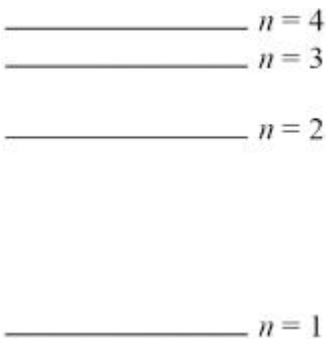
Practice Question Set For A-Level
Subject : Physics
Paper-1 Topic: Particle And Radiation

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

Q1.

The four lowest energy levels of an atom are shown.



A gas contains atoms in the n = 4 level.
The atoms de-excite to the n = 1 level.

How many photon frequencies are observed?

A 3 ⬭
B 4 ⬭
C 5 ⬭
D 6 ⬭

(Total 1 mark)

Q2.

Monochromatic light of frequency f is incident on a metal surface in a vacuum.
Photoelectrons are emitted from the surface.

The photoelectric current I is measured.

The magnitude of the stopping potential V_s is then measured.

f is increased without changing the rate at which photons arrive at the metal surface.

What are the new measurements of the photoelectric current and the magnitude of the stopping potential?

	Photoelectric current	Magnitude of the stopping potential	
A	I	V_s	⬭
B	I	$> V_s$	⬭
C	$> I$	V_s	⬭
D	$> I$	$> V_s$	⬭

(Total 1 mark)

Q3.

An electron and a positron annihilate each other.

Which quantity is **not** conserved in the annihilation?

A electric charge ⬭

B kinetic energy ⬭

C lepton number ⬭

D momentum ⬭

(Total 1 mark)

Q4.

Which exchange particle transfers charge during electron capture?

A meson ⬭

B pion ⬭

C virtual photon ⬭

D W boson ⬭

(Total 1 mark)

Q5.

A free neutron decays to produce a proton and

A an electron and an antineutrino. ⬭

B an electron and a neutrino. ⬭

C a positron and an antineutrino. ⬭

D a positron and a neutrino. ⬭

(Total 1 mark)

Q6.

A nucleus of bismuth-209 $\left(^{209}_{83}\mathrm{Bi}\right)$ absorbs a neutron. The newly formed nucleus subsequently decays in two stages to form a nucleus of nuclide **X**.
One beta-minus particle and one alpha particle are emitted during these two decays.

What are the nucleon number and the proton number of **X**?

	Nucleon number	Proton number	
A	205	82	⬭
B	205	83	⬭
C	206	82	⬭
D	206	83	⬭

(Total 1 mark)

Q7.

The concept of exchange particles was introduced to explain forces between elementary particles.

This concept requires that exchange particles have

A charge. ⬭

B momentum. ⬭

C phase. ⬭

D rest mass. ⬭

(Total 1 mark)

Q8.

A nucleus contains N neutrons and Z protons.

Which combination of N and Z gives a nucleus with the greatest specific charge?

	N	Z	
A	6	5	⬭
B	8	7	⬭
C	16	13	⬭
D	20	17	⬭

(Total 1 mark)

Q9.

Which statement about muons is correct?

A They consist of a quark and an antiquark. ⬭

B They include pions and kaons. ⬭

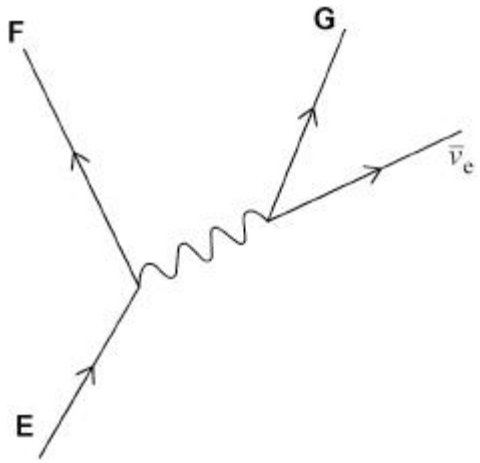
C They are subject to the strong interaction. ⬭

D They decay into electrons. ⬭

(Total 1 mark)

Q10.

The diagram represents a quark change in which an electron antineutrino is produced.



What are **E**, **F** and **G**?

	E	F	G	
A	up quark	down quark	β^-	⬭
B	down quark	up quark	β^-	⬭
C	up quark	down quark	β^+	⬭
D	down quark	up quark	β^+	⬭

(Total 1 mark)

Q11.

Which row has the largest value for

$$\frac{\text{specific charge of the particle in column X}}{\text{specific charge of the particle in column Y}}?$$

	X	Y	
A	electron	alpha particle	⬭
B	alpha particle	electron	⬭
C	electron	proton	⬭

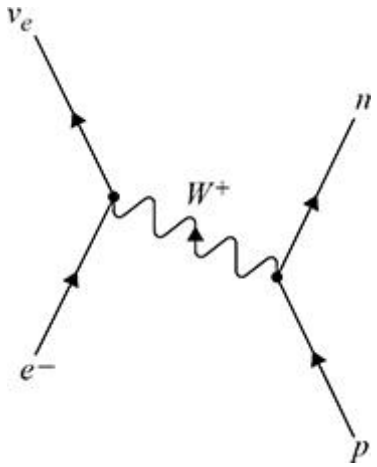
D	proton	alpha particle	⬭

(Total 1 mark)

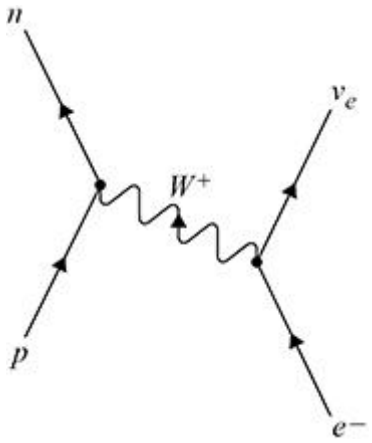
Q12.

