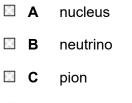# Particle Physics and The Standard Model (MCQ Only)

**Q1.**

Which of the following particles is an example of a fundamental particle?

☒ **A** nucleus

☒ **B** neutrino

☒ **C** pion

☒ **D** proton

**(Total for question = 1 mark)**

**Q2.**

A particle has a mass of 1 u and a charge of −1.6 × 10⁻¹⁹ C.

Which of the following could be the particle?

☒ **A** antiproton

☒ **B** electron

☒ **C** neutron

☒ **D** positron

**(Total for question = 1 mark)**

**Q3.**

A proton has a mass of 1.67 × 10⁻²⁷ kg.

Which of the following shows the conversion of this mass to GeV/c² ?

☒ **A** $\dfrac{1.67 \times 10^{-27} \times 1.60 \times 10^{-10}}{(3.00 \times 10^{8})^{2}}$

☒ **B** $\dfrac{1.67 \times 10^{-27} \times 1.60 \times 10^{-19}}{(3.00 \times 10^{8})^{2}}$

☒ **C** $\dfrac{1.67 \times 10^{-27} \times (3.00 \times 10^{8})^{2}}{1.60 \times 10^{-10}}$

☒ **D** $\dfrac{1.67 \times 10^{-27}}{1.60 \times 10^{-10} \times (3.00 \times 10^{8})^{2}}$

**(Total for question = 1 mark)**

**Q4.**

Which of the following particle equations is correct for the decay of a proton within a nucleus?

☒ **A** p → n + β⁺

☒ **B** p → p + β⁺

☒ **C** p → n + β⁺ + *v*

☒ **D** p → p + β⁺ + *v*

**(Total for question = 1 mark)**

**Q5.**

A high-energy proton can interact with a photon to produce two particles.

Which of the following could be the two particles produced?

☒ **A** $n + \pi^{0}$

☒ **B** $n + \pi^{+}$

☒ **C** $\pi^{0} + \pi^{+}$

☒ **D** $\pi^{-} + \pi^{+}$

**(Total for question = 1 mark)**

**Q6.**

Which row of the table summarises the mass and charge of an antineutron?

| | | Mass / u | Charge / e |
|---|---|---|---|
| ☒ | A | 0 | 0 |
| ☒ | B | 0 | −1 |
| ☒ | C | 1 | 0 |
| ☒ | D | 1 | +1 |

**(Total for question = 1 mark)**

**Q7.**

The π⁻ particle has a mass of 140 MeV / c².

Which row of the table is correct for the antiparticle of a π⁻ ?

| | | Particle classification | Mass/MeV/c² |
|---|---|---|---|
| ☒ | A | Baryon | +140 |
| ☒ | B | Baryon | −140 |
| ☒ | C | Meson | +140 |
| ☒ | D | Meson | −140 |

**(Total for question = 1 mark)**

**Q8.**

Which of these is **not** made from quarks?

☒ **A**    proton

☒ **B**    neutron

☒ **C**    lepton

☒ **D**    meson

**(Total for question = 1 mark)**

# Mark Scheme - Particle Physics and The Standard Model (MCQ Only)

**Q1.**

| Question Number | Acceptable answers | Additional guidance | Mark |
|---|---|---|---|
| | B | | 1 |

**Q2.**

| Question Number | Acceptable answers | Additional guidance | Mark |
|---|---|---|---|
| | **The only correct answer is A** <br> *B is not correct because an electron has a much smaller mass* <br> *C is not correct because a neutron has no charge* <br> *D is not correct because a positron has a much smaller mass and is positive* | | 1 |

**Q3.**

| Question Number | Acceptable answers | Additional guidance | Mark |
|---|---|---|---|
| | **The only correct answer is C** <br><br> $$\dfrac{1.67 \times 10^{-27} \times (3.00 \times 10^8)^2}{1.60 \times 10^{-10}}$$ | A,B and D all contain numerical errors | 1 |

**Q4.**

| Question Number | Acceptable answers | Additional guidance | Mark |
|---|---|---|---|
| | **The only correct answer is C** <br><br> *A is not correct because lepton number is not conserved* <br> *B is not correct because charge conservation is not obeyed* <br> *D is not correct because charge conservation is not obeyed* | $p \rightarrow n + \beta^+ + \nu$ | 1 |

**Q5.**

| Question Number | Acceptable answers | Additional guidance | Mark |
|---|---|---|---|
| | The only correct answer is B<br><br>$n + \pi^+$ | A, C and D do not follow conservation laws | 1 |

**Q6.**

| Question Number | Acceptable answers | Additional guidance | Mark |
|---|---|---|---|
| | The only correct answer is C<br><br>| 1 | 0 | | A and B are incorrect as a neutron has mass<br>D is incorrect as a neutron is neutral | 1 |

**Q7.**

| Question Number | Acceptable answers | Additional guidance | Mark |
|---|---|---|---|
| | The only correct answer is C<br>A is not correct as the particle is a meson<br>B is not correct as the particle is a meson<br>D is not correct as the mass cannot be negative | | 1 |

**Q8.**

| Question number | Acceptable answers | Additional guidance | Mark |
|---|---|---|---|
| | C | | 1 |