JEE(MAIN) - 2013

CHEMISTRY

Read the instructions carefully:

Important Instructions:

1	Immediately fill in the particulars on this page of the Test Booklet with *Blue/Black Ball Point Pen. Use of pencil is strictly prohibited*.
2.	The test is of **3 hours duration.**
3.	This paper consists of **30** questions. The maximum marks are **120**.
4.	There are 30 questions in this paper which are equal weightage. Each question is allotted **4 (four)** marks for correct response.
5.	*Candidates will be awarded marks as stated above in instruction No. 4 for correct response of each question. (1/4) (one fourth) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.*
6.	There is only one correct response for each question. Filling up more than one response in any question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instruction 5 above.

1. An unknown alcohol is treated with the "Lucas reagent" to determine whether the alcohol is primary, secondary or tertiary. Which alcohol reacts fastest and by what mechanism:

(1) tertiary alcohol by S_N1

(2) secondary alcohol by S_N2

(3) tertiary alcohol by S_N2

(4) secondary alcohol by S_N1

2. The first ionization potential of Na is $5.1eV$. The value of electron gain enthalpy of Na^+ will be:

(1) $-5.1eV$

(2) $-10.2eV$

(3) $+2.55eV$

(4) $-2.55eV$

3. Stability of the species Li_2, Li, and Li, increases in the order of:

(1) $Li_2^- < Li_2^+ < Li_2$

(2) $Li_2 < Li_2^- < Li_2^+$

(3) $Li_2^- < Li_2 < Li_2^+$

(4) $Li_2 < Li_2^+ < Li_2^-$

4. The molarity of a solution obtained by mixing $750\,mL$ of $0.5(M)HCl$ with $250\,mL$ of $2(M)HCl$ will be:

(1) $1.00\,M$

(2) $1.75\,M$

(3) $0.975\,M$

(4) $0.875\,M$

5. Which of the following is the wrong statement?

(1) O_3 molecule is bent

(2) Ozone is violet-black in solid state

(3) Ozone is diamagnetic gas

(4) $ONCl$ and ONO^- are not isoelectronic

6. Four successive members of the first-row transition elements are listed below with atomic numbers. Which one of them is expected to have the highest $E^0_{M^{3+}/M^{2+}}$ value?

(1) $Mn(Z=25)$

(2) $Fe(Z=26)$

(3) $Co(Z=27)$

(4) $Cr(Z=24)$

7. A solution of $(-)-1-$chloro$-1-$ phenylethane is toluene racemizes slowly in the presence of a small amount of $SbCl_5$, due to the formation of:

(1) carbene

(2) carbocation

(3) free radical

(4) carbanion

8. The coagulating power of electrolytes having ions Na^+, Al^{3+} and Ba^{2+} for arsenic sulphide sol increases in the order:

(1) $Na^+ < Ba^{2+} < Al^{3+}$

(2) $Ba^{2+} < Na^+ < Al^{3+}$

(3) $Al^{3+} < Na^+ < Ba^{2+}$

(4) $Al^{3+} < Ba^{2+} < Na^+$

9. How many litres of water must be added to 1litre of an aqueous solution of HCl with a pH of 1 to create an aqueous solution with pH of 2 ?

(1) 0.9L

(2) 2.0L

(3) 9.0L

(4) 0.1L

10. Which one of the following molecules is expected to exhibit diamagnetic behaviour?

(1) N_2

(2) O_2

(3) S_2

(4) C_2

11. Which of the following arrangements does **not** represent the correct order of the property stated against it?

(1) $Ni^{2+} < Co^{2+} < Fe^{2+} < Mn^{2+}$: ionic size

(2) $Co^{3+} < Fe^{3+} < Cr^{3+} < Sc^{3+}$: stability in aqueous solution

(3) $Sc < Ti < Cr < Mn$: number of oxidation states

(4) $V^{2+} < Cr^{2+} < Mn^{2+} < Fe^{2+}$: paramagnetic behaviour

12. Experimentally it was found that a metal oxide has formula $M_{0.98}O$. Metal M, is present as M^{2+} and M^{3+} in its oxide. Fraction of the metal which exists as M^{3+} would be:

(1) 4.08%

(2) 6.05%

(3) 5.08%

(4) 7.01%

13. A compound with molecular mass 180 is acylated with CH_3COCl to get a compound with molecular mass 390. The number of amino groups present per molecule of the former compound is:

