

Name of Student

Roll No.

Problem 1

18 marks

Heterocyclic compounds

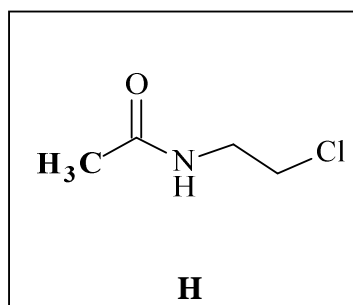
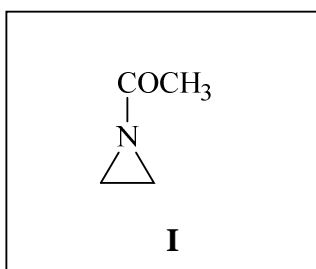
1.1

B, C

1.2

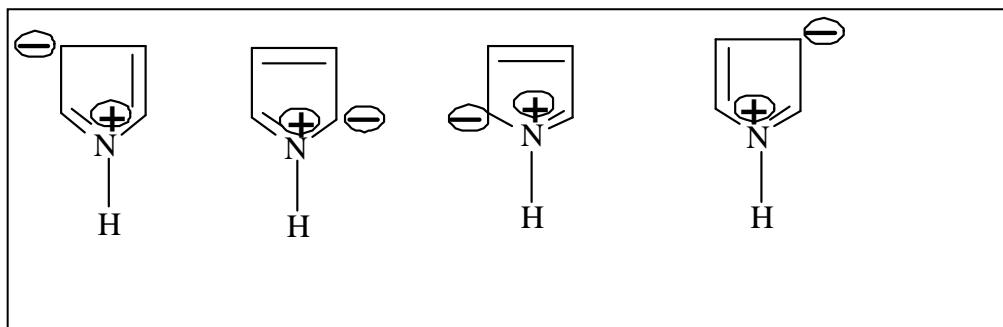
F > G > E

1.3

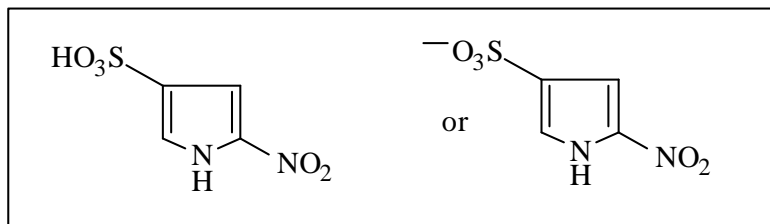


B.

1.4 a)



b)

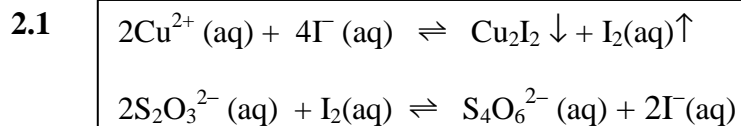


Problem 2

12 marks

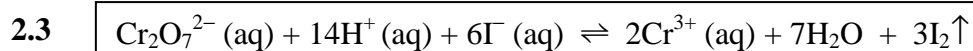
Analysis of alloys

A.



2.2

0.484 g of copper
70%



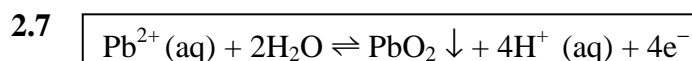
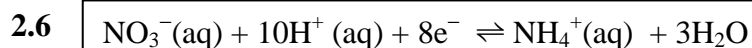
2.4

Molarity of thiosulphate = 0.0485 M

2.5

0.469 g of copper
Relative percentage deviation = 3.1%

B.



2.8

mmol of PbO_2 = 0.0132

2.9

Fraction of the total current = 36.1%.

C.

