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

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**Name of the Student**:_____
**Max. Marks : 22 Marks** **Time : 22 Minutes**

## Q1.

In photoelectricity, $V_s$ is the stopping potential.

What quantity is $eV_s$?

**A** energy of an incident photon ⬭

**B** maximum kinetic energy of a photoelectron ⬭

**C** threshold frequency × the Planck constant ⬭

**D** work function ⬭

**(Total 1 mark)**

## Q2.

Which row gives evidence for the wave nature of electrons and evidence for the particulate nature of light?

| | **Wave nature of electrons** | **Particulate nature of light** | |
|---|---|---|---|
| **A** | electron diffraction | photoelectric effect | ⬭ |
| **B** | electron diffraction | single-slit diffraction | ⬭ |
| **C** | photoelectric effect | single-slit diffraction | ⬭ |
| **D** | photoelectric effect | electron diffraction | ⬭ |

**(Total 1 mark)**

## Q3.

A fluorescent tube contains a gas.

The coating of the tube

**A** becomes ionised by the gas and emits photons of ultraviolet light. ⬭

**B** absorbs photons of ultraviolet light from the gas and emits visible light. ⬭

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**C** absorbs photons of ultraviolet light from the gas and emits photoelectrons. ⬭

**D** absorbs several photons of visible light from the gas and then emits one photon of ultraviolet light. ⬭

**(Total 1 mark)**

## Q4.

Which particle has the smallest de Broglie wavelength?

**A** an electron moving at $4 \times 10^3$ m s$^{-1}$ ⬭

**B** a proton moving at $4 \times 10^3$ m s$^{-1}$ ⬭

**C** an electron moving at $8 \times 10^5$ m s$^{-1}$ ⬭

**D** a proton moving at $8 \times 10^5$ m s$^{-1}$ ⬭

**(Total 1 mark)**

## Q5.

An atom of oxygen-15 $\left({}^{15}_{8}\mathrm{O}\right)$ gains two electrons to form an ion.

What is the specific charge of the ion?

**A** $-1.3 \times 10^7$ C kg$^{-1}$ ⬭

**B** $-2.4 \times 10^7$ C kg$^{-1}$ ⬭

**C** $-5.1 \times 10^7$ C kg$^{-1}$ ⬭

**D** $-6.4 \times 10^7$ C kg$^{-1}$ ⬭

**(Total 1 mark)**

## Q6.

Which is an exchange particle for the weak interaction?

**A** lepton ⬭

**B** photon ⬭

**C** pion ⬭

**D** $W^+$ ⬭

**(Total 1 mark)**

## Q7.

A particular baryon has a quark structure dss and decays by the weak interaction.

What are possible decay products of this baryon?

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The quark structure of $\Lambda^0$ is uds.

**A** $\Lambda^0 + \pi^-$ ⬭

**B** $n + \pi^-$ ⬭

**C** $\Lambda^0 + e^-$ ⬭

**D** $K^+ + K^0$ ⬭

**(Total 1 mark)**

## Q8.

A muon and an antimuon annihilate to produce the minimum number of photons.

What is the maximum wavelength of the photons?

**A** $5.9 \times 10^{-15}$ m ⬭

**B** $1.2 \times 10^{-14}$ m ⬭

**C** $5.9 \times 10^{-9}$ m ⬭

**D** $1.2 \times 10^{-8}$ m ⬭

**(Total 1 mark)**

## Q9.

Which row describes the nature of the strong nuclear force between two nucleons at separations of 0.25 fm, 2.0 fm and 8.0 fm?

| | **At a separation of 0.25 fm** | **At a separation of 2.0 fm** | **At a separation of 8.0 fm** | |
|---|---|---|---|---|
| **A** | attractive | repulsive | negligible | ⬭ |
| **B** | repulsive | attractive | attractive | ⬭ |
| **C** | negligible | repulsive | attractive | ⬭ |
| **D** | repulsive | attractive | negligible | ⬭ |

**(Total 1 mark)**

## Q10.

Some energy levels of a lithium atom are shown below.

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A free electron with kinetic energy $6.0 \times 10^{-19}$ J collides with a stationary lithium atom in its $n = 1$ energy level. The lithium atom is excited to the $n = 2$ energy level.

What is the kinetic energy of the free electron after the collision?

**A** $0.3 \times 10^{-19}$ J ⬭

**B** $2.6 \times 10^{-19}$ J ⬭

**C** $3.1 \times 10^{-19}$ J ⬭

**D** $5.7 \times 10^{-19}$ J ⬭

**(Total 1 mark)**

## Q11.

What are the products when a free neutron decays?

