Grade -11

Chapter-2

Atomic structure and periodic table

1995- 2011

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2007

1. Which one of the following represents an acceptable set of quantum numbers (in the order n, ℓ, m_ℓ, m_s) for an electron in an atom?

A) 2, 1, 0, 0 C) 2, 1, -1, $\frac{1}{2}$

B) 2, 0, 2, $+\frac{1}{2}$ D) 2, 0, 1, $-\frac{1}{2}$

2. Of the three types of radioactivity characterized by Rutherford, which of the following are particles?

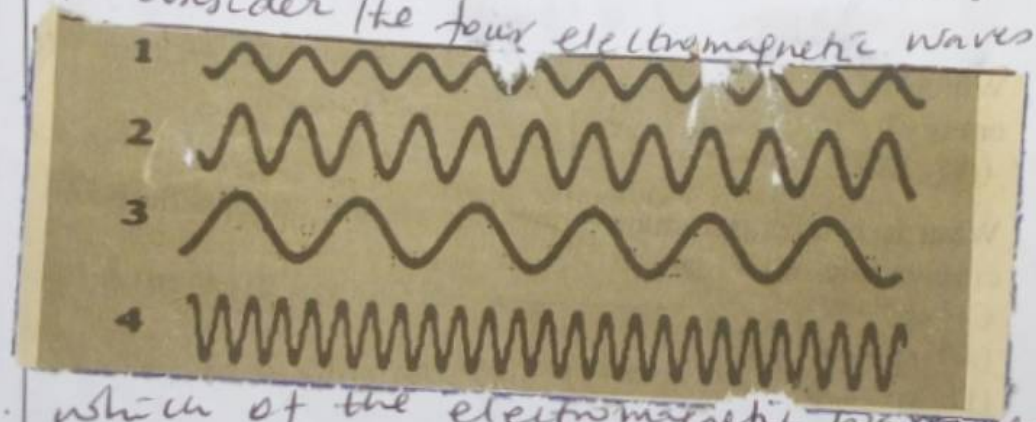
A) α-rays C) α-rays, and β-rays

B) β-rays D) α-rays, β-rays and γ-rays

3. How many orbitals are there in an atom with $n = 4$?

A) 2 B) 8 C) 16 D) 4f

4. Consider the four electromagnetic waves shown below

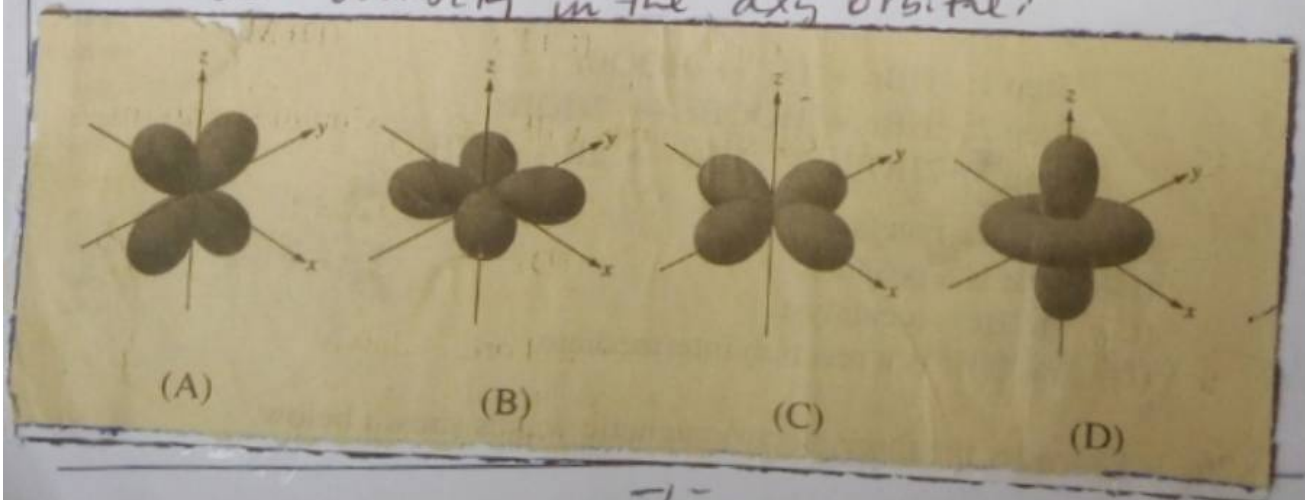


Which of the electromagnetic waves has the highest frequency?

