CHEMISTRY

11. (4)
For first order reaction,
$$k = \frac{2.303}{t}\log\frac{a}{a-x}$$
Here a = initial concentration
(consider 100 moles)
a – x = final concentration
(after 75% completion
a – x = 100 – 75 = 25
$t_{75\%} = 32\,\text{min}$
$$\therefore\ k = \frac{2.303}{32}\log\frac{100}{25}$$
$$k = \frac{2.303}{32}2\log 2$$
$$k = \frac{2.303\times 2}{32}\times 0.3010$$
$$k = \frac{1.386}{32} = 0.0433\,\text{min}^{-1}$$
For first order reaction
$$t_{\frac{1}{2}} = \frac{0.693}{k} = \frac{0.693}{0.0433} = 16\text{ min}$$

12. (2)
$$r = k'[O_3][O] = \frac{k'k''[O_3][O_3]}{[O_2]} = k[O_3]^2[O_2]^{-1}$$

13. (4)
$$E_a \propto \frac{1}{\text{Rate of reaction}}$$
(here E_a is Activation Energy)

14. (2)
Rate of formation H_2O = $\frac{6}{4}\times$
Rate of disappearance of NO
$= \frac{6}{4}\times 3.610^{-3} = 5.4 \times 10^{-3}$ mol L^{-1} s^{-1}

15. (1)
To find the rate observe the data from experiment 1 and 2 it is observed that rate increases 4 times by doubling the concentration of A without any change in concentration of B
From experiment 2 and 3 it is observed that rate remains same even though concentration of 'B' doubled by keeping concentration of 'A' as constant i.e. rate is independent of concentration of 'B'
So, rate = $k[A]^2$

16. (4)
Let the rate equation is
$r = k[NO]^x[Cl_2]^y \rightarrow$ (i) and $2r = K[NO]^x[2Cl_2]^y$ …… (2)
Dividing (2) by (1), we get y = 1
Now, $8r = k[2NO]^x[2Cl_2]^1$
Dividing (3) by (1), we get
$$\frac{8r}{r} = \frac{k[2NO]^x[2Cl_2]^y}{k[NO]^x[Cl_2]^y}$$
$8 = 2^{x+y}$. Put y =1
$8 = 2^x + 1 \Rightarrow 2^3 = 2^{x+1} \Rightarrow x + 1 = 3$
or x = 3 – 1 = 2
Thus, the overall order of the reaction
= 1 +2 = 3

17. (2)
$$r \propto [A]^n$$
$$2r \propto [8A]^n$$
Divide $\frac{2r}{r} = \left[\frac{8A}{A}\right]^n$
$2 = 8^n$ or $2^1 = 2^{3n}$
$3n = 1 \Rightarrow n = \frac{1}{3}$

18. (3)
Number of half lives $= \frac{12}{3} = 4$
Amount of substance left
$= \left(\frac{1}{2}\right)^n \times$ original amount $= \left(\frac{1}{2}\right)^4 \times 1 = \frac{1}{16}$

19. (3)
Rate = $k[A]^2$ = x
If conc. Is tripled i.e. $A^1 = 3[A]$
$Rate^1 = k[3A]^2 = k.9[A] = x^1$
$\therefore \frac{x^1}{x} = 9$ i.e., becomes nine times

20. (1)
Unit of rate and rate constants are same for zero order reaction.