-$
B. $\rho^- \rightarrow \pi^-\ \pi^0$
C. $\Lambda \rightarrow n\ \pi^0$
D. None of the above
E. All of the above.

11/24/14

Quiz 16 Q - 3 Which of the following decays conserve(s) isospin?

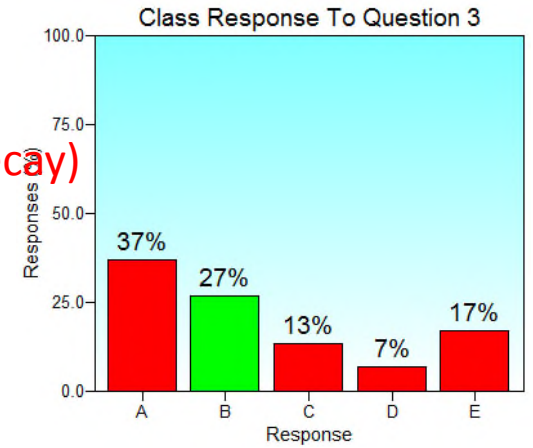
A. $\Sigma^- \rightarrow n\,\pi^-$ ($I = 1 \not\Rightarrow I = 1/2 \otimes I = 1$)

B. $\rho^- \rightarrow \pi^-\,\pi^0$ ($I = 1 \Rightarrow I = 1 \otimes I = 1$, yes, a strong decay)

C. $\Lambda \rightarrow n\,\pi^0$ ($I = 0 \not\Rightarrow I = 1/2 \otimes I = 1$)

D. None of the above

E. All of the above.



11/24/14

Quiz 16 Q - 4 Which of the following are acceptable eigenvalues of the parity operator *P*, i.e., for the intrinsic parity?

A. ± 1
B. $\pm i$
C. $\pm 1, \pm i$
D. $\pm 1/2$
E. ± 0

11/24/14

Quiz 16 Q - 4 Which of the following are acceptable eigenvalues of the parity operator *P*, i.e., for the intrinsic parity?

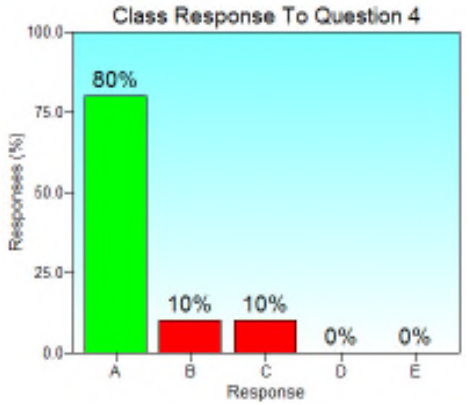
A. ± 1 (P^2 must be the unit operator)

B. $\pm i$

C. $\pm 1, \pm i$

D. $\pm 1/2$

E. ± 0



11/24/14

Quiz 17 11/26/14

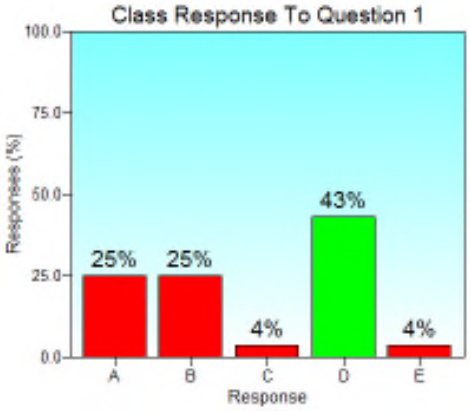
Quiz 17 Q - 1 The decay Ξ^- ($½^+$) $\rightarrow \Lambda$ ($½^+$) + π^- (0^-) violates strangeness. Which values of final state orbital angular momentum are allowed? [($½^+$) = (J^P)]

A. 0
B. 1
C. 2
D. 0 and 1
E. 0 and 2

11/26/14

Quiz 17 Q - 1 The decay $\Xi^- (½^+) \rightarrow \Lambda (½^+) + \pi^- (0^-)$ violates strangeness. Which values of final state orbital angular momentum are allowed? [$(½^+) = (J^P)$]

