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Class: XI
Subject: chemistry
Topic: Atomic Structure
No. of Questions: 20
Duration: 60 Min
Maximum Marks: 60

1. Assertion (A) On heating a solid for a longer time, radiations become white and then blue as the temperature becomes very high.
Reason (R) Radiations emitted go from a lower frequency to higher frequency as the temperature increases.

A. Both (A).and (R) are true and (R) is the correct explanation of (A).
B. Both (A) and (R) are true but (R) is not the correct explanatIon of (A).
C. (A) is true but (R) is false.
D. (A) is false but (R) is true.

Ans. A

2. Assertion (A) For n = 3, / maybe 0, 1 and 2 and m maybe 0; 0 ± 1; 0, ± l and ± 2.
Reason (R) For each value of n, there are 0 to (n 1) possible values of /; and for each value of /, there are 0 to ± 1 values of in.
A. Both (A).and (R) are true and (R) is the correct explanation of (A).
B. Both (A) and (R) are true but (R) is not the correct explanatIon of (A).
C. (A) is true but (R) is false.
D. (A) is false but (R) is true.

Ans. A

3. The frequency of a spectral transition is v for hydrogen. The frequency for the corresponding transition for Li+2 is
A. V
B. 2v
C. 3v
D. 9v

Ans. D
Solution:
The frequency is Z2 times higher. For Li, Z = 3. Hence the frequency of the emitted radiation is 3^2 ie 9 times higher

4. The designation of an orbital with n = 3 and l = 2 is

A. 3s
B. 3p
C. 3d
D. 4d

Ans. C

5. What is the correct orbital designatio n of an electron w ith quantum numbers?

$$n = 4,\ l = 3,\ m = -2,\ s = +\frac{1}{2}$$

A. 4s
B. 4d
C. 3f
D. 4f

Ans. D

Solution:

l = 3 represents f sublevel. The f sublevel of the fourth level (n = 4) is designated as 4f

6. Uncertainty in the position of a particle of mass 25g in space is 10-5 m. Uncertainty in its velocity is (h = 6.6 x 10^{-34} Js)

A. 2.1 x 10^{-34}
B. 0.5 x 10^{-34}
C. 2.1 x 10^{-28}
D. 0.5 x 10^{-23}

Ans. C

Solution:

$$\Delta x \times \Delta p = \frac{h}{4\pi} \qquad \text{i.e., } \Delta x \times m\Delta v = \frac{h}{4\pi}$$

where Δp, uncertaint y in momentum which is also equal to $m\Delta v$ where Δv is uncertaint y in velocit y

$$\Delta v = \frac{h}{4\pi\ m\ \Delta x} = \frac{6.6\times10^{-34}}{4\times3.14\times25\times10^{-3}\times10^{-5}} = 2.1\times10^{-28}\ ms^{-1}$$

7. Orbital angular momentum of an electron in 2p orbital is

A. $\frac{h}{4\pi}$
B. Zero
C. $\frac{h}{2\pi}$
D. $\frac{\sqrt{2}h}{2\pi}$

Ans. D

Solution:

$$\text{Orbital angular momentum} = \sqrt{\ell(\ell+1)}\ \frac{h}{2\pi}$$

For 2p orital, $\ell = 1$

$$\therefore \text{Orbital angular momentum} = \sqrt{1(1+1)}\ \frac{h}{2\pi} = \frac{\sqrt{2}h}{2\pi}$$

8. The number of 3d electrons which can have the s value $-\frac{1}{2}$ are

A. 10
B. 5
C. 15
D. 30

Ans. B
Solution:
In d sublevel 5 orbitals are present. They can accommodat e a maximum of 10 electrons Five of them will have clockwise spin and the remaining five will have anticlockw ise spin. Hence 5 electrons in 3d orbitals have spin value $-\frac{1}{2}$

9. Bohr model of atom is contradicted by

A. Pauli's exclusion principle
B. Planck quantum theory
C. Heisenberg's uncertainty principle
D. Metallic conductivity

Ans. C
Solution:
According to Bohr model of an atom the position and momentum of an electron can be determined accurately. However according to
Heisenberg's uncertainty principle, simultaneous determination of the position and momentum of an electron is not possible

10. The correct set of quantum numbers for the unpaired electron of the chlorine atom is

	n	l	m
A.	2	1	0
B.	2	1	1
C.	3	1	1
D.	3	0	0

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Ans. C
Solution:
The electron in the 3pz orbital is unpaired. The quantum number for the 3pz orbital is n = 3, l = 1. This combination is found in the option 3