2.10

Amount of zinc = 0.184 g
Percentage = 26.8 % of zinc

Problem 3

18 Marks

Halogens

 3.1 (c) X

 3.2 (a) X

 (c) X

 3.3 No X

 3.4 (a)

 (b) (iii) X

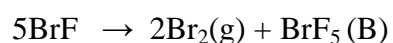
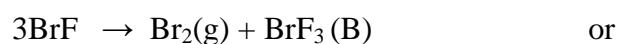
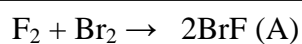
(c)

Solvent	Solubility	Solvent	Solubility
Carbon tetrachloride	19	n-Hexane	13
Diethyl ether	337	Toluene	182

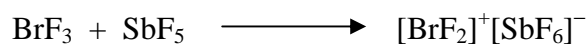
3.5

Solvent	λ_{\max}	Color
Carbon tetrachloride	520 - 540 nm	Bright violet
Diethyl ether	460 - 480 nm	Deep brown

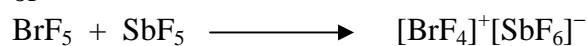
3.6



3.7



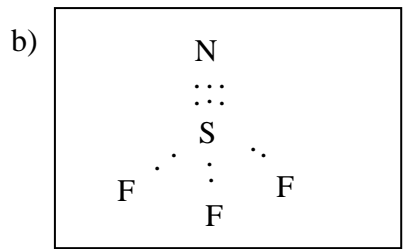
or



3.8

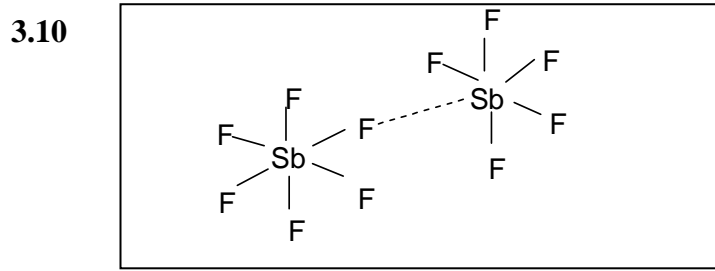
	Lewis Acid	Lewis Base
Reactants	SbF_5	F^-
Products	$\text{BrF}_2^+ / \text{BrF}_4^+$	SbF_6^-

3.9 a)



c)

d)



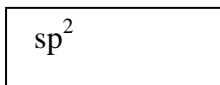
3.11

Problem 4

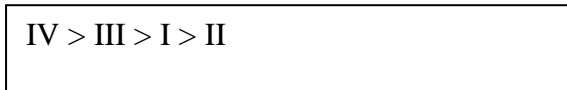
23 marks

Chemistry of carbocations

4.1



4.2



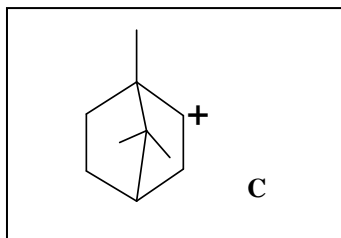
4.3

i) Yes

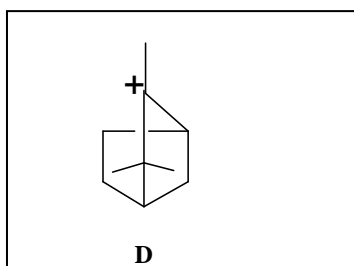
ii) No

iii) Yes

4.4



4.5



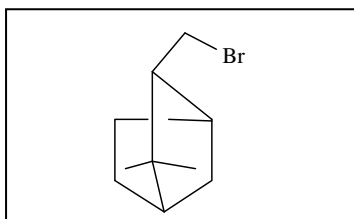
4.6

(iii)

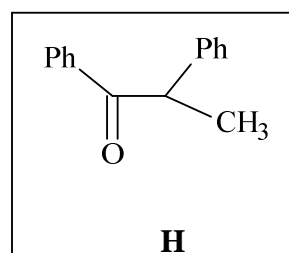
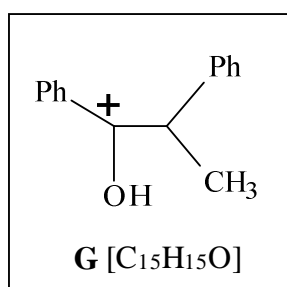
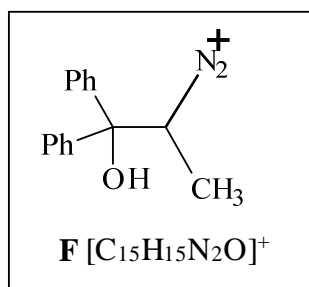
4.7