A. 0 (Can conserve J, but not P)
B. 1 (Can conserve J and P)
C. 2 (Cannot conserve J)
D. 0 and 1 (Since weak decay, Parity can be violated)
E. 0 and 2



11/26/14

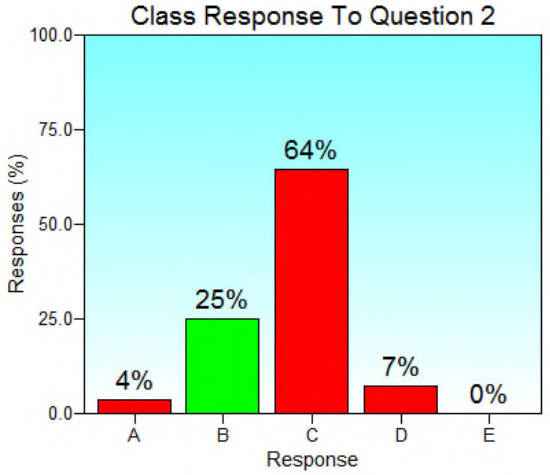
Quiz 17 Q - 2 The representation of SU(2) described by the Young diagram  has how many elements?

A. 1
B. 2
C. 3
D. 4
E. 5

11/26/14

Quiz 17 Q - 2 The representation of SU(2) described by the Young diagram  has how many elements?

A. 1
B. 2 ( 2x3x1/3x1x1 = 2, corresponding to the spin ½ baryons)
C. 3
D. 4
E. 5



11/26/14

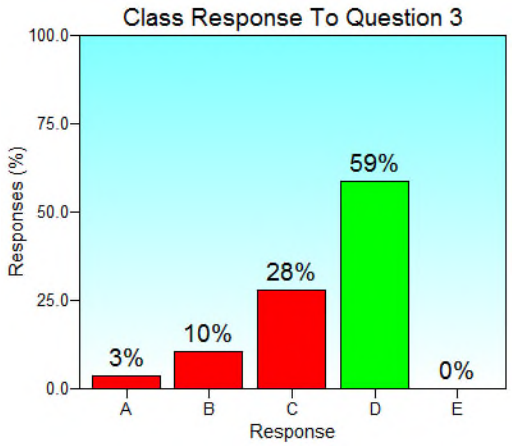
Quiz 17 Q - 3 The representation of SU(3) described by the Young diagram  has how many elements?

A. 1
B. 3
C. 6
D. 8
E. 10

11/26/14

Quiz 17 Q - 3 The representation of SU(3) described by the Young diagram  has how many elements?

A. 1
B. 3
C. 6
D. 8 ( 3x4x2/3x1x1 = 8, corresponding to the 8 of spin ½ baryons)
E. 10



11/26/14

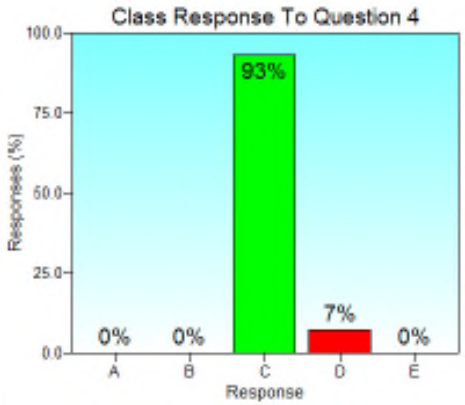
Quiz 17 Q - 4 Consider combining a spin 1 particle and a spin ½ particle with NO orbital angular momentum. The resulting state has what possible spin?

A. 1 or 1/2
B. 2 or 0
C. 3/2 or 1/2
D. Only 3/2
E. Only 0

11/26/14

Quiz 17 Q - 4 Consider combining a spin 1 particle and a spin ½ particle with NO orbital angular momentum. The resulting state has what possible spin?

