

Physics 107: Ideas of Modern Physics

Practice Final Exam

Name _____

ID # _____

Section # _____

On the Scantron sheet,

- 1) Fill in your name
- 2) Fill in your student ID # (not your social security #)
- 3) Fill in your section # (under ABC of special codes)

Fundamental constants:

$c = \text{speed of light} = 3 \times 10^8 \text{ m/s}$

$g = \text{accel. of gravity} = 10 \text{ m/s}^2$

$1 \text{ eV} = 1.6 \times 10^{-19} \text{ J}$, $1 \text{ nm} = 10^{-9} \text{ m}$

$hc = (\text{Planck's const}) \times (\text{light speed}) = 1240 \text{ eV-nm}$

sound speed in air = 340 m/s

deBroglie wavelength = $(\text{Planck's const.}) / (\text{momentum}) = h / p$

1. Points in space where a particle's quantum wavefunction is zero arise from
 - a. a breakdown in the quantum-mechanical description.
 - b. extra dimensions
 - c. quark confinement
 - d. a breakdown in the mass-energy equivalence
 - e. interference of the wavefunction with itself

2. A proton is a composite particle consisting of up (u, charge $+2/3$) and down (d, charge $-1/3$) quarks. What is a possible internal configuration for a proton?
 - a. uuu
 - b. uud
 - c. udd
 - d. ddd
 - e. Need to use antiquarks

3. Neutrinos interact only via
 - a. the weak force
 - b. the electromagnetic force
 - c. the color force
 - d. the gravitational force
 - e. All of the above.

4. The strong force has a very different nature compared to the other forces, for instance it's large interaction strength, because:
 - a. The gluon can interact with other gluons.
 - b. The strong force only interacts with quarks.
 - c. The strong force only interacts with electrically charged particles.
 - d. The reason is not understood.
 - e. none of these.

5. Investigating quantum field theories led to what surprising conclusion.
 - a. Particles always act as if they are absolutely point like with no spatial extent.
 - b. Antimatter particles exist.
 - c. Every particle has three different types with different masses.
 - d. All of the above.
 - e. None of the above.

6. In string theory, different fundamental particles appear as
- different quantum vibrations of strings.
 - different quantum interactions between strings.
 - quantum strings with different spin.
 - quantum strings of different length.
 - quantum strings of different velocity.
7. We said in class that the modern view of particle physics is built on the concept of 'fields'. Which of the following particles is not an excitation of a field
- photon
 - electron
 - Z
 - gluon
 - all of them are an excitation