**A** $p + e^- + \nu_e$ ⬭

**B** $p + e^+ + \bar{\nu}_e$ ⬭

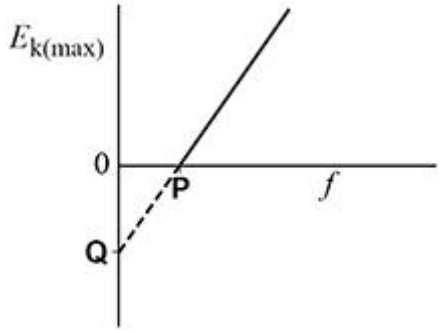
**C** $p + e^- + \bar{\nu}_e$ ⬭

**D** $p + e^+ + \nu_e$ ⬭

**(Total 1 mark)**

## Q12.

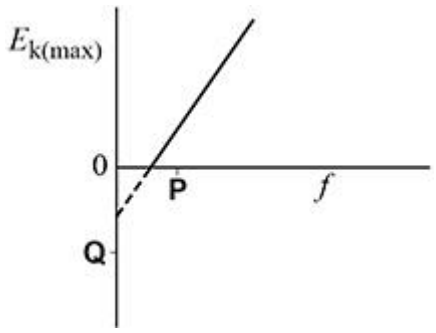
The graph shows how the maximum kinetic energy $Ek_{(max)}$ of photoelectrons emitted from a metal surface varies with the frequency $f$ of the incident radiation.
**P** is the intercept on the $f$ axis. **Q** is the intercept on the $Ek_{(max)}$ axis.



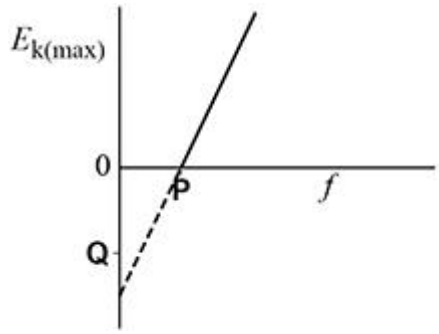

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Which graph shows the variation of $Ek_{(max)}$ with $f$ for a metal with a greater work function?

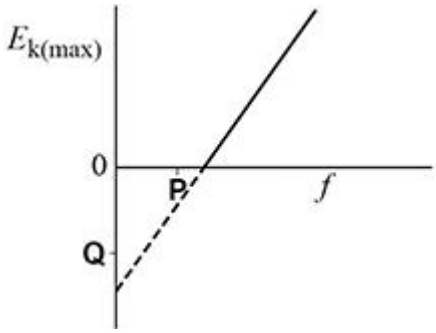
**A**



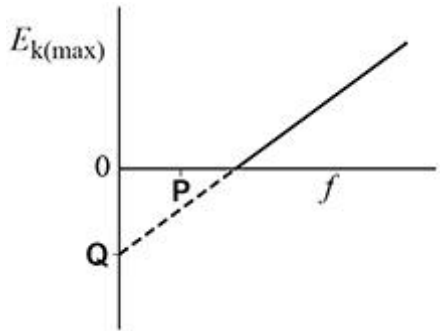

**B**




**C**




**D**




**A** ⬭

**B** ⬭

**C** ⬭

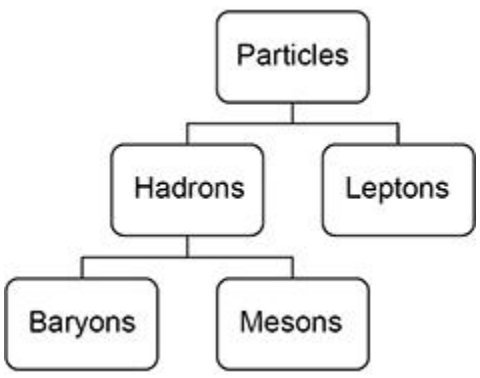
**D** ⬭

**(Total 1 mark)**

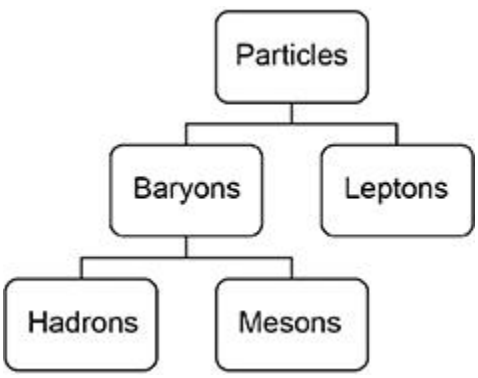
## Q13.

Which shows the classification of particles?