11. Which one of the following groupings represents a collection of isoelectronic species? (Atomic numbers.: Cs: 55, Br: 35)
A. Na+, Ca2+, Mg2+
B. N3- , F-, Na+
C. Be, Al3+, Cl-
D. Ca2+, Cs+, Br

Ans. B
Solution:
All the ions in the grouping N^{3-} and F- Na^{+} contains 10 electrons each

12. Assertion (A) Electronic configuration of K(19) is $1s^2\ 2s^2\ 2p^6\ 3s^2 3p^6\ 4s^1$
Reason (R) Energy of 4s <3d, hence 4s is filled before 3d as decided by Aufbau rule.
A. Both (A).and (R) are true and (R) is the correct explanation of (A).
B. Both (A) and (R) are true but (R) is not the correct explanatIon of (A).
C. (A) is true but (R) is false.
D. (A) is false but (R) is true.

Ans. A

13. Neutron was discovered by
A. J. J. Thomson
B. James Chadwick
C. G.T. Seaborg
D. Rutherford

Ans.B
Solution:
When Chadwick bombarded berylium with á - particles neutrons were emitted. This experiment by Chadwick lead to the discovery of neutrons.

14. The magnetic quantum number m is fixed by the azimuthal quantum number. If 1 = 3, the type and number of orbitals are indicated by
A. d,5
B. f,7
C. s,1
D. p,3

Ans. B
Solution:
When l = 3, the orbital is designated as f. Further m values are - 3, -2, -1, 0, + 1, + 2, + 3. Thus the 7 values indicate the 7 orbitals. Thus option 2 indicates the f sublevel with 7 orbitals in it

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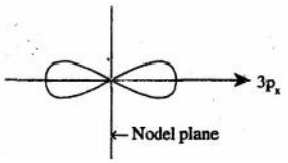
15. The number of nodal planes in 3px orbital is equal to
A. One
B. Two
C. Three
D. Zero
Ans. A
Solution:



The orbital $3p_x$ has one nodel plane where there is no electron density

16. The atomic number of Ni and Cu are 28 and 29 respectively. The electron configuration $1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^6$ $3d^{10}$represents
A. Cu^{2+}
B. Cu^{+}
C. Ni
D. Ni^{2+}
Ans. B
Solution:
When n = 3, l = 0, 1, 2. For l = 0, m value is 0. For l = 1, m values are -1, 0, +1
For l = 2, m values are -2, -1, 0, +1, +2.
Hence a total of 9 values for m are possible. Each value represents an otbital. Thus
n = 3 level contains 9 orbitals

17. Assertion (A) The plot of atomic number (y-axis) versus number of neutrons (x-axis) for stable nuclei shows a curvature towards xaxis from the line of 45° slope as the atomic number is increased.
Reason (R) Proton-proton electrostatic repulsions begin to overcome attractive forces involving protons and neutrons in heavier nuclides.
A. Both (A).and (R) are true and (R) is the correct explanation of (A).
B. Both (A) and (R) are true but (R) is not the correct explanatIon of (A).
C. (A) is true but (R) is false.
D. (A) is false but (R) is true.
Ans. A

18. The atomic mass of a metal is 27, and is atomic number is 13. The number of protons, electrons and neutrons present respectively are
A. 13, 13, 14
B. 14, 14, 13
C. 13, 14, 13
D. 14, 13, 14

Ans. A
Solution:

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A = Z+N A = 27, Z = 13, N = 14. Number of electrons = Number of protons = 13

19. The electronic configuration of P in H3PO3 (atomic number of P is 15)

A. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3$
B. $1s^2\ 2s^2\ 2p^6\ 3s^2$
C. $1s^2\ 2s^2\ 2p^6$
D. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1$

Ans. B
Solution:
Oxidation state of P is +5. (+3 + x - 8 = 0). Atomic number of P = 15. Hence,
P = 15. Hence P in H3PO3 contains 10 electrons

20. The wavelength of the radiation emitted, when in a hydrogen atom electron falls from infinity to stationary state1, would be (Rydberg constant = 1.097 x 107 m-1)

A. 406 nm
B. 192 nm
C. 91 nm
D. 9.1×10^{-8} nm

Ans. C
Solution:

$$\bar{\nu} = R\left(\frac{1}{1^2} - \frac{1}{\infty^2}\right) = 1.097 \times 10^7\ m^{-1}$$

$$\therefore \lambda = \frac{1}{\nu} = \frac{1}{1.097 \times 10^7} = 91.15 \times 10^{-9}\ m = 91\ nm$$