A) 1 C) 3

B) 2 D) 4

5. Which of the following diagrams describes the electron density in the d_{xy} orbital?



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6. The wave number of an electromagnetic radiation is $1 \times 10^5\ cm^{-1}$. The frequency of the radiation would be

A) $3 \times 10^8\ s^{-1}$
B) $3 \times 10^6\ s^{-1}$
C) $3 \times 10^{10}\ s^{-1}$
D) $3 \times 10^5\ s^{-1}$

7. The maximum number of electrons in p-orbital with $n=6$, $m_e=0$ is

A) 2
B) 6
C) 16
D) 14

8. Which of the following transitions will emit maximum energy in the hydrogen atom?

A) $n=4 \rightarrow n=3$
B) $n=4 \rightarrow n=2$
C) $n=2 \rightarrow n=1$
D) $n=3 \rightarrow n=2$

9. Which of the following statement is true?

A) All forms of electromagnetic radiation are visible.
B) Radio waves have shorter wave lengths than visible light.
C) Ultraviolet light has longer wavelengths than visible light.
D) The frequency of radiation increases as the wave length decreases.

2006

10. Which electron transition in a hydrogen atom releases the largest energy?

A) $n=2 \rightarrow n=1$
B) $n=4 \rightarrow n=2$
C) $n=6 \rightarrow n=3$
D) $n=7 \rightarrow n=6$

11. What is the ratio of the energy of photon of 300nm wave length radiation to that of 600nm radiation?

A) 1:2
B) 1:1
C) 2:1
D) 3:1

12. In which region of the periodic table would the element with the electronic structure below be located?

$1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 4d^{10} 5s^2$

A) Group 6
B) Noble gas
C) S block
D) d block

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13. Which of the following atoms in its ground state has the greatest number of unpaired electron?

A) $_{13}Al$ C) $_{15}P$

B) $_{14}Si$ D) $_{16}S$

14. Which of the following particles contain one electrons than neutrons?

I. $_{1}^{1}H$ II. $_{17}^{35}Cl^-$ III. $_{19}^{39}K^+$

A) I only C) I and III only

B) II only D) II and III only

15. Which set of quantum numbers (n, l, me, ms) is not possible?

A) 1, 0, 0, ½ C) 1, 0, 0, -½

B) 3, 1, 0, ½ D) 2, 1, -1, ½

16. Which of the electron configuration describes the ground state electron configuration of Cl^-?

A) $1s^2 2s^2 2p^6 3s^2 3p^6$ C) $1s^2 2s^2 2p^6 3s^1$

B) $1s^2 2s^2 2p^6 3s^1$ D) $1s^2 2s^2 2p^6 3s^2 3p_x^2 3p_y^1$

17. What is the Ionization energy of an iron atom if it requires a radiation of 276 nm to completely remove its outer most electron in the gaseous state?

(plank's constant, $h = 6.626 \times 10^{-34}$ Js, $c = 3 \times 10^8$ m/s

A) 7.21×10^{-19} J C) $7.21 \times 10^{+19}$ J

B) 7.21×10^{-19} kJ D) 7.21×10^{19} kJ

18. How many 3d electrons are present in the ground state of chromium atom?

A) 4 C) 6

B) 5 D) 10

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2005

19. Which of the following statement is true?
A) Ultraviolet light has longer wave length than visible light.
B) The energy of radiation decreases as the wave length decreases
C) The freqluency of radiation increases as the wave length decreases.
D) Wave number of an electromagnetic radiation increases as wave length increases.

