

Redox Reactions & Hydrogen & Environmental Chemistry

1. Given below are two statements :

Statement I : H_2O_2 can act as both oxidising and reducing agent in basic medium.

Statement II : In the hydrogen economy, the energy is transmitted in the form of dihydrogen.

In the light of the above statement, choose the correct answer from the options given below:

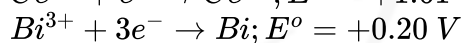
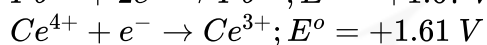
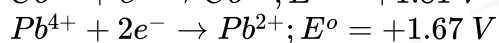
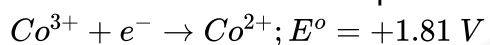
- A.** Both statement I and statement II are false
 - B.** Statement I is true but statement II is false
 - C.** Both statement I and statement II are true
 - D.** Statement I is false but statement II is true
2. An example of a disproportionation reaction is:
- A.** $2KMnO_4 \rightarrow K_2MnO_4 + MnO_2 + O_2$
 - B.** $2MnO_4^- + 10I^- + 16H^+ \rightarrow 2Mn^{2+} + 5I_2 + 8H_2O$
 - C.** $2CuBr \rightarrow CuBr_2 + Cu$
 - D.** $2NaBr + Cl_2 \rightarrow 2NaCl + Br_2$

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3. In order to oxidise a mixture of one mole of each of FeC_2O_4 , $Fe_2(C_2O_4)_3$, $FeSO_4$ and $Fe_2(SO_4)_3$ in acidic medium, the number of moles of $KMnO_4$ required is :

- A. 2
- B. 1
- C. 3
- D. 1.5

4. Given standard reduction potentials:



oxidizing power of the species will increase in the order:

- A. $Ce^{4+} < Pb^{4+} < Bi^{3+} < Co^{3+}$
- B. $Bi^{3+} < Ce^{4+} < Pb^{4+} < Co^{3+}$
- C. $Co^{3+} < Ce^{4+} < Bi^{3+} < Pb^{4+}$
- D. $Co^{3+} < Pb^{4+} < Ce^{4+} < Bi^{3+}$

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5. Given that $E_{O_2/H_2O}^o = +1.23V$;

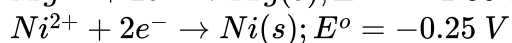
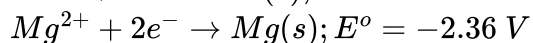
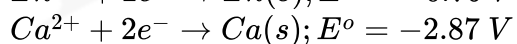
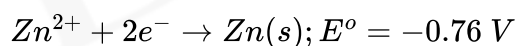
$$E_{S_2O_8^{2-}/SO_4^{2-}}^o = 2.05V$$

$$E_{Br_2/Br^-}^o = +1.09V$$

$$E_{Au^{3+}/Au}^o = +1.4V$$

The strongest oxidising agent is:

- A. Au^{3+}
 - B. O_2
 - C. $S_2O_8^{2-}$
 - D. Br_2
6. Consider the following reduction processes:



The reducing power of the metals increases in the order:

- A. $Ca < Zn < Mg < Ni$
- B. $Ni < Zn < Mg < Ca$
- C. $Zn < Mg < Ni < Ca$
- D. $Ca < Mg < Zn < Ni$

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7. In the reaction of oxalate with permanganate in acidic medium, the number of electrons involved in producing one molecule of CO_2 is:
- A. 1
 - B. 10
 - C. 2
 - D. 5
8. Dihydrogen of high purity (>99.95%) is obtained through:
- A. The electrolysis of acidified water using *Pt* electrodes.
 - B. The electrolysis of warm $Ba(OH)_2$ solution using *Ni* electrodes.
 - C. The reaction of *Zn* with dilute *HCl*
 - D. The electrolysis of brine solution.
9. The metal that gives hydrogen gas upon treatment with both acid as well as base is :
- A. Zinc
 - B. Iron
 - C. Magnesium
 - D. Mercury

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10. Hydrogen has three isotopes (A), (B) and (C). If the number of neutron(s) in (A), (B) and (C) respectively, are (x), (y) and (z), the sum of (x), (y) and (z) is :
- A. 4
 - B. 3
 - C. 2
 - D. 1
11. NaH is an example of:
- A. Electron-rich hydride
 - B. Molecular hydride
 - C. Saline hydride
 - D. Metallic hydride
12. The total number of isotopes of hydrogen and number of radioactive isotopes among them, respectively, are :
- A. 2 and 0
 - B. 3 and 2
 - C. 3 and 1
 - D. 2 and 1

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13. 5 g of zinc is treated separately with an excess of
 (a) dilute hydrochloric acid and
 (b) aqueous sodium hydroxide.