Which diagram represents the process of electron capture?

A



B



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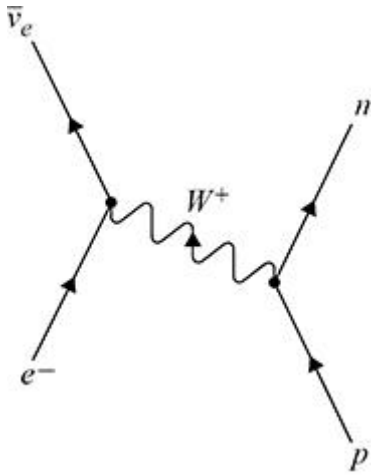
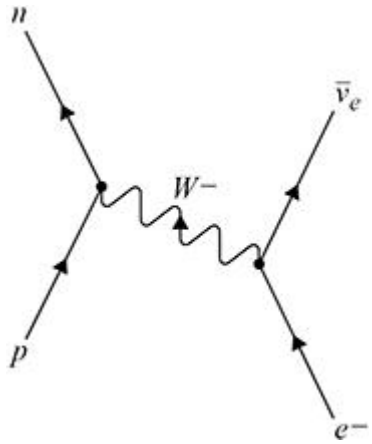


D



A ⬭

B ⬭

C ⬭

D ⬭

(Total 1 mark)

Q13.

Which row is correct?

Name of particle	Classification	Quark structure

A	antineutron	meson	$\bar{u}\bar{u}\bar{d}$	⬭
B	positive kaon	baryon	$\bar{u}\ s$	⬭
C	antiproton	baryon	$\bar{u}\bar{u}\bar{d}$	⬭
D	positive pion	meson	$\bar{u}\ d$	⬭

(Total 1 mark)

Q14.

An alpha particle and a nucleus of boron $^{10}_{5}\mathrm{B}$ interact to form an unstable nucleus and a free neutron.

The unstable nucleus decays by positron emission to form a nucleus of nuclide **X**.

What is **X**?

A $^{13}_{5}\mathrm{B}$ ⬭

B $^{13}_{6}\mathrm{C}$ ⬭

C $^{13}_{7}\mathrm{N}$ ⬭

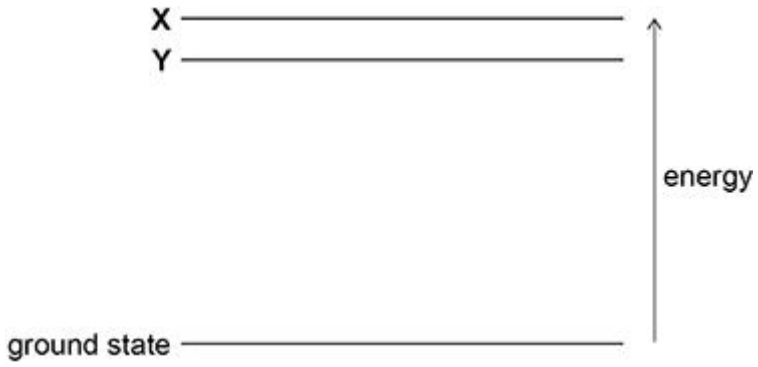
D $^{13}_{8}\mathrm{O}$ ⬭

(Total 1 mark)

Q15.

The diagram shows the ground state and two higher-energy states **X** and **Y** of an atom.

A transition from **X** to the ground state produces a photon of wavelength $147\ \mathrm{nm}$.
A transition from **Y** to the ground state produces a photon of wavelength $160\ \mathrm{nm}$.



What is the energy difference between **X** and **Y**?

A $1.5 \times 10^{-17}\ \mathrm{J}$ ⬭

B $1.4 \times 10^{-18}\ \mathrm{J}$ ⬭

C 1.2×10^{-18} ⬭

D 1.1×10^{-19} J ⬭

(Total 1 mark)

Q16.

What is the specific charge of a $^{13}_{6}C$ nucleus?

A 4.4×10^{7} C kg^{-1} ⬭

B 5.2×10^{7} C kg^{-1} ⬭

C 8.3×10^{7} C kg^{-1} ⬭

D 2.1×10^{8} C kg^{-1} ⬭

(Total 1 mark)

Q17.

Which provides evidence for discrete atomic energy levels?

A β^{+} decay ⬭

B electron diffraction ⬭

C line spectra ⬭

D the photoelectric effect ⬭

(Total 1 mark)

Q18.

Which row describes the variation with distance of the strong nuclear force?

	Attractive	Repulsive	
A	beyond 3 fm	from 0.5 fm to 3 fm	⬭
B	from 0.5 fm to 3 fm	beyond 3 fm	⬭
C	from 0.5 fm to 3 fm	up to 0.5 fm	⬭
D	up to 0.5 fm	from 0.5 fm to 3 fm	⬭

(Total 1 mark)

Q19.

Which combination of quarks is possible?

A sd ⬭

B sū ⬭

C sūd ⬭

D ud ⬭

(Total 1 mark)

Q20.

Which statement is correct?

A All strange particles are mesons. ⬭

B Strange particles are always created in pairs. ⬭

C Strangeness can only change in strong interactions. ⬭

D Strangeness can only have a value of 0 or −1 ⬭

(Total 1 mark)