20. Which of the following quantum number(s) is(are) related to the size and energy of an electron in a hydrogen atom?
A) n
B) n, ℓ
C) n, ℓ, m
D) n, ℓ, m, s

21. Which of the following represents the general electron configuration of the transition elements?
A) ns^2np^6
B) $ns(n-1)d$
C) $ns(n-2)f$
D) $ns^2np^6(n-1)d^{10}$

22. An electron has a spin quantum number, $s = +\frac{1}{2}$ and a magnetic quantum number, $m_ℓ = +1$. In which of the following orbital will it not represent?
A) s-orbital
B) p-orbital
C) d-orbital
D) f-orbital

23. What is the wave length associated with an electron of mass, $m = 9.11 \times 10^{-28}$ g, traveling at 40% of the velocity of light?
A) 6.06×10^{-15} m
B) 2.42×10^{-15} m
C) 6.06×10^{-12} m
D) 2.42×10^{-11} m

24. The quantum numbers listed below are meant for four different electrons in an atom:
I. $n=4$, $ℓ=0$, $m_ℓ=0$, $m_s=+½$.
II. $n=3$, $ℓ=1$, $m_ℓ=1$, $m_s=+½$

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III. $n=3, \ell=2, m_\ell=0, m_s=+1/2$

IV. $n=4, \ell=1, m_\ell=0, m_s=-1/2$

When these sets of numbers are arranged in order of increasing energy, one may get:

A) I < II < III < IV
C) II < I < III < IV
B) I < III < II < IV
D) IV < III < II < I

25. What sizes of particles and velocities can consider quantum effect?

A) particles with very large mass and large velocities.
B) particles with very large mass and small velocities
C) particles with very small mass and large velocities.
D) particles with very small mass and small velocities.

2004

26. The compound CuCl emits blue light having a wave length of 450nm when heated at about 1200°C. What is the increment in energy (quantum) that is emitted at 450nm?

A) 2.25×10^{-19} J
C) 8.20×10^{-19} J
B) 4.41×10^{-19} J
D) 16.20×10^{-19} J

27. What is the difference between chlorine-35 and calorine-37?

A) Chlorine-37 has two more protons than chlorine-35.
B) Chlorine-37 has two more neutrons than chlorine-35.
C) chlorine-37 has two more electrons than chlorine-35.
D) Chlorine-37 has one more proton and one more neutron than chlorine-35.

28. Which of the following electromagnetic radiation has the shortest wave length?

A) X-rays
C) gamma rays
B) UV rays
D) micro waves

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29. Which group of elements is characterized with ns^2np^2 Outer electron configuration?

A) Group 2A
B) Group 4A
C) Group 4B
D) Group 3B

30. For elements in the left most column of the periodic table, properties that have increasing values as the atomic number increases include which of the following?

I. Ionization energy
II. Atomic radius
III. Atomic mass

A) III only
B) I, II and III
C I and II only
D II and III only

31. Which of the following quantum number(s) determine the energy of an electron in a hydrogen atom?

A) n
B) n and ℓ
c) n, ℓ and m
D) n, ℓ, m and s

32. For an electron that has a quantum numbers n=4 and $m_\ell = 0$, which of the following is true?

A) It must have the quantum number n=0.
B) It must have the quantum number ℓ=0.
c) It must have the quantum number $m_s = +\frac{1}{2}$
D) It may have the quantum number ℓ: 0, 1, 2, 3

33. Which of the following transitions requires the smallest energy to be absorbed by the hydrogen atom?

A) from n=1 to n=2
B) from n=2 to n=3
c) from n=3 to n=4
D) from n=4 to n=5

34. What did Rutherford's alpha particles experiment show?

A) Electrons have a negative charge.
B) A proton is a hydrogen atom without electron.
C) Electrons circle the nucleus of an atom in orbits.
D) Most of the mass and all of the positive charges of an atom is found in a tiny nucleus.

