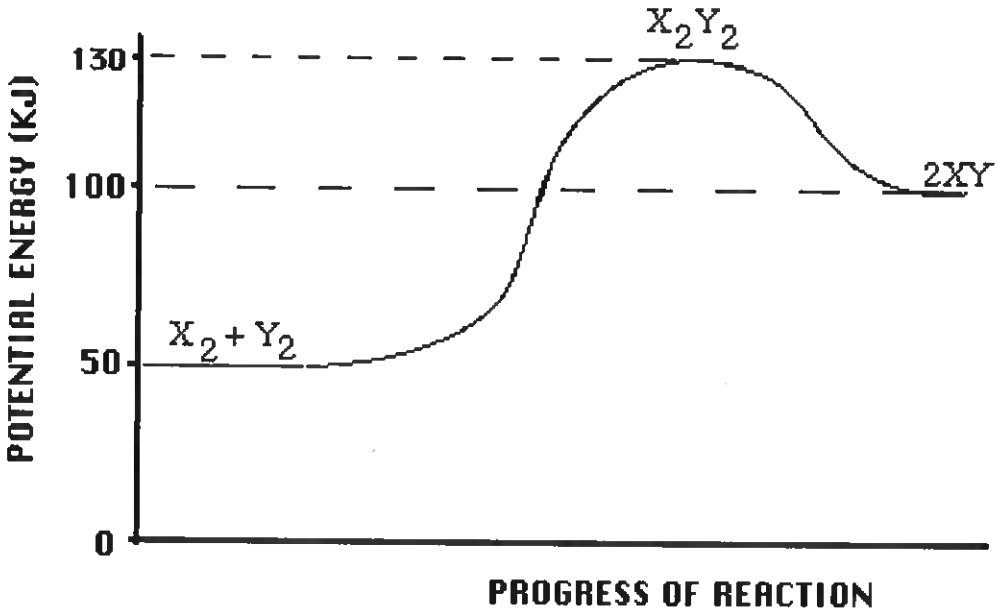
Worksheet 1-2 - Potential Energy Diagrams

USE THE **POTENTIAL ENERGY DIAGRAM** TO ANSWER THE QUESTIONS BELOW:



1. Is the overall reaction as shown **exothermic** or **endothermic**?
   endo
2. What is the **activation energy** for the forward reaction?
   130-50 = +80 KJ
3. What is the **activation energy** for the reverse reaction?
   130-100 = +30 KJ
4. What is the **enthalpy change of reaction** (ΔH) for the *forward* reaction?
   100-50 = +50 KJ
5. What is the **ΔH** for the *reverse* reaction?
   50-100 = -50 KJ
6. Is the ***reverse*** reaction **exothermic** or **endothermic**? exo
7. Which species forms the ***activated complex***? X_2Y_2
8. Which species or set of species has the *highest* **potential energy**?
   X_2Y_2

9. Which species or set of species has the *highest* **kinetic energy**?
$X_2 + Y_2$

10. Which species or set of species has the ***weakest*** **bonds**?
X_2Y_2

11. Which species or set of species has the ***strongest*** **bonds**?
$X_2 + Y_2$

12. What is **ΔH** for the reaction: $\mathbf{X_2Y_2 \rightarrow X_2 + Y_2}$?
50 - 130 = -80 kJ

13. Which do you think would be *faster*, the **forward** reaction or the **reverse** reaction?
reverse Explain. The Ea is lower ∴ more molecules will have enough KE to get to Ea.

14. Which species or set of species has the ***lowest*** **kinetic energy**?
X_2Y_2

15. Show the **ΔH**, the Activation Energy for the *forward* reaction and the Activation Energy for the *reverse* reaction on the graph above.

