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

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Name of the Student:_____
Max. Marks : 21 Marks **Time : 21 Minutes**

Q1.

(a) Describe the interaction that is responsible for keeping protons and neutrons together in a stable nucleus.
You should include details of the properties of the interaction in your answer.

(3)

(b) Nuclei can decay by alpha decay and by beta decay.

In alpha decay only one particle is emitted but in beta decay there are two emitted particles.

Explain how baryon number is conserved in alpha and beta decay.

(3)

(c) Kaons are mesons that can be produced by the strong interaction between pions and protons.

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The equation shows a reaction in which a kaon and a lambda particle are produced.

$$\pi^- + p \rightarrow K^0 + \Lambda^0$$

Deduce the quark structure of the Λ^0

quark structure = _____

(2)

(d) The kaon decays by the weak interaction.

The equation shows an example of kaon decay.

$$K^0 \rightarrow \pi^+ + \pi^-$$

State **one** feature of this decay that shows it is an example of the weak interaction.

_____

_____

(1)

(e) There have been considerable advances in our understanding of particle physics over the past 100 years.

Explain why it is necessary for many teams of scientists and engineers to collaborate in order for these advances to be made.

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(2)

(Total 11 marks)

Q2.

The diagram shows some of the energy levels for a hydrogen atom.

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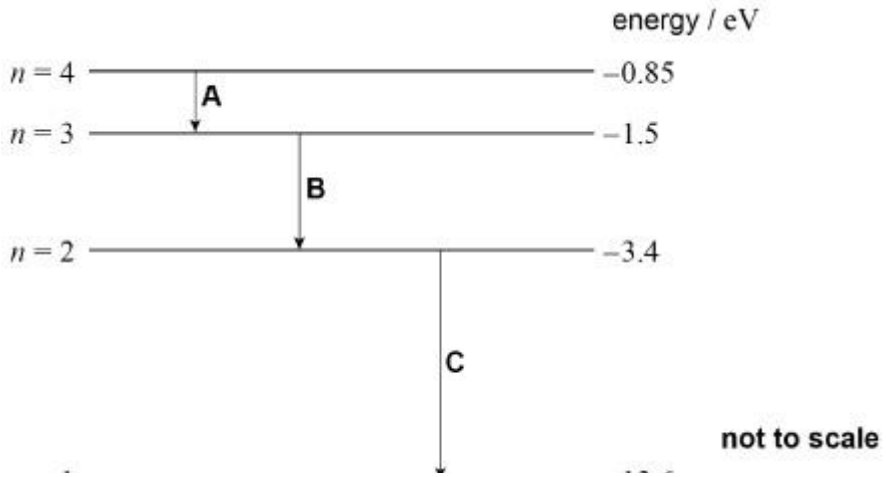

An excited hydrogen atom can emit photons of certain discrete frequencies. Three possible transitions are shown in the diagram.

(a) The transitions shown in the diagram result in photons being emitted in the ultraviolet, visible and infrared regions of the electromagnetic spectrum.

To which region of the spectrum do the emitted photons belong?

Tick (✔) the correct box for each transition, **A**, **B** and **C**.

Transition	Ultraviolet	Visible	Infrared
A	☐	☐	☐
B	☐	☐	☐
C	☐	☐	☐

(1)

(b) Two ways to excite a hydrogen atom are by collision with a free electron or by the absorption of a photon.

Explain why, for a particular transition, the photon must have an exact amount of energy whereas the free electron only needs a minimum amount of kinetic energy.

_____

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(3)

(c) The surface of a sample of caesium is exposed to photons emitted in each of the three transitions shown in the diagram.

The threshold frequency of caesium is 5.1×10^{14} Hz

Determine whether any of these transitions would produce photons that would cause electrons to be emitted from the surface of caesium.

_____

_____

_____

_____

(3)

(d) Photons each with energy 12.1 eV are incident on the surface of the caesium sample.

Calculate the maximum speed of electrons emitted from the caesium.

maximum speed = _____ m s^{-1}

(3)

(Total 10 marks)

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