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2003

35. Which element corresponds to the electron configuration $[Ne]3s^2 3p^1$?

A) Mg
B) Al
C) Si
D) Ga

36. Within a specified period, an increase in atomic number is usually accompanied by:

A) an increase in atomic radius and an increase in electronegativity.
B) a decrease in atomic radius and an increase in electronegativity.
C) an increase in atomic radius and a decrease in electronegativity.
D) a decrease in atomic radius and a decrease in electronegativity.

37. Which of the following sets of quantum numbers is not allowed in the hydrogen atom?

A) $n=2, \ell=1, m_\ell=-1$
B) $n=1, \ell=0, m_\ell=0$
C) $n=8, \ell=7, m_\ell=6$
D) $n=2, \ell=0, m_\ell=2$

38. Which one of the following electromagnetic radiation has the longest wave length?

A) Gamma rays
B) Micro waves
C) Radio waves
D) X-rays

~~39. Which one~~

39. What are the possible values of the azimuthal quantum number for an electron in the 4f subshell?

A) 0, 1, 2, 3
B) 1, 2, 3
C) 3
D) 4

40. Which one of the following is the correct electronic configuration of Ni?

A) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^8 4s^2$
B) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^9 4s^1$
C) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4p^6 3s^2$
D) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4p^2$

41. The energy required to remove an electron from an iron atom amounts to 7.21×10^{-19} J. What is the maximum wave length of light that can perform this?

A) 250nm
B) 276nm
C) 289nm
D) 300nm

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42. Hydrogen atom is excited to the stationery state designated by the principal quantum number, n=4. What will be the number of lines (frequencies) emitted by the hydrogen atom?

A) 1
B) 4
C) 6
D) 16

2002

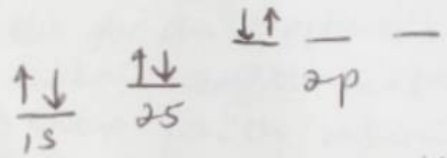
43. Which groups of elements are the most reactive of all the metallic elements?

A) Alkali metals
B) Alkali earth metals
C) Transition metals
D) Group 2B metals

44. Which set of quantum numbers (n, ℓ, mℓ, ms) is NOT permitted by the rules of quantum mechanics?

A) 1, 0, 0, ½
B) 3, 3, 1, -½
C) 2, 1, -1, -½
D) 4, 3, 2, ½

45. What can you conclude from the figure below?



A) Hund's rule has been violated
B) The pauli exclusion principle has been violated.
C) The Aufbau principle has been violated
D) This is a valid Orbital diagram

46. A monoatomic ion that has 20 protons and +2 charge:

A) has 16 protons
B) has the symbol Ar^{+2}
C) has 18 neutrons
D) is isoelectronic with Ar.

47. What is the correct order of the atomic radius in the elements below?

A) Mg < Al < Cl
B) Al < Mg < Cl
C) Mg > Al > Cl
D) Cl > Al > Mg

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48 The Outer most electron(s) of which of the following experiences is the greatest effective nuclear charge?

A) K
B) Ca
C) Br
D) P

49 When the atom Li, Be, B, Na are arranged in Order of increasing atomic radius, which is the correct Order?

A) Li, Be, B, Na
B) Li, Na, B, Be
C) Na, Li, Be, B
D) B, Be, Li, Na

2001

50. What is the maximum number of electrons in an atom that can have the quantum n=5, me= +1?

A) 8
B) 16
C) 32
D) 64

51. Which of the following is determined by the Millikan's Oil drop experiment?

A) Charge on the electron
B) e/m ratio for an electron
C) Mass of electron
D) Velocity of electron

52. which alkali earth metal shares diagonal relationship with aluminium?

A) Ba
B) Be
C) Ca
D) Mg

53. How many spectral lines are emitted from a hydrogen atom excited to the state designated by the principal quantum number, n=3?

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

2000

54. Which one of the following statements is correct about the Millikan Oil Drop experiment?

A) It demonstrated that most of the mass and positive charge of the atom are located in small region called nucleus.
B) It measured the mass to charge ratio of the atom.

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C) It determined the magnitude of the electron charge
D) It measured the mass of neutron.

55) Which of the following statement is NOT correct about quantum mechanical model of the atom?

