Classification of Elements and Periodicity in Properties

Question 1.
The group number, number of valence electrons, and valency of an element with the atomic number 15, respectively, are:
(a) 16, 5 and 2
(b) 15, 5 and 3
(c) 16, 6 and 3
(d) 15, 6 and 2

▼ Answer

Answer: (b) 15, 5 and 3
Explanation:
Atomic number (Z) = 15 = P → [Ne] $3s^2$ $3p^3$
Phosphorus belongs to 15th group
Number of valence electrons $3s^2$ $3p^3$ = 5 and valency = 3 in ground state.

Question 2.
The d-block elements consists mostly of
(a) Monovalent metals
(b) All non-metals
(c) Elements which generally form stoichiometric metal oxide
(d) Many metals with catalytic properties

▼ Answer

Answer: (d) Many metals with catalytic properties
Explanation:
Many metals with catalytic properties because (i) They provide surface area for reaction to occur (ii) They decreases the ionisation energy. (iii) They have vacant d-orbitals.

Question 3.
Which of the following has the highest boiling point?
(a) Ne
(b) Xe
(c) Ar
(d) Kr.

▼ Answer

Answer: (b) Xe
Explanation:
Xe has the highest atomic size and molecular weight. Hence, it has strong Vander Waals forces of attraction. Hence, it has the highest boiling point.

Question 4.
The chemistry of lithium is very similar to that of magnesium even though they are placed in different groups. Its reason is:
(a) Both are found together in nature
(b) Both have nearly the same size
(c) Both have similar electronic configuration
(d) The ratio of their charge and size (i.e. charge density) is nearly the same

▼ Answer

Answer: (d) The ratio of their charge and size (i.e. charge density) is nearly the same
Explanation:
The chemistry of lithium is very similar to that of magnesium even though they are placed in different groups because of diagonal relationship.

Question 5.
Which one of the following groupings represents a collection of isoelectronic species? (At. nos: Cs-55, Br-35)
(a) Na^+, Ca^{2+}, Mg^{2+}
(b) N^{3-}, F^-, Na^+
(c) Be, Al^{3+}, Cl^-
(d) Ca^{2+}, Cs^+, Br

▼ Answer

Answer: (b) N^{3-}, F^-, Na^+
Explanation:
Isoelectronic species are the neutral atoms, cations or anions of different elements which have the same number of electrons but different nuclear charge.
Number of electrons in N^{3-} = 7 + 3 = 10.
Number of electrons in F^- = 9 + 1 = 10
Number of electrons in Na^+ = 11 – 1 = 10.

Question 6.
Which of the following has the maximum number of unpaired electrons?
(a) Mg^{2+}
(b) Ti^{3+}
(c) V^{3+}
(d) Fe^{2+}

▼ Answer

Answer: (d) Fe^{2+}
Explanation:
Mg^{2+}: $1s^2\ 2s^2\ 2p^6$: no unpaired electron
Ti^{3+}: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^1$: one unpaired electron
V^{3+}: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^1$: two unpaired electrons
Fe^{2+}: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^6$: four unpaired electrons

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Question 7.
In the periodic table, the element with atomic number 16 will be placed in the group
(a) Third
(b) Fourth
(c) Fifth
(d) Sixth

▼ Answer

Answer: (d) Sixth
Explanation:
16-$1s^2 2s^2 2p^6 3s^2 3p^4$ there are $6e^-$ in outer most shell therefore its group is VIth A

Question 8.
Representative elements are those which belong to
(a) p and d – Block
(b) s and d – Block
(c) s and p – Block
(d) s and f – Block

▼ Answer

Answer: (c) s and p – Block
Explanation:
Elements in which all the inner shells are complete but outer shell is incomplete is known as representative elements i.e. Those elements which have less than 8 electrons in outermost shell are representative.
s and p block elements except inert gas is known as representative elements.

Question 9.
Which pair of elements belongs to same group?
(a) Elements with atomic no. 17 and 38
(b) Elements with atomic no. 20 and 40
(c) Elements with atomic no. 17 and 53
(d) Elements with atomic no. 11 and 33

▼ Answer

Answer: (c) Elements with atomic no. 17 and 53
Explanation:
Atomic no. 17(Cl) and 53 (I) are present in the same group

Question 10.
The most electronegative element of the periodic table is
(a) Iodine
(b) Sulphur
(c) Oxygen
(d) Fluorine.