The ratio of the volumes of H_2 evolved in these two reactions is :

- A. 1 : 1
 - B. 2 : 1
 - C. 1 : 4
 - D. 1 : 2
14. The synonym for water gas when used in the production of methanol is:
- A. Natural gas
 - B. Laughing gas
 - C. Syn gas
 - D. Fuel gas
15. The temporary hardness of water is due to:
- A. $Ca(HCO_3)_2$
 - B. $NaCl$
 - C. Na_2SO_4
 - D. $CaCl_2$

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16. The one that is NOT suitable for the removal of permanent hardness of water is :
- A. Treatment with sodium carbonate
 - B. Calgon's method
 - C. Clark's method
 - D. Ion-exchange method
17. The type of pollution that gets increased during the day time and in the presence of O_3 is
- A. Reducing smog
 - B. Acid rain
 - C. Global warming
 - D. Oxidising smog
18. The green house gas/es is (are):
(A) Carbon dioxide (B) Oxygen
(C) Water vapour (D) Methane

Choose the most appropriate answer from the options given below:

- A. (A), (C) and (D) only
- B. (A) and (B) only
- C. (A) and (C) only
- D. (A) only

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19. Reducing smog is a mixture of

- A. Smoke, fog and $CH_2 = CH - CHO$
- B. Smoke, fog and SO_2
- C. Smoke, fog and N_2O_3
- D. Smoke, fog and O_3

20. Which of the following statement(s) is/(are) incorrect reason(s) for eutrophication?

- (1) Excess usage of fertilisers
- (2) Excess usage of detergents
- (3) Dense plant population in water bodies
- (4) Lack of nutrients in water bodies that prevent plant growth

Choose the most appropriate answer from the options given below.

- A. (4) Only
- B. (1) only
- C. (2) and (4) only
- D. (3) only

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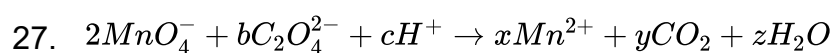
21. (A) Methane leads to both global warming and photochemical smog
 (B) Methane is generated from paddy fields
 (C) Methane is a stronger global warming gas than CO_2
 (D) Methane is a part of reducing smog

The statements that are true :

- A.** (A), (B), (C) only
- B.** (A), (B), (D) only
- C.** (A) and (B) only
- D.** (B), (C), (D) only
22. Which one of the following statements is not correct?
- A.** Eutrophication leads to increase in the oxygen level in water
- B.** Eutrophication indicates that water body is polluted
- C.** Eutrophication leads to anaerobic conditions
- D.** The dissolved oxygen concentration below 6 ppm inhibits fish growth
23. Biochemical Oxygen Demand (BOD) is the amount of oxygen required (in ppm):
- A.** for the photochemical breakdown of waste present in 1 m^3 volume of a water body.
- B.** by bacteria to break-down organic waste in a certain volume of a water sample.
- C.** for sustaining life in a water body.
- D.** by anaerobic bacteria to break down inorganic waste present in a water body.

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24. The statement that is not true about ozone is:
- A. in the stratosphere, CFCs release chlorine free radicals (Cl) which reacts with O_3 to give chlorine dioxide radicals.
 - B. in the stratosphere, it forms a protective shield against UV radiation.
 - C. It is a toxic gas and its reaction with NO gives NO_2
 - D. in the atmosphere, it is depleted by CFCs.
25. Thermal power plants can lead to :
- A. Eutrophication
 - B. Acid rain
 - C. Ozone layer depletion
 - D. Blue baby syndrome
26. The correct statement(s) among (a) - (b) regarding acid rain is (are):
- (a) It can corrode water pipes
 - (b) It can damage structures made up of stone.
 - (c) It cannot cause respiratory ailments in animals
 - (d) It is not harmful for trees
- A. (a), (c) and (d)
 - B. (c) and (d)
 - C. (a), (b) and (d)
 - D. (c) only



If the above equation is balanced with integer coefficients, the value of c is

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(Round off to the nearest Integer)

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28. When 10 mL of an aqueous solution of Fe^{2+} ions was titrated in the presence of dil H_2SO_4 using diphenylamine indicator, 15 mL of 0.02 M solution of $K_2Cr_2O_7$ was required to get the end point. The molarity of the solution containing Fe^{2+} ions is $x \times 10^{-2} M$. The value of x is _____. (Nearest integer)
29. In basic medium, CrO_4^{2-} oxidises $S_2O_3^{2-}$ to form $Cr(OH)_4^-$ and SO_4^{2-} . How many mL (nearest integer) of 0.154 M CrO_4^{2-} are required to react with 40.0 mL of 0.246 M $S_2O_3^{2-}$?
- [Hint : $0.0154 M = 0.154 \times 3 N CrO_4^{2-}$ and $0.246 M = 0.246 \times 8 N S_2O_3^{2-}$]
30. The volume strength of 8.9 M H_2O_2 solution calculated at 273 K and 1 atm is _____. ($R = 0.0821 L atm K^{-1} mol^{-1}$) (rounded off to the nearest integer)