PARTICLE PHYSICS QUIZ

1. Which sentence best describes the known dimensions of physics?
a) There are two known dimensions: matter and antimatter
b) We live in a multi-dimensional universe with infinite dimensions
c) There are four known dimensions: length, height, width and weight
d) There are four known dimensions: Length, height, width and time

2. Our universe is dominated by…
a) Ordinary matter
b) Dark matter
c) Dark energy
d) Equal amounts of all three

3. Fundamental or elementary particles are particles that aren't made up of smaller particles. What is the most common type of fundamental particle in the universe?
a) Atom
b) Meson
c) Neutrino
d) Quark

4. What are the fundamental particles of an atom?
a) Quarks, gluons and electrons
b) Protons, neutrons and electrons
c) The nucleus and electron orbits
d) An atom cannot be broken down into anything smaller than itself

5. What are fermions?
a) Elements with ferrous metallic properties
b) Fundamental particles of matter
c) Hard subatomic solids
d) Groups of particles with the same charge or mass

6. What are bosons?
a) Elementary crew members on merchant vessels
b) A term in particle physics used to describe matter
c) Subatomic particles that carry forces
d) An electron switch used in nano-circuits

7. What are mesons?
a) A type of composite particle produced by high energy
b) A contagious disease caught by subatomic particles
c) An antimatter version of the electron
d) A type of Japanese soup

8. Which of the following sentences about antimatter is NOT true:

a) Antimatter is normal matter with an opposite charge

b) Antimatter is only produced in particle accelerators
c) Antimatter annihilates matter
d) Equal amounts of antimatter and matter were created during the Big Bang

9. What is super string?
a) Coloured material which can be sprayed out of cans and provide hours of fun for all ages
b) A time line in physics and chemical reactions needed for an effect to take place
c) Forces needed to hold atoms together
d) A hypothesis which attempts to explain the elementary particles of nature

ANSWERS

1. Answer: d) There are four known dimensions: Length, height, width and time
There are three spatial dimensions of length, height and width, plus one temporal dimension of time. Some theoretical physicists and cosmologists have proposed the existence of additional hidden dimensions to explain hypothesis such as super string theory, but no experimental evidence to date has found any hidden dimensions.

2. Answer: c) Dark energy
Less than 5 per cent of the universe is made up of ordinary matter that makes stars, planets, comets, asteroids, houses, trees, cars and people etc. Amazingly 25 per cent of the cosmos is composed of a mysterious material scientists don't fully understand and have named dark matter. They know it's there and they know it has gravity because it stops galaxies flying apart through centrifugal force as they spin. Even more mysterious is a strange force called dark energy that accounts for 70 per cent of the universe. It's a repulsive force that opposes gravity and causes the expansion of the universe to accelerate.

3. Answer: c) Neutrino
While a quark is a fundamental particle, it's not as common as the neutrino. Trillions of neutrinos are produced every second in nuclear reactions at the centre of stars and in supernova explosions when stars die. Millions of them are passing through your body right now, but they're so weakly interactive, you don't notice them.

Neither atoms nor mesons are fundamental particles because they are made up of other particles.

4. Answer: a) Quarks, gluons and electrons
Atoms are made up of fundamental particles called quarks, gluons and electrons. Quarks and gluons make up protons and neutrons, which found in the nucleus of an atom. Each proton and neutron consists of three quarks held together by gluons, which transmit the strong nuclear force (one of the four fundamental forces of nature). Electrons, which orbit around the nucleus, are the third type of fundamental particle in an atom.

5. Answer: b) Fundamental particles of matter
Fermions are fundamental particles of matter such as quarks, electrons and neutrinos. There are 24 known fermions: six quarks — up, down, charm, strange, top and bottom; six leptons — electron, electron neutrino, muon, muon neutrino, tau and tau neutrino; and 12 antimatter counterparts.

6. Answer: c) Subatomic particles that carry forces

Bosons are subatomic particles that carry or mediate force. There are six elementary bosons:

Gluons, which carry the strong nuclear force that binds protons and neutrons and holds atoms together;
W and Z bosons, which mediate the weak nuclear force that is responsible for radioactive decay and initiates hydrogen fusion in stars making them shine;
Photons, which carry the electromagnetic force which generates electric and magnetic fields;
The graviton — the theoretical but yet to be discovered force carrier for gravity;
And the yet to be found Higgs particle which should give all other particles mass.

7. Answer: a) A type of composite particle produced by high energy

Mesons are a type of composite particle called a hadron, which is composed of a quark and an anti-quark bound by a gluon. They only exist for very short periods of time and are produced through very high energy interactions such as those caused by cosmic rays or in particle accelerators.

The other type of hadron is a baryon.

8. Answer: b) Antimatter is only produced in particle accelerators

Antimatter is produced synthetically in particles accelerators for experiments. But it's also produced naturally through the radioactive decay of potassium 40, cosmic ray interactions in the atmosphere and thunderstorms. It's also been detected in the Earth's Van Allen radiation belts.

Antimatter is normal matter but with an opposite charge. For example, the antimatter particle of an electron, which has a negative charge, is the positron, which has a positive charge.

Because matter and antimatter annihilate each other when they come into contact, one of the great mysteries of physics is why we live in a universe dominated by matter rather than antimatter. Equal amounts of matter and antimatter would have been created in the big bang 13.7 billion years ago so they should have annihilated each other, yet here we are!

9. Answer: d) A hypothesis which attempts to explain the elementary particles of nature

Super string (or string theory) is a hypothesis that attempts to explain the subatomic world at the smallest scale. According to this idea, the most elementary particles in nature are strings of pure vibrating energy. If they vibrate at one frequency, they're an electron, if they vibrate at another they're a quark and so on. Super strings are Planck length — the smallest size that can exist, which is 10-33 centimetres, or about a millionth of a billionth of a billionth of a billionth of a centimetre.