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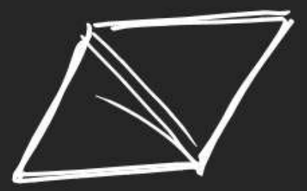
THERMODYNAMICS

$a = b \neq c$

$V = a^2 \times c$



$a = b \neq c$

$2 \times \left(\frac{\sqrt{3}a^2}{4}\right) \times c$

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THERMODYNAMICS

essential criterion for a function to be a state function function

(1) $\int_A^B d\phi = \phi_B - \phi_A$

(2) $\oint d\phi = 0$

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(3) A state function must satisfy Euler's reciprocity theorem.

$$\phi = f(x, y)$$

$$\frac{\partial}{\partial y}\left[\left(\frac{\partial \phi}{\partial x}\right)_y\right]_x = \frac{\partial}{\partial x}\left[\left(\frac{\partial \phi}{\partial y}\right)_x\right]_y$$

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Q. Prove that for a given amount of ideal gas Pressure is state function

$$P = \frac{nRT}{V} = f(T, V)$$

$$\left(\frac{\partial P}{\partial T}\right)_V = \frac{nR}{V}$$

$$\frac{\partial}{\partial V}\left[\left(\frac{\partial P}{\partial T}\right)_V\right]_T = -\frac{nR}{V^2}$$

$$\frac{d}{dx}x = 1$$

$$\frac{d}{dx}x^2 = 2x$$

$$\frac{d}{dx}\left(\frac{1}{x}\right) = -\frac{1}{x^2}$$

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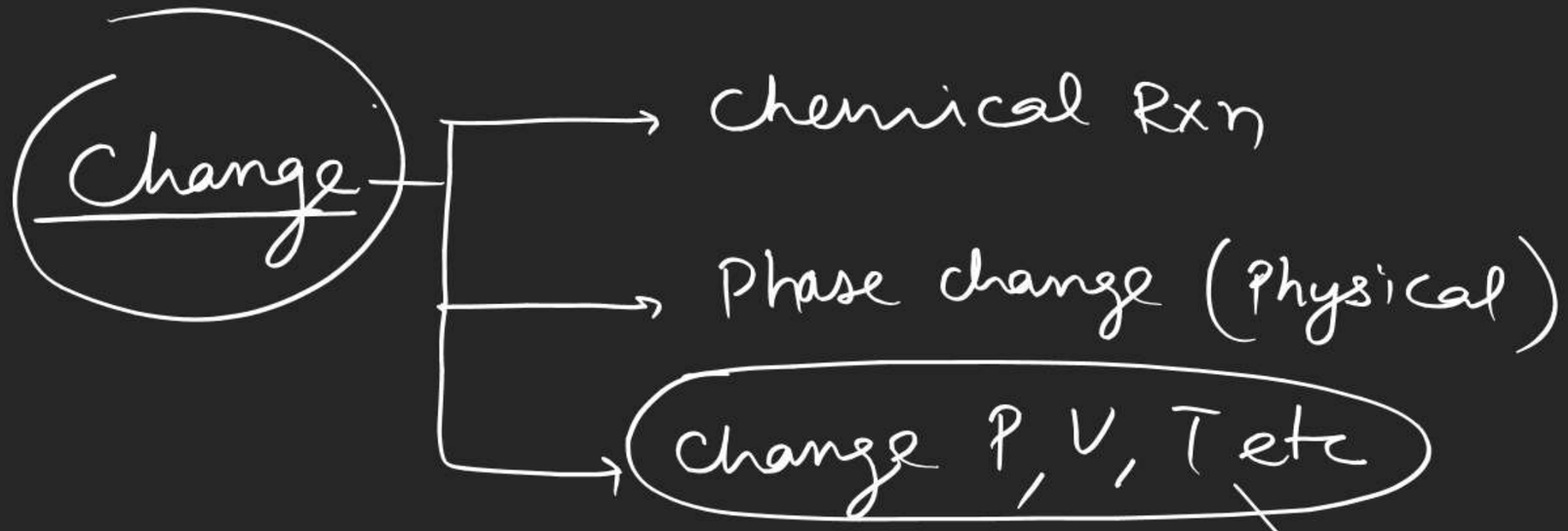
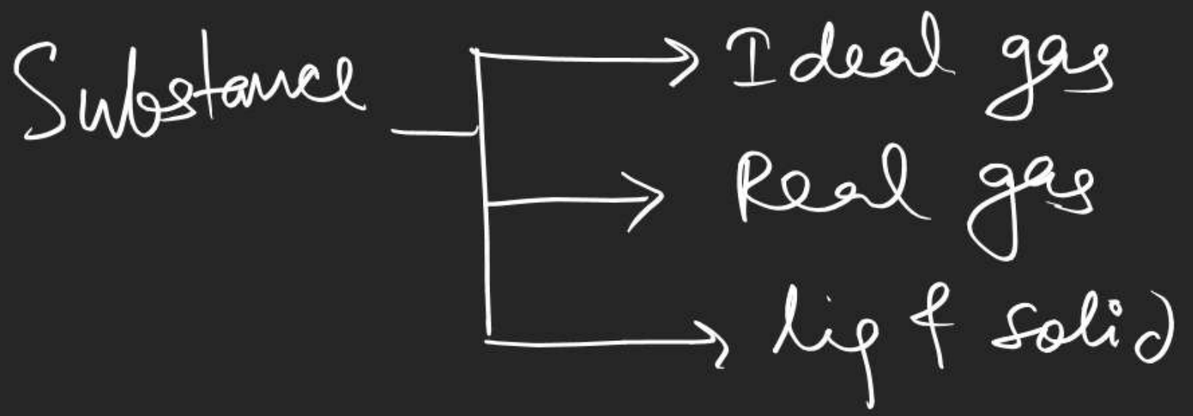
Change :→