**A**



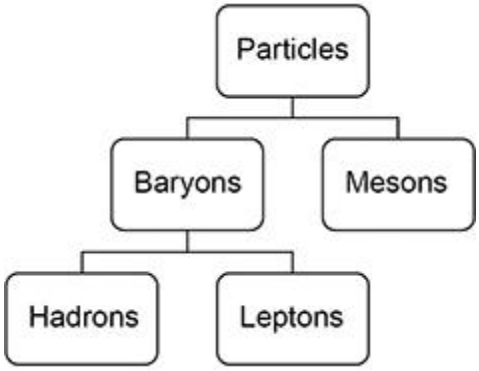

**B**

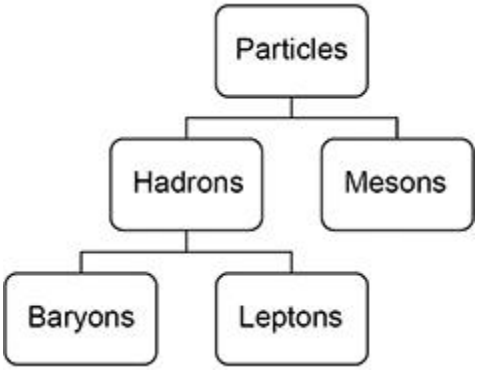



**C**

**D**

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**A** ⬭

**B** ⬭

**C** ⬭

**D** ⬭

**(Total 1 mark)**

## Q14.

The gravitational force is one of the four fundamental forces.
The ticks in the table match particles with the other fundamental forces.

In which row is the particle matched to the only other fundamental forces it experiences?

| | Particle | Electromagnetic force | Weak nuclear force | Strong nuclear force | |
|---|---|---|---|---|---|
| **A** | $\mu^+$ | ✓ | ✓ | | ⬭ |
| **B** | $\overline{p}$ | ✓ | | ✓ | ⬭ |
| **C** | $\pi^0$ | ✓ | ✓ | ✓ | ⬭ |
| **D** | $\nu_e$ | | ✓ | ✓ | ⬭ |

**(Total 1 mark)**

## Q15.

The proton number of uranium is 92 and the proton number of radon is 88

Which series of decays turns a uranium nucleus into a radon nucleus?

**A** $\alpha + \beta^- + \beta^- + \alpha + \alpha$ ⬭

**B** $\beta^- + \beta^- + \alpha + \beta^- + \alpha$ ⬭

**C** $\alpha + \alpha + \alpha + \alpha + \beta^-$ ⬭

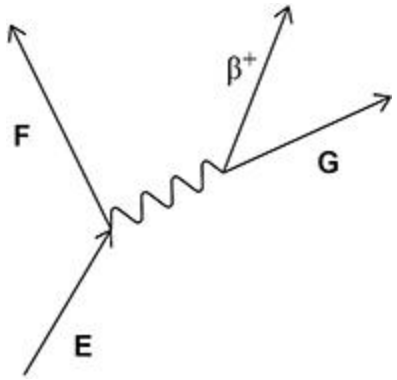
**D** $\beta^- + \beta^- + \beta^- + \beta^- + \alpha$ ⬭

**(Total 1 mark)**

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## Q16.

The diagram represents a particle interaction.




Which row identifies particles **E**, **F** and **G**?

| | E | F | G | |
|---|---|---|---|---|
| **A** | up quark | down quark | neutrino | ⬭ |
| **B** | down quark | up quark | neutrino | ⬭ |
| **C** | up quark | down quark | antineutrino | ⬭ |
| **D** | down quark | up quark | antineutrino | ⬭ |

**(Total 1 mark)**

## Q17.

The quark combination of a particle is sū.

Which is true for this particle?

**A** It has a baryon number of 1 ⬭

**B** It has a charge of $-1.6 \times 10^{-19}$ C. ⬭

**C** It is a pion. ⬭

**D** It has a strangeness of $-\frac{1}{3}$ ⬭

**(Total 1 mark)**

## Q18.

Monochromatic light with a photon energy of $4.1 \times 10^{-19}$ J is incident on a metal surface. The maximum speed of the photoelectrons released is $4.2 \times 10^{5}$ m s$^{-1}$.

What is the work function of the metal?

**A** $2.5 \times 10^{-19}$ J ⬭

**B** $3.3 \times 10^{-19}$ J ⬭

**C** $4.1 \times 10^{-19}$ J ⬭

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**D** $4.9 \times 10^{-19}$ J ⬭

**(Total 1 mark)**

## Q19.

What is the role of the mercury vapour in a fluorescent tube?

