Practice Question Set For A-Level
Subject : Physics
Paper-1 Topic : 8_ Nuclear and Particle Physics

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Student:_____
Max. Marks : 20 Marks **Time : 20 Minutes**

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.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

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.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

A subatomic particle consists of the quark combination $\mathrm{u}\,\bar{\mathrm{s}}$.

Which of the following is the classification for this particle?

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☒ **A** baryon

☒ **B** lepton

☒ **C** meson

☒ **D** nucleon

(Total for question = 1 mark)

Q4.

Answer the question with a cross in the box you think is correct ☒ . If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒ .

Which of the following could **not** be accelerated in a LINAC?

☒ **A** electron

☒ **B** helium atom

☒ **C** proton

☒ **D** uranium ion

(Total for question = 1 mark)

Q5.

When alpha particles are directed at a thin gold foil it is found that most of the alpha particles go straight through undeflected. However a very small number are scattered through angles greater than 90°.

Which of the following is **not** a valid conclusion?

☒ **A** The atom is mainly empty space.

☒ **B** The nucleus must be positively charged.

☒ **C** The nucleus must contain most of the mass of the atom.

☒ **D** There is a large charge concentration in the centre of the atom.

(Total for question = 1 mark)

Q6.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Alpha particle scattering investigations were first carried out in the early part of the 20th century.

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An alpha particle with initial kinetic energy 8.8×10^{-13}J approaches a nucleus of a gold $\left({}^{197}_{79}\text{Au}\right)$ atom.

Which of the following is an equation for the closest distance *r*, in metres, between the alpha particle and the nucleus?

☒ **A** $r = 8.99 \times 10^{9} \left(\dfrac{2 \times 1.6 \times 10^{-19} \times 79 \times 1.6 \times 10^{-19}}{8.8 \times 10^{-13}} \right)$

☒ **B** $r = \dfrac{2 \times 1.6 \times 10^{-19} \times 197 \times 1.6 \times 10^{-19}}{8.99 \times 10^{9} \times 8.8 \times 10^{-13}}$

☒ **C** $r = 8.99 \times 10^{9} \left(\dfrac{8.8 \times 10^{-13}}{4 \times 1.6 \times 10^{-19} \times 79 \times 1.6 \times 10^{-19}} \right)$

☒ **D** $r = 8.99 \times 10^{9} \left(\dfrac{2 \times 79}{8.8 \times 10^{-13}} \right)$

(Total for question = 1 mark)

Q7.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Alpha particle scattering investigations were first carried out in the early part of the 20th century.

Which of the following conclusions could **not** be made as a result of these investigations?

☒ **A** The atom is mostly empty space.

☒ **B** The atom is neutral.

☒ **C** The nucleus is charged.

☒ **D** The nucleus is very small compared to the atom.

(Total for question = 1 mark)

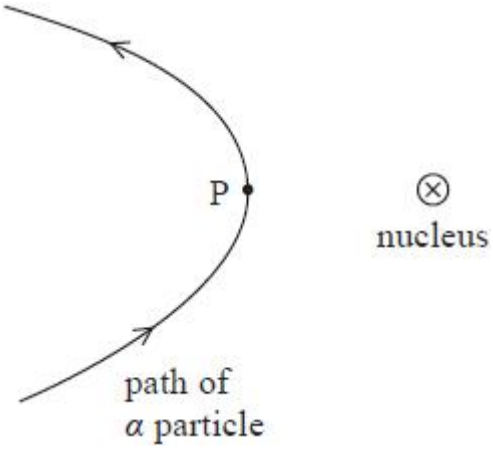
Q8.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Alpha particle scattering investigations were first carried out in the early part of the 20th century.

The diagram shows the path of an *α* particle that is being deflected by the nucleus of a gold atom. The closest distance of approach of the *α* particle to the nucleus is at point P.