A) The energy and the position of an electron can not be determined simultaneously.
B) Lower energy orbitals are filled with electrons before higher energy orbitals.
C) When filling orbitals of equal energy, two electrons will occupy the same orbital before filling a new orbital
D) No two electrons can have the same four quantum numbers.

56) How many electrons can fit to the orbital that comprise the quantum shell ($n=3$)?

A) 2
B) 8
C) 9
D) 8

57) Which of the following has 45 neutrons, 38 protons and 36 electrons?

A) $^{80}_{35}Hg$
B) $^{103}_{45}Rh^-$
C) $^{80}_{35}Br$
D) $^{71}_{35}Lu^-$

58. A neutral atom X at its ground state has half filled 4f orbital. What is the atomic number of X?

A) 45
B) 71
C) 63
D) 57

59. Which of the following configuration for the electrons in p orbital of carbon atom satisfies Hund's rule?

A) ↿⇂ _
B) ↿⇂ ↿ _
C) ↿ ↿ ↿
D) ↿⇂ ↿ ↿

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60. Which of the following sets of quantum numbers identify the outer most electron in oxygen atom?

	n	l	ml	ms
A)	2	1	1	+½
B)	2	1	2	-½
C)	3	0	0	+½
D)	2	0	-1	-½

61. Which one of the following is a correct prediction about the period and group of the periodic table the element $^{70}_{31}X$ belongs and the number of unpaired electron it has?

	Period	Group	No of unpair electron
A)	4	VIIA	2
B)	5	V A	1
C)	4	V A	3
D)	4	III A	1

62. Which of the following statement is true about atomic radii and ionic radii of alkali metals?

A) Atomic radii decreases while ionic radii increases as you go down the group.
B) Both atomic radii and ionic radii increases as you go down the group.
C) Atomic radii increases while ionic radii decreases as you go down the group.
D) Both ionic radii and atomic radii decreases as you go down the group.

1999

63. Which conclusion is based on Rutherford's gold foil experiment and the resulting model of the atom?

A) An atom is mainly an empty space, and the nucleus has a positive charge.
B) An atom is mainly an empty space, and the nucleus has a negative charge.

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C) An atom has hardly an empty space, and the nucleus has a positive charge
D) An atom has hardly an empty space, and the nucleus has negative charge

64. Which atom in the ground state has three half-filled Orbitals?

A) P
B) Si
C) Al
D) Li

65. For alkali earth metals, the first ionization energy:

A) increases sharply down the group
B) increases slightly down the group
C) decreases down the group
D) decreases from beryllium to magnesium and increases from magnesium to calcium

66. Which element of Group IV A forms the most acidic oxide?

A) Carbon
B) Silicon
C) Germanium
D) Tin

67. Which of the following diagrams describes the electron density in the $d_{x^2-y^2}$ orbital?

[USE Question #5 choice]

68. What is the electron configuration of N^{3-}?

A) $1s^2 2s^2 2p^3$
B) $1s^2 2s^2 2p^4$
C) $1s^2 2s^2 2p^6$
D) $1s^2 2s^2 2p^5$

69. A $^{59}_{27}Co^{+2}$ ion has

	protons	Neutrons	electrons
A)	27	32	25
B)	27	30	25
C)	25	34	27
D)	27	32	27

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70. Which list of elements are arranged in order of increasing atomic radii?

A) Li, Be, B, C
B) Sr, Ca, Mg, Be
C) Sc, Ti, V, Cr
D) F, Cl, Br, I

1998

71. How many orbitals are in an atomic sublevel with $\ell = 3$?

A) 3
B) 7
C) 5
D) 9

72. As atomic number increases within a group, what happens to the electronegativity of the elements?

A) The electronegativity increases because the atomic number increases
B) The electronegativity decreases because the atomic size increases
C) The electronegativity increases because the number of energy levels increases
D) The electronegativity decreases because the atomic number increases

