Rate of a reaction

23. **Answer:** (d) All of these

Explanation:

The rate of a chemical reaction can be influenced by:

- **Time:** Some reactions slow down as reactants are consumed.
- **Pressure:** Especially for reactions involving gases, increasing pressure can increase the rate.
- **Concentration:** Higher concentration of reactants generally increases the frequency of collisions, hence the rate.

24. (c) The rate of formation of SO_3 is $1.28 \times \frac{10^{-3} g}{sec}$

2 5. The reaction is:$A + B \rightleftharpoons AB$

Assuming this is an **elementary reaction**, the rate law is:

$Rate = k[A][B]$

Step 1: Original rate $Rate_{original} = k[A][B]$

Step 2: Change in concentration $[A] \rightarrow 2[A]$, $[B]$ unchanged

Step 3: New rate $\text{Ratenew} = k(2[A])[B] = 2k[A][B]$

Answer: (a) Doubled

26. (a) $\frac{K_t+10}{K_t} = \frac{r_t+10}{r_t} = 2$; For an increase of temperature to 50^oC, *i.e.* 5 times, the rate increases by 2^5times, *i.e.* 32 times.

27. An increase in temperature by 10◦C approximately **doubles** the rate of a reaction.

This is because the **Arrhenius equation**

An increase in temperature by $k = Ae^{-\frac{Ea}{RT}}$

shows that increasing T increases the rate constant k, and for most reactions at moderate temperatures, a 10°C rise roughly **doubles k**

28. (b) $\frac{K_{t+10}}{K_t} = \frac{r_{t+10}}{r_t} = 2.$

For an increase of temperature to $20°C$ *i.e.* 2 times, the rate increase by 2^2times, *i.e.* 4 times.

29. (b) $\frac{k_{t+10}}{K_t} = \frac{r_{t+10}}{r_t} = 2$

For an increase of temperature to 90^oC *i.e.* 9 times, the rate increases by 2^9 times *i.e.* 512.

30. (b) Catalyst increases the rate by decreasing the activation energy.

31. (a) For 10K rise in temperature, the rate of reaction nearly doubles.

32. (c) Temperature coefficient $\frac{K_{35^oC}}{K_{25^oC}} = \frac{K_{308k}}{K_{298k}} = 2$ and 3 for most reactions.

33. (b) Catalyst decrease energy of activation.

34. (a) Thus both rate and rate constant *K* increase with temperature, $r = k(\text{reactant})^n$

and $k = Ae^{-\frac{E_a}{RT}}$

35. (c) Enzymes does not always increase activation energy.

36. (d) Catalyst reduce the activation energy for reaction and thus increase the rate of reaction.

37. (a) Catalyst affect only activation energy. It brings down the activation energy of reaction.

38. (b) As we know that the velocity constant become double by increasing the temperature by 10°C so if at 290 K, velocity constant $= 3.2 \times 10^{-3}$ then at 300 K, velocity constant $= 2(K_{290}) = 2 \times 3.2 \times 10^{-3} = 6.4 \times 10^{-3}$.

39. (a) Higher the value of rate constant so, faster the reaction rate.

40. (c) Rate of reaction may increase or decrease with increase in temperature. If reaction is exothermic, rate decreases with increasing temperature while that of endothermic reactions increase with increasing temperature.

41. (a) $2N_2O_{5(g)} \rightarrow 4NO_{2(g)} + O_{2(g)}$

Rate of reaction with respect to NO_2

$= \frac{1}{4}\frac{d[NO_2]}{dt} = \frac{1}{4} \times \frac{5.2 \times 10^{-3}}{100} = 1.3 \times 10^{-5} ms^{-1}$

42. (b) In first phase, $K = \frac{2.303}{20} log \frac{90}{100}$ .....(i)

In second phase $K = \frac{2.303}{t} log \frac{81}{100}$ .....(ii)

From eq. (i) $\frac{2.303}{20} log \frac{90}{100} = \frac{2.303}{t} log \frac{81}{100}$

$t = \frac{20(log\,81 - log\,100)}{(log\,90 - log\,100)}$

$= \frac{20(1.908-2)}{(1.954-2)} = \frac{20 \times (-0.092)}{(-0.046)}$= 40 minutes