A. 1 or 1/2
B. 2 or 0
C. 3/2 or ½ ($\square\square \otimes \square = \square\square\square \oplus \begin{smallmatrix}\square\square\\\square\end{smallmatrix}$)
D. Only 3/2
E. Only 0



11/26/14

Quiz 18 12/1/14

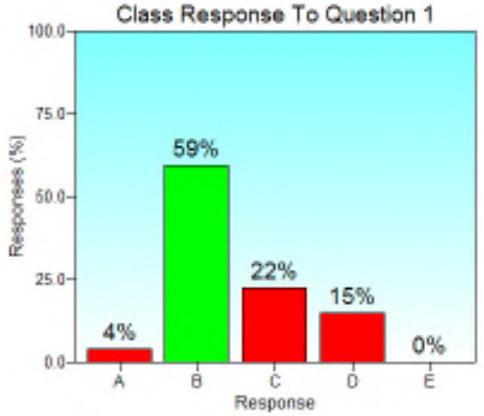
Quiz 18 Q - 1 Consider combining an isospin 1 particle with an isospin 1 particle. The resulting state has what possible isospin?

A. 2 or 1
B. 2 or 1 or 0
C. 1 or 0
D. Only 2
E. Only 0

12/1/14

Quiz 18 Q - 1 Consider combining an isospin 1 particle with an isospin 1 particle. The resulting state has what possible isospin?

A. 2 or 1
B. 2 or 1 or 0 (like adding angular momentum)
C. 1 or 0
D. Only 2
E. Only 0



12/1/14

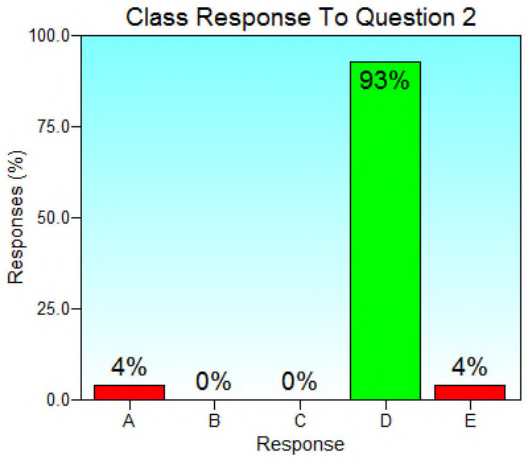
Quiz 18 Q - 2 The decay $\Sigma^+ \rightarrow \pi^+ + \pi^0$ violates which of the following?

A. Baryon number
B. Strangeness
C. Angular momentum
D. All of the above
E. None of the above

12/1/14

Quiz 18 Q - 2 The decay $\Sigma^+ \rightarrow \pi^+ + \pi^0$ violates which of the following?

A. Baryon number (changes by 1)
B. Strangeness (changes by 1)
C. Angular momentum (half-integer baryon cannot go to 2 integer-spin mesons)
D. All of the above
E. None of the above



12/1/14

Quiz 18 Q - 3 Which of the following decays are forbidden by *C*-invariance?

A. $\omega^0 \rightarrow \pi^0 \gamma$
B. $\pi^0 \rightarrow \gamma \gamma$
C. $\rho^0 \rightarrow \gamma \gamma$
D. All of the above
E. None of the above

12/1/14

Quiz 18 Q - 3 Which of the following decays are forbidden by *C*-invariance?

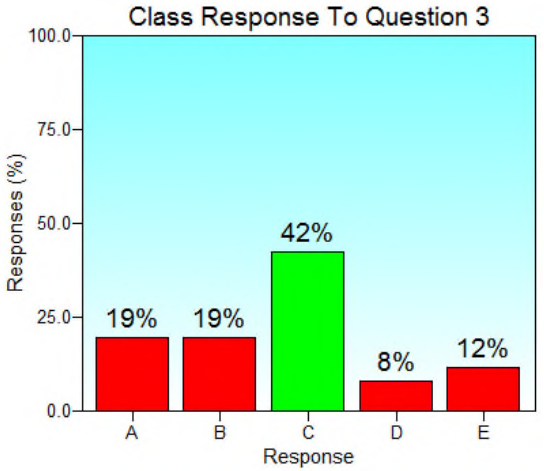
A. $\omega^0 \rightarrow \pi^0 \gamma$ ((-) = (+)(-))