73. Which element of group IV A forms the most acidic oxide?

A) Si
B) C
C) Sn
D) Pb

74. Which region of the electromagnetic spectrum is capable of inducing electron transitions with the greatest energy?

A) Infrared
B) Microwave
C) Ultraviolet
D) Visible

75. A $^{52}_{24}Cr^{+2}$ ion has

	protons	neutrons	electrons
A)	22	30	24
B)	24	28	22
C)	24	54	22
D)	24	28	26

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1997

76. Which one of the following sets of quantum numbers could be those of the last electron of Mo (At. No. = 42)

A) $n=4, \ell=0, m_\ell=0, m_s=+\frac{1}{2}$
B) $n=5, \ell=0, m_\ell=0, m_s=+\frac{1}{2}$
C) $n=4, \ell=2, m_\ell=-1, m_s=+\frac{1}{2}$
D) $n=3, \ell=2, m_\ell=0, m_s=+\frac{1}{2}$

77. What did Rutherford conclude from the experiments he carried out in which a beam of alpha particles was directed at a thin piece of metal foil?

A) The positively charged parts of atoms are moving about with velocity approaching the speed of light.
B) The positively charged parts of atoms are extremely small and extremely heavy particles.
C) The diameter of an electron is approximately equal to that of nucleus.
D) Electrons travel in circular orbits around the nucleus.

78. Which of the following is not true about halogens?

A) They are non-metals
B) They show the -1 oxidation states in most of their compounds
C) Their compounds with metals are generally ionic in nature
D) The electronic configuration of their outer most electron is ns^2np^6

79. What are the numbers of protons, neutrons and electrons respectively in $^{79}_{34}Se^{-2}$?

A) 32, 34, 79
B) 34, 45, 36
C) 34, 36, 79
D) 34, 45, 32

80. Natural copper consists of Cu-63 and Cu-65. What is the % abundance of Cu-63 if the average mass of Cu is 63.5?

A) 25 B) 33 C) 50 D) 75

81. All of the following statements concerning the characteristics of the halogens are true except?
A) The first ionization energies decrease as the atomic number of the halogens increase.
B) Flourine is the best oxidizing agent.
C) Flourine atoms have the smallest radii
D) Iodine liberates free bromine from a solution of bromide ion

82. Elements with electron configuration $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^5$ is found in which period and group of the periodic table respectively?
A) 4, VB
B) 4, IV B
C) 4, VI A
D) 4, I B

1996

83. In which case are the metals arranged in order of increasing metallic character?
A) Mg, Ca, K, Cs
B) Ca, Mg, K, Cs
C) Mg, Ca, Cs, K
D) K, Mg, Ca, Cs

84. Which member of group IV A forms the most basic oxide?
A) C
B) Si
C) Sn
D) Pb

85. In which pair of elements do the nuclei of the atoms contain the same number of neutrons?
A) $^{7}_{3}Li$ and $^{9}_{4}Be$
B) $^{23}_{11}Na$ and $^{24}_{12}Mg$
C) $^{14}_{7}N$ and $^{16}_{8}O$
D) $^{32}_{16}S$ and $^{35}_{17}Cl$

86. The hydrogen line spectrum provides evidence for the
A) Heisenberg Uncertainity Principle
B) wave like properties of light
C) diatomic nature of H_2
D) quantized nature of atomic energy states.

87. What is the complete chemical symbol for the ion that contains 19 protons, 18 electrons and 20 neutrons

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A) $^{38}_{19}K^+$

B) $^{40}_{20}K^+$

C) $^{39}_{19}K^+$

D) $^{29}_{20}K^{+1}$

1993

88. If the mass of the neutron were half of its actual mass, and that of the electron were twice its actual mass, then the mass of one atom $^{32}_{16}S$ would be, approximately ____

A) Unchanged

B) decreased by 25%

C) Increased by 75%

D) doubled

89. Which of the following should have the largest atomic radii?

A) Na^{+1}

B) F^-

C) Al^{+3}

D) Mg^{+2}

90. Natural copper (Cu) is a mixture of only two isotopes, one of which has 29 protons, 34 neutrons and a relative abundance of 69.17%. The relative atomic mass of natural copper is 63.6. How many neutrons must be there in the second isotope?