(1) 5

(2) 4

(3) 6

(4) 2

14. Given

$$E^0_{Cr^{3+}/Cr} = -0.74\,V; E^0_{MnO_4^-/Mn^{2+}} = 1.51V$$
$$E^0_{Cr_2O_7^{2-}/Cr^{3+}} = 1.33\,V; E^0_{Cl/Cl^-} = 1.36V$$

Based on the data given above, strongest oxidizing agent will be:

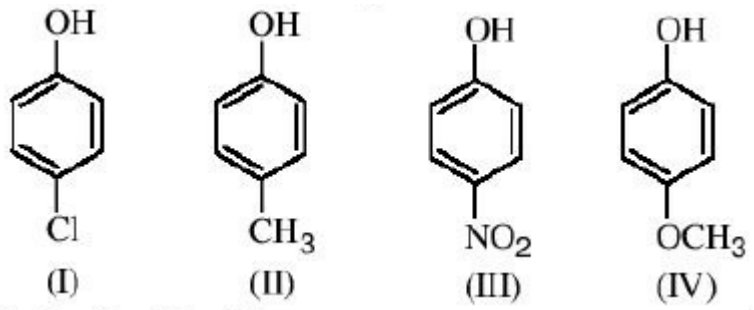
(1) Cr^{3+}

(2) Mn^{2+}

(3) MnO_4^-

(4) Cl^-

15. Arrange the following compounds in order of decreasing acidity:



(1) *I > II > III > IV*

(2) *III > I > II > IV*

(3) *IV > III > I > II*

(4) *II > IV > I > III*

16. The rate of a reaction doubles when its temperature changes from $300\,K$ to $310\,K$. Activation energy of such a reaction will be:

$\left(R = 8.314\,JK^{-1}\text{mol}^{-1} \text{ and } \log 2 = 0.301\right)$

(1) $48.6\,kJ\ \text{mol}^{-1}$

(2) $58.5\,kJ\ \text{mol}^{-1}$

(3) $60.5\,kJ\ \text{mol}^{-1}$

(4) $53.6\,kJ\ \text{mol}^{-1}$

17. Synthesis of each molecule of glucose in photosynthesis involves:

(1) 10 molecules of ATP

(2) 8 molecules of ATP

(3) 6 molecules of ATP

(4) 18 molecules of ATP

18. Which of the following complex species is not expected to exhibit optical isomerism?

(1) $\left[\mathrm{Co(en)_2Cl_2}\right]^+$

(2) $\left[\mathrm{Co(NH_3)_3Cl_3}\right]$

(3) $\left[\mathrm{Co(en)(NH_3)_2Cl_2}\right]^+$

(4) $\left[\mathrm{Co(en)_3}\right]^{3+}$

19. A piston filled with 0.04 mol of an ideal gas expands reversibly from 50.0 mL to 375 mL at a constant temperature of 37.0°C. As it does so, it absorbs 208 J of heat. The values of q and w for the process will be:

$(R = 8.314\,J/\mathrm{mol}\,K)(\ell n 7.5 = 2.01)$

(1) $q = -208J, w = -208J$

(2) $q = -208J, w = +208J$

(3) $q = +208J, w = +208J$

(4) $q = +208J, w = -208J$

20. A gaseous hydrocarbon gives upon combustion 0.72 g of water and 3.08 g of CO_2. The empirical formula of the hydrocarbon is:

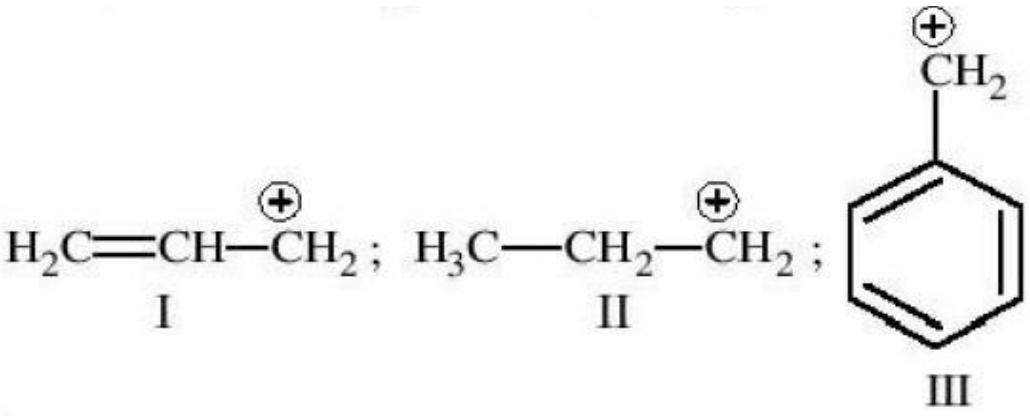
(1) C_3H_4

(2) C_6H_5

(3) C_7H_8

(4) C_2H_4

21. The order of stability of the following carbocations:



is:

(1) *II* > *III* > *I*

(2) *I* > *II* > *III*

(3) *III* > *I* > *II*

(4) *III* > *II* > *I*

22. Which of the following represents the correct order of increasing first ionization enthalpy for Ca, Ba, S, Se and Ar ?