(ii)

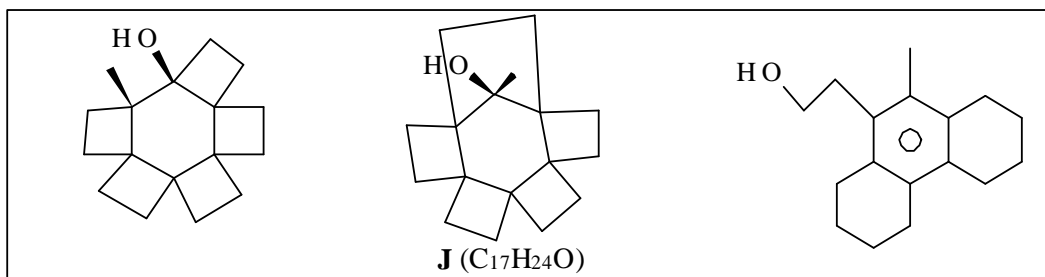
4.8



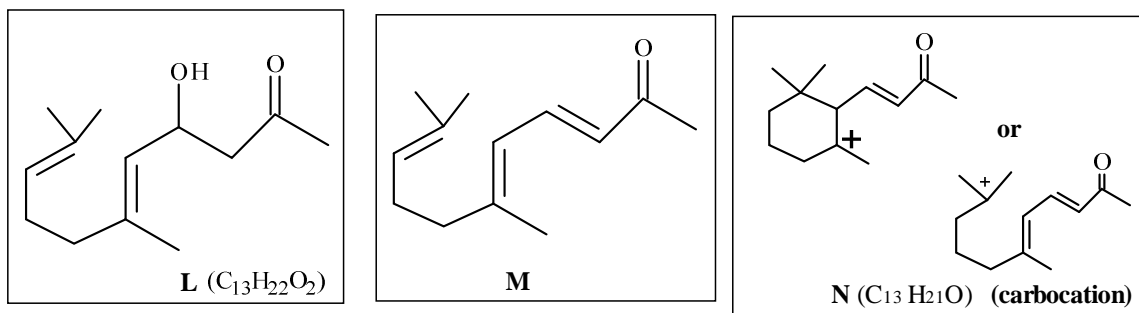
4.9



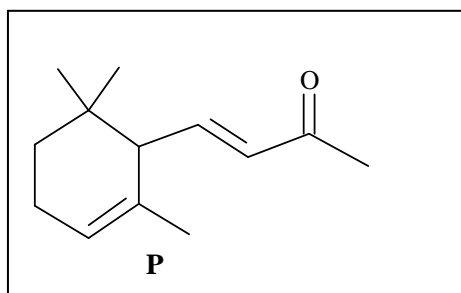
4.10



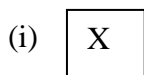
4.11



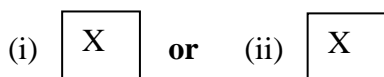
4.12



4.13

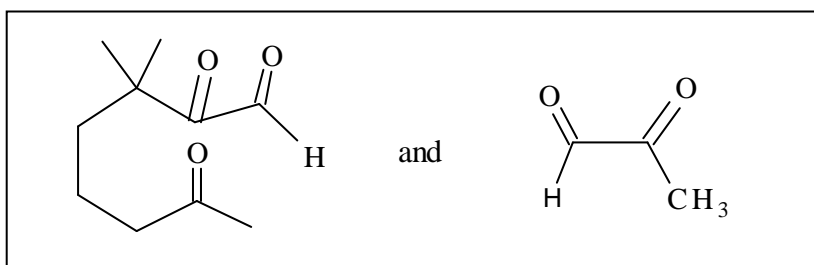


4.14



(As per the given structure of **P** in 4.12)