A) 29

B) 36

C) 32

D) 35

91. Which of the following is true about alkali earth metals?

A) Reactivity decreases down the group

B) All of them react with water

C) melting point decreases down the group.

D) Atomic radius decreases down the group.

92. Which set is arranged in order of decreasing radii?

A) $Na > Na^+ > Mg^{+2} > Al^{+3}$

B) $Na > Mg^{+2} > Na > Al^{+3}$

C) $Na^+ > Na > Mg^{+2} > Al^{+3}$

D) $Al^{+3} > Mg^{+2} > Na^+ > Na$

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93. The pauli exclusion principle -
A) tells the energy of an electron
B) tells the shape of an electron
c) describes the position of an electron in space
D) limits the number of an electron in an orbital two

94. Which idea is inconsistent with Bohr's model of atomic structure?
A) Absorbtion spectra occurs at specific energies
B) Heisenberg's uncertainity principle
C) The photoelectric effect
D) The discovery of neutron

95. An ion isoelectronic with Ar is ____
A) Na^+
B) Mg^{+2}
C) O^{-2}
D) S^{-2}

96. Which law states "It is impossible for two electrons with the same spin quantum to be in the same orbitals?
A) Hund's rule
B) Uncertainity principle
C) Pauli exclusion principle
D) Anfbau principle

2008

97. Which of the following are NOT electromagnetic waves?
A) Infrared waves
B) Gamma waves
C) Radio waves
D) Sound waves

98. What is the distance that a radio wave will travel in 0.250 sec?
A) $1.2 \times 10^7 m$
B) $12 \times 10^7 m$
C) $7.5 \times 10^7 m$
D) $5.6 \times 10^7 m$

99. What values of l are permitted for an electron with $n = 4$?
A) 1,2,3
B) 1,2,3,4
C) 0,1,2,3,4
D) 0,1,2,3

100. Which of the following electrons, identified only by their n and l quantum numbers have the highest energy?
A) $n=3$, $l=2$
B) $n=4$, $l=1$
C) $n=4$, $l=2$
D) $n=3$, $l=0$

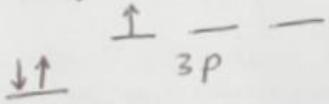
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101. What is the maximum number of unpaired electrons in d subshell?
A) 2 C) 3
B) 5 4) 4

102. Which of the following types of rays combine to form atoms of helium?
A) gamma (γ) rays C) Alpha (α) rays
B) beta (β) rays 2) X-rays

103. What is the relationship between frequency (υ), wavelength (λ) and speed of light (c)?
A) $\lambda/\upsilon = c$ C) $hc/\lambda = \upsilon$
B) $\upsilon c = h\lambda$ D) $c = \upsilon\lambda$

104. The following energy level diagram represents the outermost shell of what ground state element?



A) B C) Al
B) He D) Be

105. What is the magnitude of quantum of energy and the frequency for an object whose wavelength is 0.6×10^{-6} m?
A) 3.31×10^{-19} J, 5×10^{14} s^{-1} C) 1.99×10^{-25} J, 3.98×10^{-40} s^{-1}
B) 3.98×10^{-40} J, 2×10^{-15} s^{-1} D) 9.94×10^{-12} J, 1.99×10^{-25} s^{-1}

106. What new concept did Bohr adapts and use to formulate his model of the atom?
A) Electromagnetic theory developed by Maxwell
B) The quantum concept developed by Plank
C) Photoelectric theory developed by Thomson
D) Neutron theory developed by Chadwick

2009

107. Which of the following transitions will have minimum wavelength?
A) $n_4 \rightarrow n_1$ C) $n_4 \rightarrow n_2$
B) $n_2 \rightarrow n_1$ D) $n_3 \rightarrow n_1$

108. What is the energy associated with one photon of microwave radiation having a frequency of 2.45×10^9 s^{-1}?
A) 1.62×10^{24} J C) 2.45×10^{-9} J
B) 2.45×10^{9} J D) 1.62×10^{-24} J

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108. What is frequency of a radiation (in Hz) from an atom if its wavelength is 1.0×10^{-9} nm?