**A** It absorbs photons of UV light and emits visible light. ⬭

**B** It absorbs photons of visible light and emits UV light. ⬭

**C** It emits photons of visible light following ionisation or excitation. ⬭

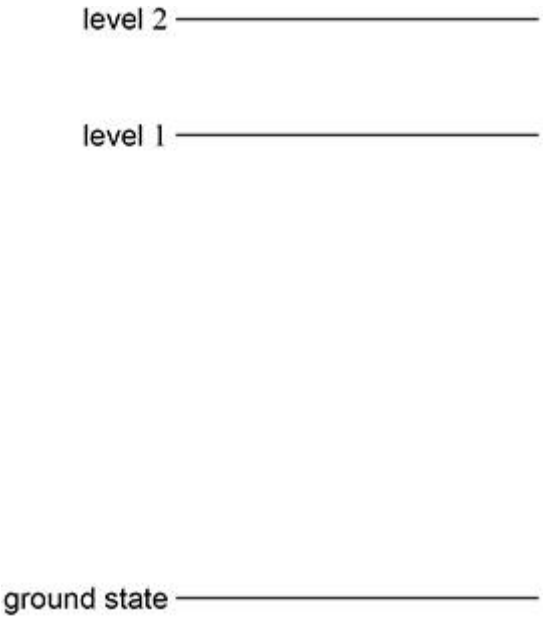
**D** It emits photons of UV light following ionisation or excitation. ⬭

**(Total 1 mark)**

## Q20.

The diagram shows the three lowest energy levels for an atom.

The energy levels have been drawn to scale.




Transitions of electrons between these energy levels produce photons of the following frequencies:

$4.56 \times 10^{14}$ Hz
$2.46 \times 10^{15}$ Hz
$2.92 \times 10^{15}$ Hz.

What is the difference in energy between the ground state and energy level 1?

**A** $0.3 \times 10^{-18}$ J ⬭

**B** $1.3 \times 10^{-18}$ J ⬭

**C** $1.6 \times 10^{-18}$ J ⬭

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**D** $1.9 \times 10^{-18}$ J ⬭

**(Total 1 mark)**

## Q21.

A muon and an electron are travelling at the same speed.

Which row gives the particle with the greater kinetic energy and the particle with the longer de Broglie wavelength?

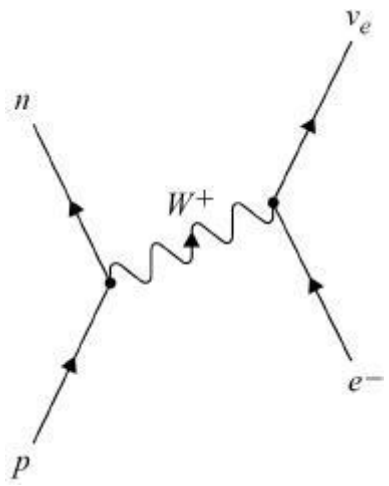
| | Greater kinetic energy | Longer de Broglie wavelength | |
|---|---|---|---|
| **A** | muon | muon | ⬭ |
| **B** | muon | electron | ⬭ |
| **C** | electron | muon | ⬭ |
| **D** | electron | electron | ⬭ |

**(Total 1 mark)**

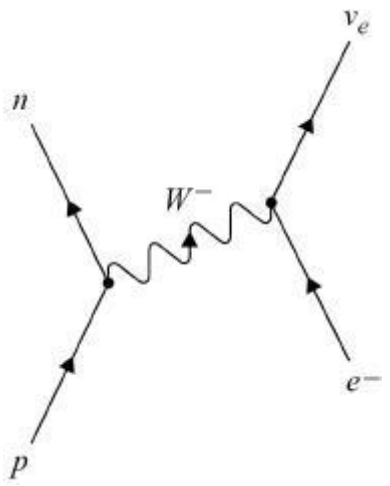
## Q22.

Which diagram represents electron capture?

**A**



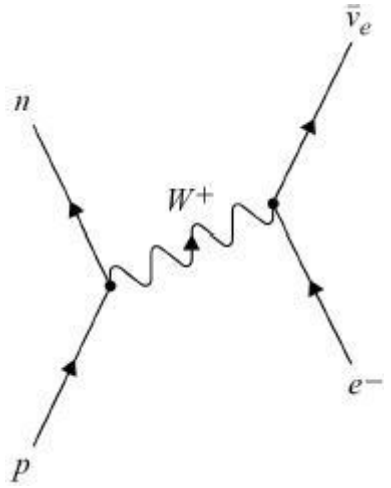

**B**

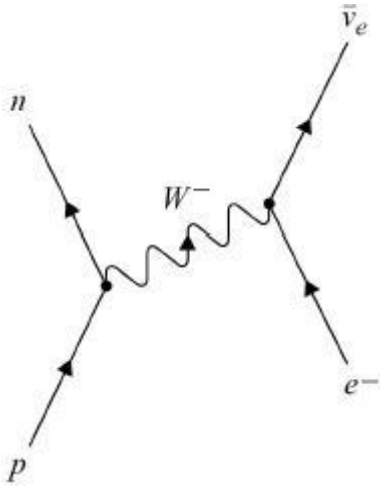



**C**

**D**

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**A** ⬭

**B** ⬭

**C** ⬭

**D** ⬭

**(Total 1 mark)**

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