4.15



Problem 5

18 marks

The 'light' side of chemistry

- 5.1 Propagation steps: (ii) & (iii)
Termination step: (iv)

5.2
$$\frac{d[\text{H}^\bullet]}{dt} = 0 \Rightarrow k_1[\text{Cl}^\bullet][\text{H}_2] - k_2[\text{H}^\bullet][\text{Cl}_2]$$

$$\frac{d[\text{Cl}^\bullet]}{dt} = 0 \Rightarrow 2I_{\text{abs}} + k_2[\text{H}^\bullet][\text{Cl}_2] - k_1[\text{Cl}^\bullet][\text{H}_2] - 2k_3[\text{Cl}^\bullet]^2$$

$$[\text{H}^\bullet] = \frac{k_1}{k_2} \left(\frac{I_{\text{abs}}}{k_3} \right)^{1/2} \frac{[\text{H}_2]}{[\text{Cl}_2]}$$

5.3
$$\frac{d[\text{HCl}]}{dt} = k' [I_{\text{abs}}]^{1/2} [\text{H}_2] \quad \text{or} \quad 2K_1 \frac{I_{\text{abs}}^{1/2}}{k_3^{1/2}} \cdot [\text{H}_2]$$

- 5.4 The correct statement/s is/are

i) X

ii) X

5.5 Quantum Yield = 1.05

B.

5.6 a)
$$\Delta U_{\text{AOH}} = N_A h \nu_{\text{AOH}}$$

$$\Delta U_{\text{AO}^-} = N_A h \nu_{\text{AO}^-}$$

b)
$$\Delta U^* = \Delta U_{\text{AO}^-} + \Delta U - \Delta U_{\text{AOH}}$$

c)
$$\Delta H - \Delta H^* = N_A h (\nu_{\text{AOH}} - \nu_{\text{AO}^-})$$

5.7 a)
$$\Delta \text{p}k_a = N_A h (\nu_{\text{AO}^-} - \nu_{\text{AOH}}) / 2.303RT$$

b)
$$\Delta \text{p}k_a = -3.5$$

Problem 6

11 marks

Acids, bases and buffers

A.

6.1

$$\frac{[\text{Pr NH}_2]}{[\text{Pr NH}_3^+]} = 0.1$$

6.2

$$\text{pH} = 10.08$$

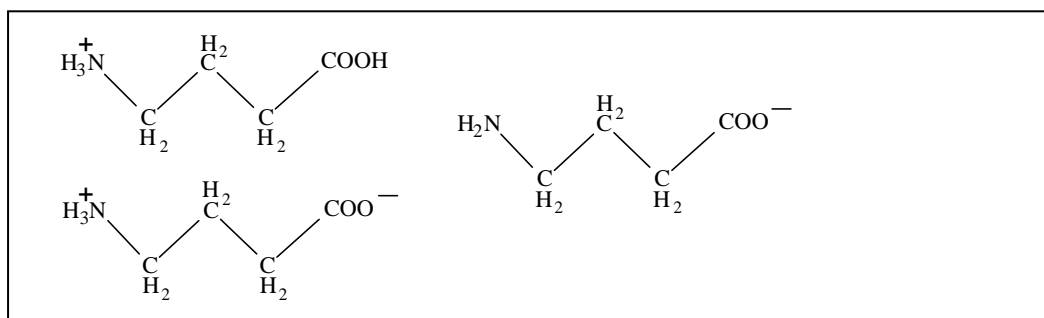
6.3

$$\text{pH} \approx 6$$

appropriate indicator is –Methyl red. (4.2-6.2)

B.

6.4



6.5

around point B

around point D

6.6

$$\frac{[\text{H}_2\text{N} - \text{R} - \text{COO}^-]}{[\text{H}_3\text{N}^+ - \text{R} - \text{COOH}]} = 0.03$$

6.7

(iii)