B. $\pi^0 \rightarrow \gamma \gamma$ ((+) = (-)(-))

C. $\rho^0 \rightarrow \gamma \gamma$ ((-) $\neq$ (-)(-))

D. All of the above

E. None of the above



12/1/14

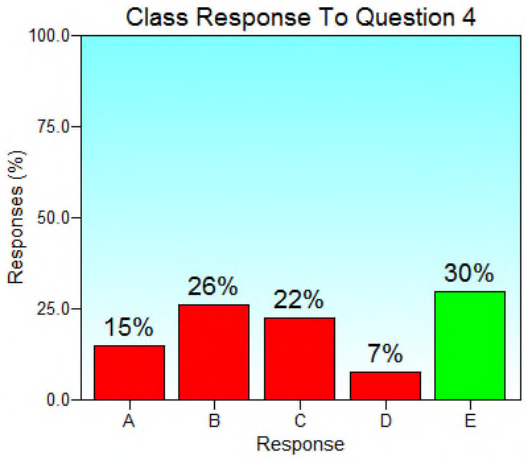
Quiz 18 Q - 4 Which of the following decays could occur via the strong interactions?

A. $\pi^+ \rightarrow \mu^+ \nu_\mu$
B. $\pi^0 \rightarrow \gamma \gamma$
C. $K^0 \rightarrow \pi^+ \pi^-$
D. All of the above
E. None of the above

12/1/14

Quiz 18 Q - 4 Which of the following decays could occur via the strong interactions?

A. $\pi^+ \rightarrow \mu^+ \nu_\mu$ (weak decay, ν in final state)
B. $\pi^0 \rightarrow \gamma\ \gamma$ (EM decay, γ's in final state)
C. $K^0 \rightarrow \pi^+ \pi^-$ (weak decay, violates strangeness)
D. All of the above
E. None of the above



12/1/14

Quiz 19 12/3/14

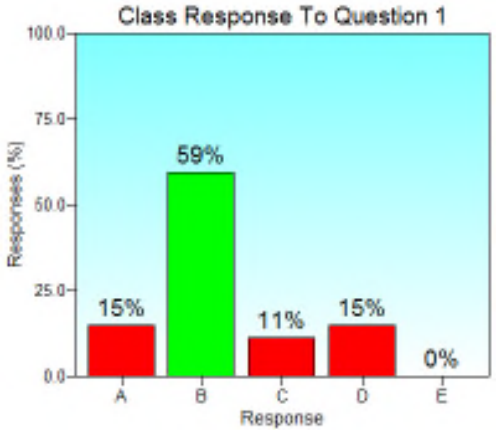
Quiz 19 Q - 1 What is the (total) isospin and quark content of the K^+ meson?

A. 1 and $u\bar{s}$
B. ½ and $u\bar{s}$
C. ½ and $s\bar{u}$
D. 1 and $s\bar{u}$
E. 1 and $d\bar{u}$

12/3/14

Quiz 19 Q - 1 What is the (total) isospin and quark content of the K^+ meson?

A. 1 and $u\bar{s}$ (wrong isospin, just isospin of *u*)
B. ½ and $u\bar{s}$ (yes)
C. ½ and $s\bar{u}$ (wrong electric charge)
D. 1 and $s\bar{u}$ (wrong isospin)
E. 1 and $d\bar{u}$ (wrong strangeness)



12/3/14

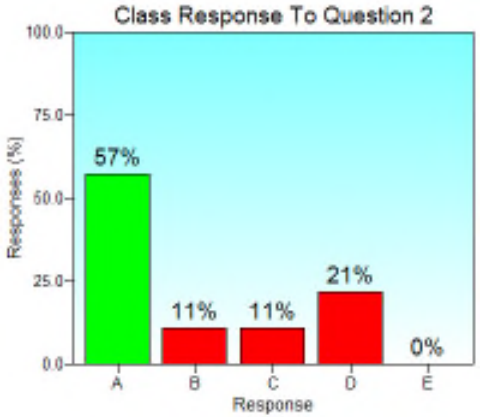
Quiz 19 Q - 2 What is the (total) isospin and quark content of the $\bar{\Sigma}^0$ baryon?

