



Name _____ Class _____ Date _____

1 After electrons in hydrogen atoms are excited to the $n = 3$ energy state, how many **different frequencies of radiation** can be emitted as the electrons return to the ground state?

- A 1
- B 2
- C 3
- D 4



2 Which phenomenon best supports the theory that **matter** has a **wave nature**?

- A electron momentum
- B electron diffraction
- C photon momentum
- D photon diffraction

3 According to the Standard Model of Particle Physics, a **meson** is composed of

- A a quark and a muon neutrino
- B a quark and an antiquark
- C three quarks
- D a lepton and an antilepton

4 A **microwave** and an **x ray** are traveling in a **vacuum**. Compared to the wavelength and period of the microwave, **the x ray has a wavelength that is**

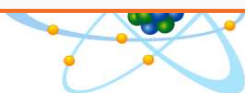
- A longer and a period that is shorter
- B longer and a period that is longer



PREVIEW

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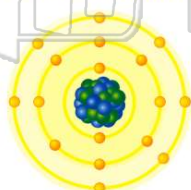
7 A
C
A
E $6.0 \times 10^{-19} \text{ C}$
C $3.2 \times 10^{-19} \text{ C}$
D $5.0 \times 10^{-19} \text{ C}$



- B opposite sign and the same magnitude
- C same sign and a smaller magnitude
- D same sign and the same magnitude

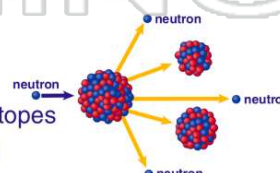
9 Which type of force **overcomes the repulsive electrostatic force between protons** in the nucleus of an atom?

- A magnetic
- B nuclear
- C gravitational
- D centrifugal



10 High-energy neutrons are released in all nuclear fission reactions. **What material is used in a reaction to reduce the energy of these neutrons to thermal levels?**

- A shielding
- B moderators
- C fissionable isotopes
- D thin metal foils

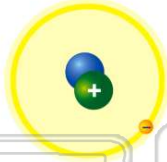




ANSWER KEY

After electrons in hydrogen atoms are excited to the $n = 3$ energy state, how many **different frequencies of radiation** can be emitted as the electrons return to the ground state?

- A 1
- B 2
- C 3
- D 4



(c)

Which phenomenon best supports the theory that **matter** has a **wave nature**?

- A electron momentum
- B electron diffraction
- C photon momentum
- D photon diffraction

(b)

According to the Standard Model of Particle Physics, a **meson** is composed of

- A a quark and a muon neutrino
- B a quark and an antiquark
- C three quarks
- D a lepton and an antilepton

(b)

A **microwave** and an **x ray** are traveling in a **vacuum**. Compared to the wavelength and period of the microwave, the **x ray** has a **wavelength** that is

- A longer and a period that is shorter
- B longer and a period that is longer
- C shorter and a period that is longer

(b)



PREVIEW

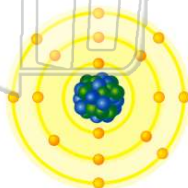
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D $5.0 \times 10^{-19} \text{ C}$

D same sign and the same magnitude

Which type of force **overcomes** the **repulsive electrostatic force between protons** in the nucleus of an atom?

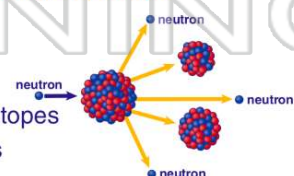
- A magnetic
- B nuclear
- C gravitational
- D centrifugal



(b)

High-energy neutrons are released in all nuclear fission reactions. **What material is used in a reaction to reduce the energy of these neutrons to thermal levels?**

- A shielding
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- C fissionable isotopes
- D thin metal foils



(b)