(1) S < Se < Ca < Ba < Ar

(2) Ba < Ca < Se < S < Ar

(3) Ca < Ba < S < Se < Ar

(4) Ca < S < Ba < Se < Ar

23. For gaseous state, if most probable speed is denoted by C^*, average speed by $\overline{C}$ and mean square speed by C, then for a large number of molecules the ratios of these speeds are:

(1) $C^*:\overline{C}:C = 1.128:1.225:1$

(2) $C^*:\overline{C}:C = 1:1.128:1.225$

(3) $C^*:\overline{C}:C = 1:1.225:1.128$

(4) $C^*:\overline{C}:C = 1.225:1.128:1$

24. The gas leaked from a storage tank of the Union Carbide plant in Bhopal gas tragedy was:

(1) Methylamine

(2) Ammonia

(3) Phosgene

(4) Methylisocyanate

25. Consider the following reaction:

$$xMnO_4^- + yC_2O_4^{2-} + zH^+ \rightarrow xMn^{2+} + 2yCO_2 + \frac{z}{2}H_2O$$

The values of x, y and z in the reaction are, respectively:

(1) $2, 5 \text{ and } 8$

(2) $2, 5 \text{ and } 16$

(3) $5, 2 \text{ and } 8$

(4) $5, 2 \text{ and } 16$

26. Which of the following exists as covalent crystals in the solid state?

(1) Silicon

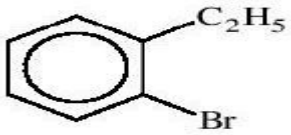
(2) Sulphur

(3) Phosphorous

(4) Iodine

27. Compound (A), C_8H_9Br, gives a white precipitate when warmed with alcoholic $AgNO_3$, Oxidation of (A) gives a acid (B), $C_8H_6O_4$. (B) easily forms anhydride on heating. Identify the compound (A).

(1)



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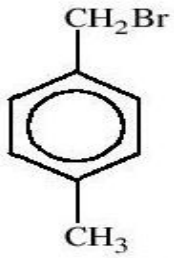

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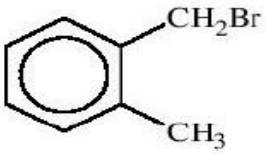

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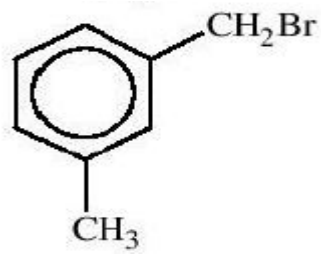


28. Energy of an electron is given by $E = -2.17810^{-18}\,\text{J}\left(\frac{Z^2}{n^2}\right)$ Wavelength of light required to excite an electron in an hydrogen atom from level $n = 1$ to $n = 2$ will be

$\left(h = 6.62\times10^{-34}\,Js \text{ and } c = 3.0\times10^{8}\,\text{ms}^{-1}\right)$

(1) $2.816\times10^{-7}\,\text{m}$

(2) $6500\times10^{-7}\,\text{m}$

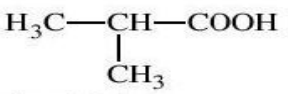
(3) $8.500\times10^{-7}\,\text{m}$

(4) $1.214\times10^{-7}\,\text{m}$

29. An organic compound A upon reacting with NH_3 gives B. On heating B gives C. C in presence of KOH reacts with Br_2 to give $CH_3CH_2NH_2$. A is

(1) $CH_3CH_2CH_2COOH$

(2)



(3) CH_3CH_2COOH

(4) CH_3COOH

30. In which of the following pairs of molecules/ions, both the species are not likely to exist?

(1) H_2^-, He_2^{2-}

(2) H_2^{2+}, He_2

(3) H_2^-, He_2^{2+}

(4) H_2^+, He_2^{2-}