A. 1 and $\bar{u}\bar{d}\bar{s}$
B. ½ and $\bar{u}\bar{d}\bar{s}$
C. ½ and sud
D. 1 and sud
E. 1 and ddu

12/3/14

Quiz 19 Q - 2 What is the (total) isospin and quark content of the $\bar{\Sigma}^0$ baryon?

A. 1 and $\bar{u}\bar{d}\bar{s}$ (isospin of anti-ud pair)
B. ½ and $\bar{u}\bar{d}\bar{s}$ (wrong isospin)
C. ½ and sud (wrong baryon number and isospin)
D. 1 and sud (wrong baryon number)
E. 1 and ddu (wrong baryon number, isospin and strangeness)



12/3/14

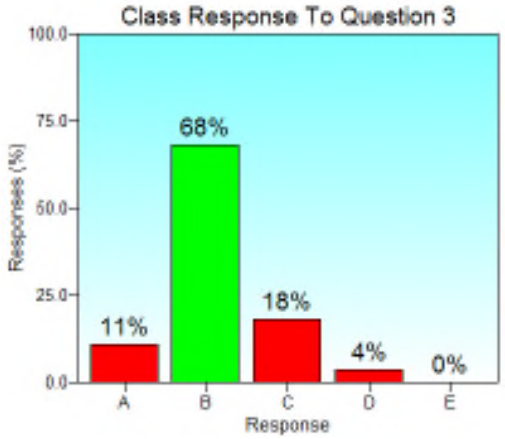
Quiz 19 Q - 3 The decay $K^+ \rightarrow \pi^+ \pi^0$ occurs via what interaction?

A. Strong
B. Weak
C. EM
D. It does not occur.
E. All 3.

12/3/14

Quiz 19 Q - 3 The decay $K^+ \rightarrow \pi^+ \pi^0$ occurs via what interaction?

A. Strong (no, since violates strangeness)
B. Weak (violates strangeness, isospin and parity [L = 0], 21% branching ratio)
C. EM (no, since violates strangeness)
D. It does not occur.
E. All 3.



12/3/14

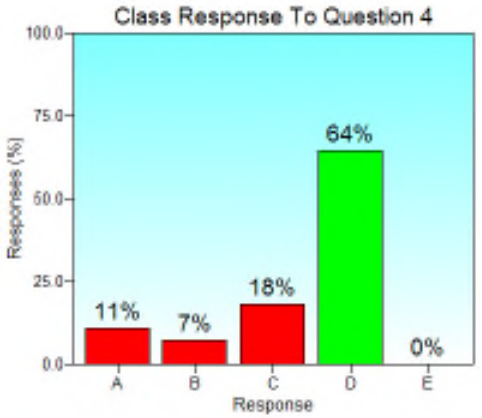
Quiz 19 Q - 4 The decay $\pi^0 \rightarrow \mu^+ e^- \nu_e$ occurs via what interaction?

A. Strong
B. Weak
C. EM
D. It does not occur.
E. All 3.

12/3/14

Quiz 19 Q - 4 The decay $\pi^0 \rightarrow \mu^+ e^- \nu_e$ occurs via what interaction?

A. Strong
B. Weak
C. EM
D. It does not occur. (Violates angular momentum, lepton number and isospin)
E. All 3.



12/3/14

Quiz 20 12/5/14

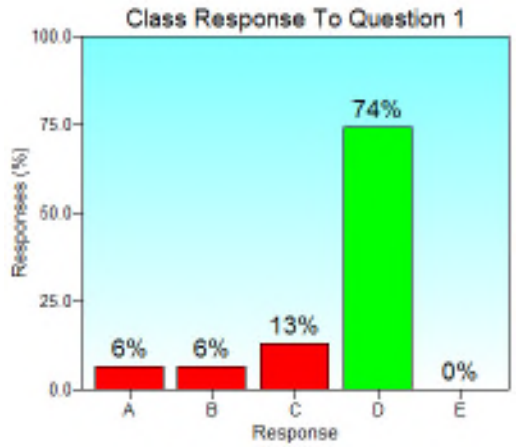
Quiz 20 Q - 1 Which of the following are continuous symmetries and the corresponding conserved quantities?

