Practice Question Set For A-Level
Subject : Physics
Paper-1 Topic: Particle And Radiation

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Name of the Student:_____
Max. Marks : 20 Marks **Time :** 20 **Minutes**

Q1.

One strong interaction that occurs when two high-energy protons collide is

$$p + p \rightarrow p + \pi^+ + \pi^- + \mathbf{X}$$

(a) Determine the lepton number, strangeness and charge of particle **X**.

lepton number = _____

strangeness = _____

charge = _____

(2)

(b) Identify particle **X**.

_____

(1)

(c) A possible decay of a negative pion is

$$\pi^- \rightarrow e^- + \mathbf{Y}$$

What is particle **Y**?
Tick (✓) **one** box.

$\bar{\nu}_e$ ☐

ν_e ☐

π^0 ☐

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$^{1}_{0}n$ ☐

(1)

(d) Some subatomic particles are classified as hadrons. There are two classes of hadrons.

Discuss the nature of hadrons.
Your answer should include:

- the identifying properties of hadrons
- the structure of a hadron in each class
- a discussion of the stability of free hadrons.

(6)

(Total 10 marks)

Q2.

A sample of pure boron contains only isotope **X** and isotope **Y**.
A nucleus of **X** has more mass than a nucleus of **Y**.

(a) The sample is ionised, producing ions each with a charge of $+1.6 \times 10^{-19}$ C.
The specific charge of an ion of **X** is 8.7×10^{6} C kg^{-1}.

Calculate the mass of an ion of **X**.

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mass of ion = _____ kg

(1)

(b) Determine the number of nucleons in a nucleus of **X**.

mass of a nucleon = 1.7×10^{-27} kg

number of nucleons = _____

(2)

(c) Compare the nuclear compositions of **X** and **Y**.

_____

_____

_____

_____

_____

_____

(2)

(d) Ions of **Y** have the same charge as ions of **X**.

State and explain how the specific charge of an ion of **X** compares with that of an ion of **Y**.

_____

_____

_____

_____

(2)

(e) The table contains data about two completely ionised samples of pure boron. Each sample contains only isotopes **X** and **Y**.

Sample number	Number of ions in sample	Mass of sample / kg	Charge on each ion / C
1	3.50×10^{16}	6.31×10^{-10}	$+1.60 \times 10^{-19}$
2	3.50×10^{7}	6.20×10^{-19}	$+1.60 \times 10^{-19}$

Deduce which sample, **1** or **2**, contains a greater percentage of isotope **Y**.

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_____

_____

_____

(3)

(Total 10 marks)

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