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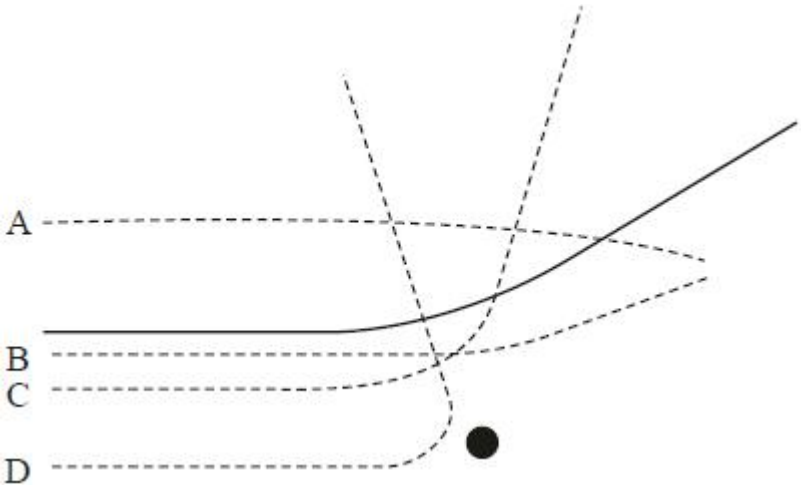
Which of the following can be concluded about a gold atom from the deflection of this *α* particle?

- ☒ **A** The atom contains electrons.
- ☒ **B** The atom has zero charge.
- ☒ **C** The nucleus is very small compared to the atom.
- ☒ **D** The nucleus of the atom is positively charged.

(Total for question = 1 mark)

Q9.

The solid line shows the path of an alpha particle as it passes close to a nucleus.



Another alpha particle approaches the nucleus with the same initial kinetic energy.

Which dashed path is possible for this alpha particle?

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

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(Total for question = 1 mark)

Q10.

The equation $\Delta E = c^2 \Delta m$ can be used with data at the back of this paper to calculate

- ☒ **A** the kinetic energy of an electron.
- ☒ **B** the energy produced when a lambda particle decays.
- ☒ **C** the energy of the photons produced when a proton and an antiproton annihilate.
- ☒ **D** the mass of uranium that produces 50 MJ of energy in a nuclear reactor.

(Total for question = 1 mark)

Q11.

The nucleus of one of the isotopes of nickel is represented by $^{60}_{28}\text{Ni}$.

Which line correctly identifies a neutral atom of this isotope?

	Number of protons	Number of neutrons	Number of electrons
☒ A	28	32	28
☒ B	28	32	32
☒ C	28	60	28
☒ D	60	28	28

(Total for Question = 1 mark)

Q12.

Select the row in the table that correctly identifies the composition of a $^{235}_{92}U^{+}$ ion.

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		Number of protons	Number of neutrons	Number of electrons
☐	**A**	92	143	91
☐	**B**	92	143	92
☐	**C**	92	235	91
☐	**D**	93	235	92

(Total for Question = 1 mark)

Q13.

A radioactive isotope of aluminium is $^{25}_{13}Al$

Select the row in the table that correctly identifies a neutral atom of this isotope.

	Neutrons	Protons	Electrons
☐ **A**	12	13	12
☐ **B**	13	12	13
☐ **C**	13	12	12
☐ **D**	12	13	13

(Total for question = 1 mark)

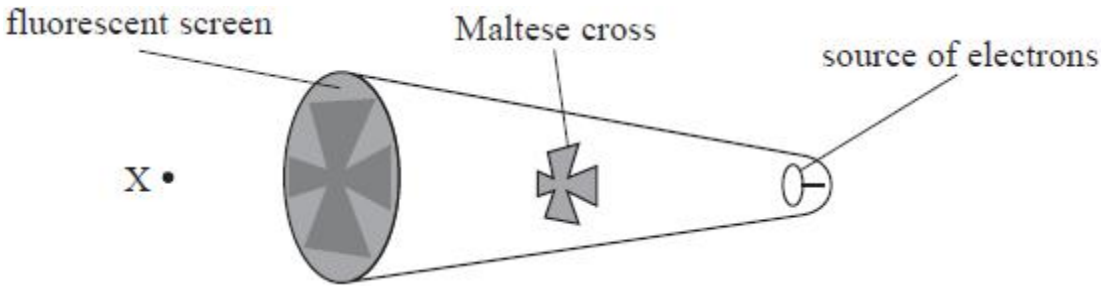
Q14.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