A. Translation in time and energy
B. Translation in space and linear momentum
C. Rotations and total angular momentum
D. All of the above
E. None of the above

12/5/14

Quiz 20 Q - 1 Which of the following are continuous symmetries and the corresponding conserved quantities?

A. Translation in time and energy
B. Translation in space and linear momentum
C. Rotations and total angular momentum
D. All of the above
E. None of the above



12/5/14

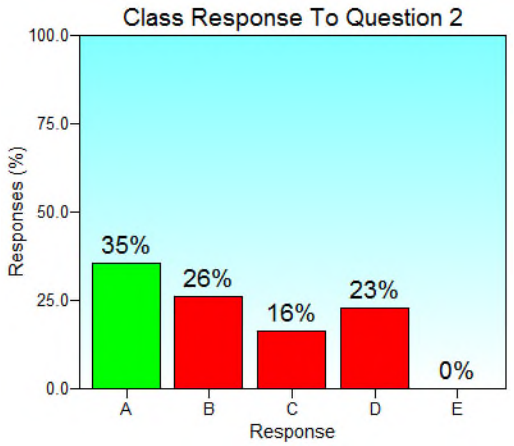
Quiz 20 Q - 2 The conservation of electric charge arises from what sort of continuous symmetry (i.e., what group)?

A. U(1)
B. SU(2)
C. SU(3)
D. All of the above
E. None of the above

12/5/14

Quiz 20 Q - 2 The conservation of electric charge arises from what sort of continuous symmetry (i.e., what group)?

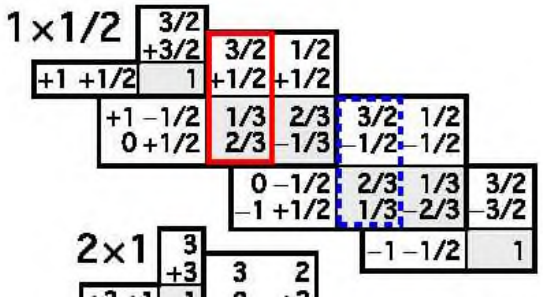
A. U(1) (also true for lepton number a nd baryon number)
B. SU(2)
C. SU(3)
D. All of the above
E. None of the above



12/5/14

Quiz 20 Q - 3 For the strong decay of the Q = 0 $\Delta(1232)$ (I = 3/2) baryon to a nucleon and a pion, the ratio $\Gamma(\Delta^0 \rightarrow p\ \pi^-)/\Gamma(\Delta^0 \rightarrow n\ \pi^0)$ is -

A. 2
B. 3
C. 1/2
D. 1/3
E. $1/\sqrt{2}$



12/5/14

Quiz 20 Q - 3 For the strong decay of the Q = 0 $\Delta(1232)$ (I = 3/2) baryon to a nucleon and a pion, the ratio $\Gamma(\Delta^0 \to p\,\pi^-)/\Gamma(\Delta^0 \to n\,\pi^0)$ is -