▼ Answer

Answer: (d) Fluorine.
Explanation:
Fluorine is the most electronegative element. Fluorine has an electronegativity of 3.98 on the Pauling Electronegativity Scale and a valence of 1. A fluorine atom needs one electron to fill its outer electron shell and achieve stability, which is why free fluorine exists as the F^- ion.

Question 11.
In the third period of the Periodic Table the element having smallest size is
(a) Na
(b) Ar
(c) Cl
(d) Si

▼ Answer

Answer: (b) Ar
Explanation:
In the third period of the Periodic Table the element having smallest size is Ar.

Question 12.
The element with highest second ionization energy is
(a) Cl
(b) S
(c) Na
(d) Mg

▼ Answer

Answer: (c) Na
Explanation:
Sodium has 11 electrons which can be written as (2, 8, and 1). Its outer orbit has 1 electron When it is ionized for the first time, the outer most electron is removed very easily, so that it can form the electronic configuration of the nearest inert gas Neon (2, 8).
Neon has 8 electrons in its outermost orbit. Thus it is highly stable. Now, when the second electron is removed, a very very high amount of energy is required because it doesnt want to give away one of its outermost electron by disrupting its stability.
Thus, second ionization energy of sodium is extremely high.

Question 13.
Which of the following properties generally decreases along a period?
(a) Ionization Energy
(b) Metallic Character
(c) Electron Affinity
(d) Valency.

▼ Answer

Answer: (b) Metallic Character
Explanation:
The IE, EA increases along the period. The valency initially increases then decreases. The metallic character decreases along the period.

Question 14.
Increasing order of electronegativity is
(a) Bi < P < S < Cl
(b) P < Bi < S < Cl
(c) S < Bi < P < Cl
(d) Cl < S < Bi < P

▼ Answer

Answer: (a) Bi < P < S < Cl
Explanation:
Increasing order of electronegativity is Bi < P < S < Cl.

Question 15.
Which of the following oxides is amphoteric in character?
(a) SnO_2
(b) CO_2
(c) SiO_2
(d) CaO

▼ Answer

Answer: (a) SnO_2
Explanation:

CaO is basic; CO_2 is acidic; SiO_2 is weakly acidic. SnO_2 is amphoteric.

Question 16.
Which of the following statement is correct with respect to the property of elements with an increase in atomic number in the carbon family (group 14)
(a) Atomic size decrease
(b) Ionization energy increase
(c) Metallic character decrease
(d) Stability of +2 oxidation state increase

▼ Answer

Answer: (d) Stability of +2 oxidation state increase
Explanation:
As we go down the group inertness of ns^2 pair increase hence tendency to exhibit +2 oxidation state increases and that of +4 oxidation state decreases.

Question 17.
The elements which occupy the peaks of ionisation energy curve, are
(a) Na, K, Rb, Cs
(b) Na, Mg, Cl, I
(c) Cl, Br, I, F
(d) He, Ne, Ar, Kr

▼ Answer

Answer: (d) He, Ne, Ar, Kr
Explanation:
All the noble gases occupy the peaks of I.E. curve.

Question 18.
According to the periodic law of elements, the variation in properties of elements is related to their
(a) nuclear neutron – proton number ratios
(b) atomic masses
(c) nuclear masses
(d) atomic numbers

▼ Answer

Answer: (d) atomic numbers
Explanation:
The Periodic Law states that the physical and chemical properties of the elements recur in a systematic and predictable way when the elements are arranged in order of increasing atomic number.

Question 19.
The group number, number of valence electrons, and valency of an element with the atomic number 15, respectively, are:
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(b) 15, 5 and 3
(c) 16, 6 and 3
(d) 15, 6 and 2

▼ Answer

Answer: (b) 15, 5 and 3
Explanation:

Atomic number (Z) =15 =P → [Ne] $3s^2\ 3p^3$
Phosphorus belongs to 15th group
Number of valence electrons $3s^2\ 3p^3$ = 5 and valency = 3 in ground state.

Question 20.
A sudden large jump between the values of second and third ionisation energies of an element would be associated with the electronic configuration
(a) $1s^2, 2s^2p^6, 3s^1$
(b) $1s^2, 2s^2p^6, 3s^2p^1$
(c) $1s^2, 2s2p^6, 3s^2$
(d) $1s^2, 2s^2p^6, 3s^2p^2$

▼ Answer

Answer: (c) $1s^2, 2s2p^6, 3s^2$
Explanation:
$1s^2, 2s2p^6, 3s^2$ – In III transition e^- is to be removed from stable configuration.
