Q1 - 24 January - Shift 1

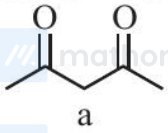
5 g of NaOH was dissolved in deionized water to prepare a 450 mL stock solution. What volume (in mL) of this solution would be required to prepare 500 mL of 0.1 M solution ?

Given : Molar Mass of Na, O and H is 23, 16 and 1 g mol^{-1} respectively

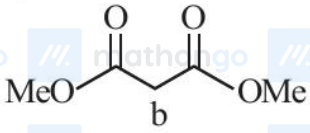
Space for your notes:

Q2 - 24 January - Shift 2

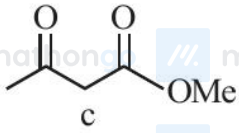
Which will undergo deprotonation most readily in basic medium?



a



b



c

(1) a only
(2) c only
(3) Both a and c
(4) b only

Space for your notes:

Q3 - 25 January - Shift 1

The density of a monobasic strong acid (Molar mass 24.2 g mol) is 1.21 kg L. The volume of its solution required for the complete neutralization of 25 mL of 0.24 M NaOH is _____ × 10^{-2} mL (Nearest integer)

Space for your notes:

Q4 - 29 January - Shift 2

An indicator 'X' is used for studying the effect of variation in concentration of iodide on the rate of reaction of iodide ion with H_2O_2 at room temp. The indicator 'X' forms blue colored complex with compound 'A' present in the solution. The indicator 'X' and compound 'A' respectively are

(1) Starch and iodine

(2) Methyl orange and H_2O_2

(3) Starch and H_2O_2

(4) Methyl orange and iodine

Space for your notes:

Q5 - 29 January - Shift 2

The volume of HCl, containing 73 g L^{-1}, required to completely neutralise NaOH obtained by reacting 0.69 g of metallic sodium with water, is _____ mL. (Nearest Integer)

(Given : molar Masses of Na, Cl, O, H are 23, 35.5, 16 and 1 g mol^{-1} respectively)

Space for your notes:

Q6 - 30 January - Shift 1

The number of electrons involved in the reduction of permanganate to manganese dioxide in acidic medium is .

Space for your notes:

Q7 - 30 January - Shift 2

$KMnO_4$ oxidises I^- in acidic and neutral/faintly alkaline solution, respectively to

(1) I_2 & IO_3^-

(2) IO_3^- & I_2

(3) IO_3^- & IO_3^-

(4) I_2 & I_2

Space for your notes:

Q8 - 01 February - Shift 1

25 mL of an aqueous solution of KCl was found to require 20 mL of 1 M $AgNO_3$ solution when titrated using K_2CrO_4 as an indicator. What is the depression in freezing point of KCl solution of the given concentration? _____ (Nearest integer).

(Given : $K_f = 2.0$ K kg mol^{-1})

Assume

1) 100% ionization and

2) density of the aqueous solution as 1 g mL^{-1}

Space for your notes:

Q9 - 01 February - Shift 2

Given below are two statements : one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : An aqueous solution of KOH when for volumetric analysis, its concentration should be checked before the use.

Reason (R) : On aging, KOH solution absorbs atmospheric CO_2.

In the light of the above statements, choose the correct answer from the options given below.

(1) **(A)** is not correct but **(R)** is correct

(2) Both **(A)** and **(R)** are correct but **(R)** is **not** the correct explanation of **(A)**

(3) Both **(A)** and **(R)** are correct and **(R)** is the correct explanation of **(A)**

(4) **(A)** is correct but **(R)** is not correct

Space for your notes:

Answer Key

(As per Official NTA Key released on 2 Feb)

Q1 (180)	**Q2** (1)	**Q3** (12)	**Q4** (1)
Q5 (15)	**Q6** (3)	**Q7** (1)	**Q8** (3)
Q9 (3)			

Q1 (180)

$$M = \frac{5}{40} \times \frac{1000}{450}$$

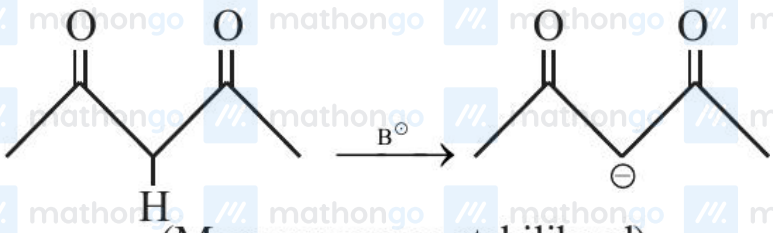
$$M_1V_1 = M_2V_2$$

$$\left(\frac{5}{40} \times \frac{1000}{450}\right) \times V_1 = 0.1 \times 500$$

$$V_1 = 180$$

Q2 (1)

Most easily deprotonation



(More resonance stabilibsed)

Q3 (12)

millimole of $NaOH = 0.24 \times 25$

$\therefore$ millimole of acid $= 0.24 \times 25$

$\Rightarrow$ mass of acid $= 0.24 \times 25 \times 24.2$ mg

for pure acid,

$$V = \frac{w}{d};\ (d = 1.21\ kg/L = 1.21\ g/ml)$$

$$\therefore V = \frac{0.24 \times 25 \times 24.2}{1.12} \times 10^{-3}$$

$$= 120 \times 10^{-3}\ ml$$

$$= 12 \times 10^{-2}\ ml$$

Q4 (1)

$$I^- + H_2O_2 \longrightarrow \underset{(A)}{I_2} + H_2O$$

$$I_2 + \underset{(Indicator)}{Starch} \longrightarrow Blue$$

Q5 (15)

Mole of Na $= \frac{0.69}{23} = 3 \times 10^{-2}$

$$Na + H_2O \longrightarrow NaOH + \frac{1}{2} H_2$$

By using POAC

Moles of NaOH $= 3 \times 10^{-2}$

NaOH reacts with HCl

No. of equivalent of NaOH = No. of equivalent of HCl

$$3 \times 10^{-2} \times 1 = \frac{73}{36.5} \times V(\text{in L}) \times 1$$

$V = 1.5 \times 10^{-2}$ L

Volume of HCl = 15 ml.

Q6 (3)

$$\overset{+7}{Mn}O_4^- + 4H^+ + 3e^- \longrightarrow \overset{+4}{Mn}O_2 + 2H_2O$$

Q7 (1)

In acidic medium

$$2MnO_4^- + 10I^- + 16H^+ \rightarrow 2Mn^{2+} + 5I_2 + 8H_2O$$

In neutral/faintly alkaline solution

$$2MnO_4^- + I^- + H_2O \rightarrow 2MnO_2 + 2OH^- + IO_3^-$$

Q8 (3)

$$KCl + AgNO_3 \rightarrow AgCl + KNO_3$$

$V=25ml$ $V=20ml$, $M = 1M$

At equivalence point,

mmole of KCl = mmole of $AgNO_3$

$= 20$ mmole

Volume of solution = 25 ml

Mass of solution = 25 gm

Mass of solvent
$= 25 - \text{mass of solute}$
$= 25 - [20 \times 10^{-3} \times 74.5]$
$= 23.51$ gm

$$\text{Molality of KCl} = \frac{\text{mole of KCl}}{\text{mass of solvent in kg}}$$

$$= \frac{20 \times 10^{-3}}{23.51 \times 10^{-3}} = 0.85$$

i of KCl = 2 (100% ionisation)

$\Delta T_f = i \times K_f \times m$

$= 2 \times 2 \times 0.85$

$= 3.4$

$\simeq 3$

Q9 (3)

KOH absorb CO_2

So its concentration should be checked.