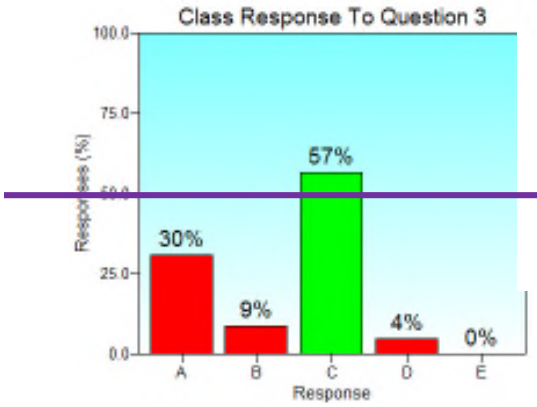
A. 2

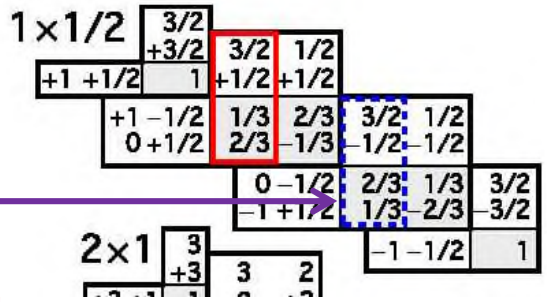
B. 3

C. 1/2 $(\Gamma(\Delta^0 \to p\,\pi^-)/\Gamma(\Delta^0 \to n\,\pi^0)$
$= (1/\sqrt{3})^2/(\sqrt{2}/\sqrt{3})^2)$

D. 1/3

E. $1/\sqrt{2}$

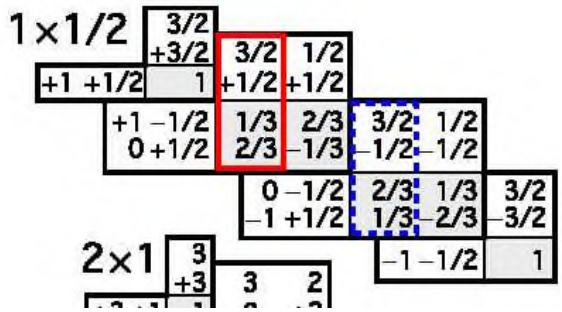




12/5/14

Quiz 20 Q - 4 For the strong decay of the Q = 0 N(1440) (I = ½) excited nucleon to a nucleon and a pion, the ratio $\Gamma(N^* \rightarrow p\ \pi^-)/\Gamma(N^* \rightarrow n\ \pi^0)$ is -

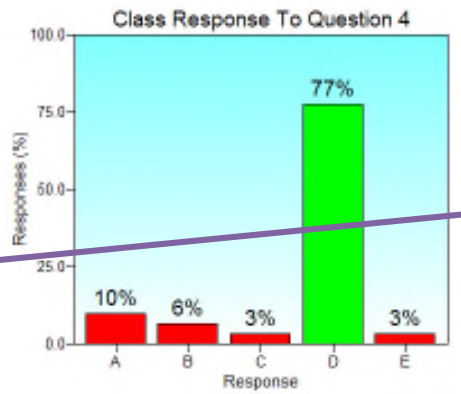
A. 1/2
B. 1/4
C. 4
D. 2
E. $\sqrt{2}$

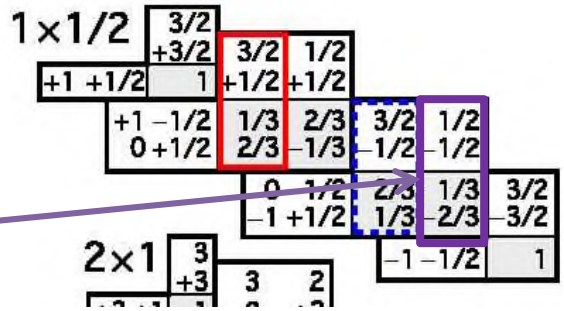


12/5/14

Quiz 20 Q - 4 For the strong decay of the Q = 0 N*(1440) (I = ½) excited nucleon to a nucleon and a pion, the ratio $\Gamma(N^* \rightarrow p\,\pi^-)/\Gamma(N^* \rightarrow n\,\pi^0)$ is -

A. 1/2
B. 1/4
C. 4
D. 2 $(\Gamma(N^* \rightarrow p\,\pi^-)/\Gamma(N^* \rightarrow n\,\pi^0)$
$= (-\sqrt{2}/\sqrt{3})^2/(1/\sqrt{3})^2)$
E. $\sqrt{2}$





11/17/14