A) 3.3×10^{-27}
B) 3.0×10^{17}
C) 3.0×10^{8}
D) 3.0×10^{26}

109. Which of the following particle was discovered by the cathode ray experiment?

A) electron
B) neutron
C) nucleus
D) proton

111. Heisenberg Uncertainty principle states that

A) Two atoms of the same element must have the same number of protons
B) No two electrons in the same atom can have the same set of four quantum numbers.
C) It is impossible to determine both position and momentum of an electron simultaneously
D) Electrons of atoms in ground state enter energetically equivalent set of orbitals singly before they pair up in any orbitals of the set.

112. What is the ground state electronic configuration for Zn^{+2}?

A) $[Ar]\ 4s^1 3d^8$
B) $[Ar]\ 4s^2 3d^7$
C) $[Ar]\ 4s^1 3d^{10}$
D) $[Ar]\ 3d^{10}$

113. Which of the following is the correct order for electrons filling in orbitals?

A) 3s, 3p, 4s, 3d
B) 2p, 3s, 3p, 3d
C) 3p, 4s, 3d, 5s
D) 4s, 3d, 4p, 4d

114. The normal human eyes responds to visible light of wave length ranging from 390 to 710nm. What is the frequency range of the human eye?

A) $7.7 \times 10^{14}\ s^{-1}$ to $4.2 \times 10^{14}\ s^{-1}$
B) $4.2 \times 10^{14}\ s^{-1}$ to $7.7 \times 10^{14}\ s^{-1}$
C) $1.3 \times 10^{-15}\ s^{-1}$ to $2.4 \times 10^{-15}\ s^{-1}$
D) $2.4 \times 10^{-15}\ s^{-1}$ to $1.3 \times 10^{-15}\ s^{-1}$

115. How many different types of orbitals in the third energy level?

A) 2
B) 3
C) 6
D) 7

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116. Who used the cathode ray tube to discover the electron and determine its charge to mass ratio?

A) Robert A. Millikan
B) James Chadwick
C) J. J. Thomson
D) Ernest Rutherford

116. Which quantum number is used to determine subshells?

A) Principal quantum number
B) Magnetic quantum number
C) Spin quantum number
D) Azimuthal quantum number

117. The maximum kinetic energy of a photoelectron emitted from a metal is 1.03×10^{-19} J when light that has a 658nm wavelength shines on the surface. What is the threshold frequency for this metal?

A) $4.57 \times 10^{14} s^{-1}$
B) $3.02 \times 10^{14} s^{-1}$
C) $3.02 \times 10^{-14} s^{-1}$
D) $4.57 \times 10^{14} s^{-1}$

118. What is the maximum number of electrons in an atom that can have the principal quantum number $n=4$?

A) 32
B) 8
C) 32
D) 18

119. Which of the following is fundamentally different from the others?

A) Light waves
B) Radio waves
C) Sound waves
D) micro waves

120. Which of the following correctly lists electromagnetic waves in order from shortest to longest wavelength?

A) microwaves, ultraviolet, visible light, gamma rays
B) gamma rays, ultraviolet, infrared, microwaves
C) radio waves, infrared, gamma rays, ultraviolet
D) gamma rays, infrared, ultraviolet, microwaves

121. What would be the length of a radio wave having a frequency of 3MHz?

A) 100nm B) 300m C) 100m D) 300nm

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127. Which of the following is NOT true about the photoelectric effect?

A) Most metals require UV light to emit electrons.

B) A bright light causes more electrons to be emitted than a weak light.

C) Higher frequency light emits electrons with higher kinetic energy

D) A bright light causes less electrons to be emitted than a weak light.

128. Which groups in the periodic table form ionic bonds?

A) Groups 1A and 7B, Groups 2A and 6B

B) " 1A and 7A, Groups 2A and 6A

C) " 1A and 8A, Groups 4B and 4A

D) Groups 3B and 5B, Groups 4B and 4A

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