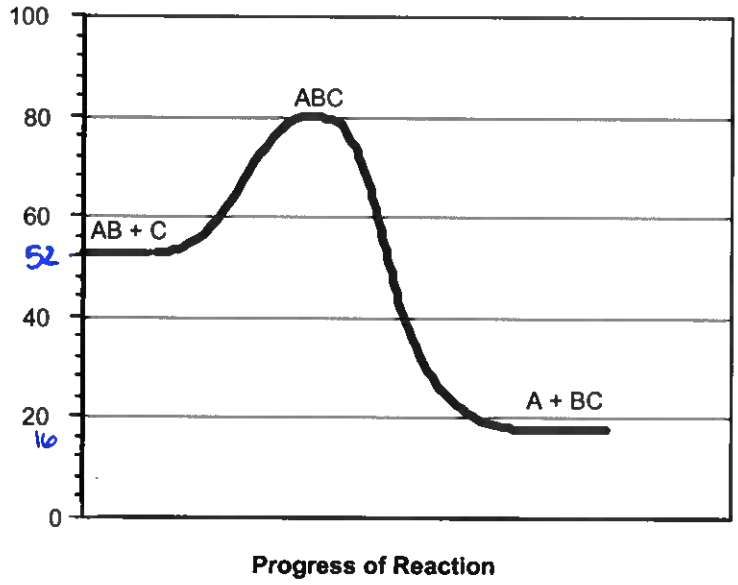
16. As reactant particles approach each other before a collision, the ***Potential*** Energy goes ↑ while the ***Kinetic*** Energy goes ↓.

17. As particles of newly formed products move away from one another, the ***Potential*** Energy goes ↓, while the ***Kinetic*** Energy goes ↑

18. As *reactant* molecules approach each other, they exert repulsive forces on each other. Thus, as they move together, their speed decreases and their *Potential Energy* increases

19. State the meaning of ***Activated Complex***. The unstable, short-lived ~~created when~~ compound created when reactants collide ~~to~~ with correct alignment & energy to form products.

20. Use the following ***Potential Energy Diagram*** to answer the questions below:



a) Determine the ***Activation Energy*** for the *forward* reaction... 80-52 +28 kJ

b) Determine the ***Activation Energy*** for the *reverse* reaction.... +64 kJ

c) What is the ***Enthalpy Change*** (ΔH) for the *forward* reaction?.. -36 kJ

d) What is the ***Enthalpy Change*** (ΔH) for the *reverse* reaction?.. +36 kJ

e) The *forward* reaction is exo thermic.

f) The *reverse* reaction is endo thermic.

g) Which species or set of species forms the ***Activated Complex***? ABC

h) Which bond is *stronger*, A--B or B--C? BC. Give a reason for your answer. More energy is needed to break the bond (seen by the higher Ea for reverse rx

i) Particles from which species or set of species is moving the *fastest*? A + BC

State how you arrived at your answer. They have the lowest potential energy and Total energy is constant ∴ KE must be the highest.

j) Particles from which species or set of species is moving *most slowly*? ABC

State how you arrived at your answer. highest PE ∴ lowest KE because Total energy should be constant.

k) The compound "AB" is a gas and the element "C" is a solid. What effect would grinding"C" into a fine powder have on the graph shown here? No effect. Potential energy is based on nature of reactants

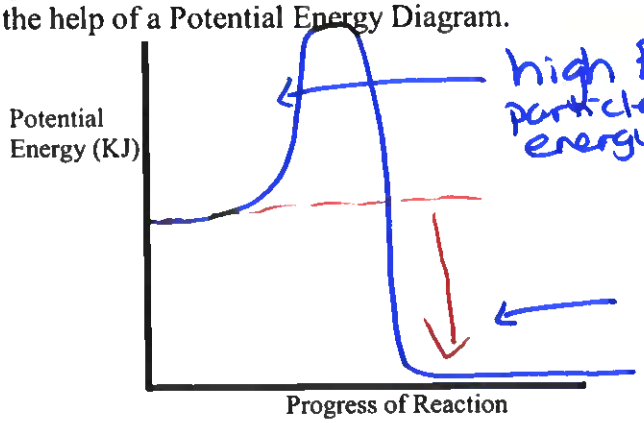
21. State the meaning of ***Activation Energy***. The minimum energy needed for the reactants to have a successful collision.

22. What two requirements must be met before a collision between two reactant particles is ***effective***?
1. Collide with enough energy
2. Collide with correct alignment

23. Describe what happens to two reactant particles which collide with *less* energy than the ***Activation Energy***.

They would ~~not~~ bounce off each other and repulsive forces would cause them to speed up as they move away.

24. Burning coal (Carbon) is a highly *exothermic* reaction. However coal, in contact with air at room temperature has such a *slow* reaction that it is not noticeable. Explain these two facts with the help of a Potential Energy Diagram.



high Ea ∴ not many particles would have sufficient energy

large −ΔH in forward reaction as products lose energy ∴ produces heat