A demonstration is carried out using a beam of electrons in an evacuated tube.

When electrons hit a fluorescent screen, light is emitted. A piece of metal, in the shape of a Maltese cross, stops electrons and produces a shadow on the screen as shown.

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The electrons are produced by heating a metal filament.

Which of the following is the name of this process?

- **A** ionisation
- **B** scattering
- **C** the photoelectric effect
- **D** thermionic emission

(Total for question = 1 mark)

Q15.
The diagram shows the tracks from an event at a point P in a bubble chamber. A magnetic field is directed into the page.



The tracks cannot show the production of a proton-antiproton pair with equal kinetic energies because

- **A** the curvature is perpendicular to the magnetic field.
- **B** the tracks curve in different directions.
- **C** the tracks have different curvatures.
- **D** there is no track before point P.

(Total for Question = 1 mark)

Q16.
Charged particles are travelling at a speed *v*, at right angles to a magnetic field of flux density *B*. Each particle has a mass *m* and a charge *Q*.

Which of the following changes would cause a decrease in the radius of the circular path of the particles?

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☒ **A** an increase in *B*

☒ **B** an increase in *m*

☒ **C** an increase in *v*

☒ **D** a decrease in *Q*

(Total for Question = 1 mark)

Q17.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

A proton has a mass of 1.67×10^{-27} kg.

Which of the following shows the conversion of this mass to GeV/c^2 ?

☒ **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)

Q18.

A cyclotron is a type of particle accelerator. It consists of two metal Dees which are connected to a high frequency voltage supply and are in a strong magnetic field.

The particles change their speed because

☒ **A** of the magnetic field they are in.

☒ **B** the voltage supply is alternating.

☒ **C** there is a potential difference between the two Dees.

☒ **D** the magnetic field is at right angles to the Dees.

(Total for Question = 1 mark)

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Q19.

Answer the question with a cross in the box you think is correct (☒). If you change your mind about an answer, put a line through the box (☒) and then mark your new answer with a cross (☒).

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

☒ **A** $p \rightarrow n + \beta^+$

☒ **B** $p \rightarrow p + \beta^+$

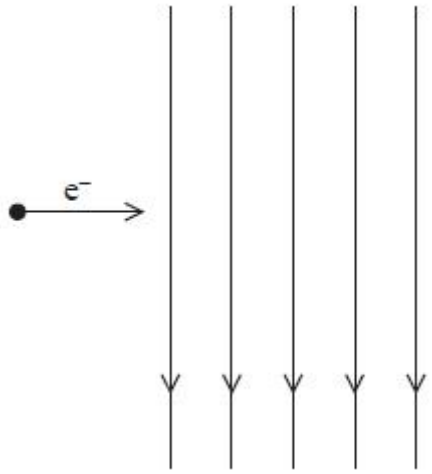
☒ **C** $p \rightarrow n + \beta^+ + \nu$

☒ **D** $p \rightarrow p + \beta^+ + \nu$

(Total for question = 1 mark)

Q20.

An electron travelling horizontally enters a uniform electric field which acts vertically downwards as shown in the diagram.



Which of the following statements is **incorrect**?

☒ **A** The electron follows a parabolic path.

☒ **B** The electron accelerates while in the field.

☒ **C** The electric force on the electron acts downwards.

☒ **D** The speed of the electron increases.

(Total for question = 1 mark)

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