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No chemical & phase change

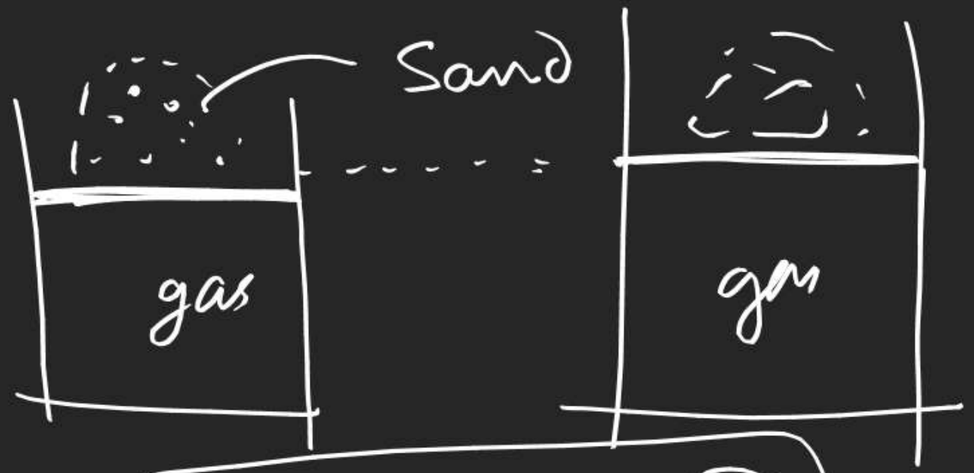
- Isothermal process — $T = \text{Const}$ — $n = \text{const}$
- Isochoric process — $V = \text{Const}$ — "
- Isobaric " — $P = \text{Const}$ — "
- polytropic

Chemical Rxn
$T = \text{Const}$

Isothermal

Reversible changes

(1) which is carried out very slowly.



i.e It takes infinite time to show any change

$$P_{ext} = P_{int} \pm dP$$

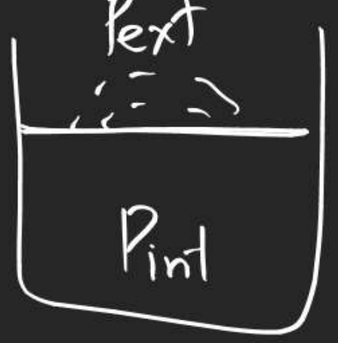
$$T_{ext} = T_{int} \pm dT$$

driving force

(2) It is hypothetical

(3) driving force should be very small (tends to zero)

driving force $\to$ 0

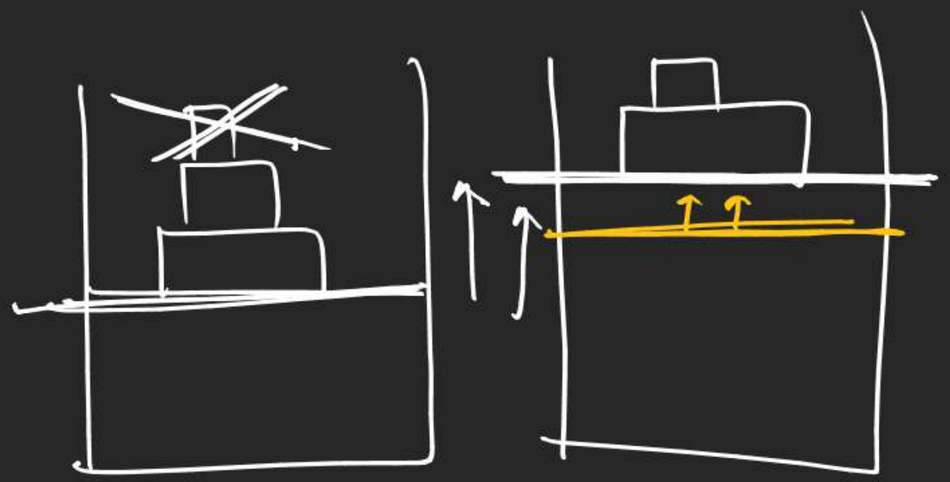
(4) 

System and surroundings exist in the state of eqlbm throughout the change

(5) change in properties in each step should be very small

(6) $PV = nRT$ eqn can be used throughout the change for an ideal gas

Irreversible Change :-



(1) It takes finite time to show any change.

(2) It is practically possible

(3) driving force show be appreciable.

$$P_{ext} = P_{int} \pm \Delta P$$

$$T_{ext} = T_{int} \pm \Delta T$$

(4) In an irreversible eqlbm exist at the initial & final state only.

(5) Change in properties in each step Should be appreciable

(6) $PV = nRT$ can be used at initial & final state only. for ideal gas

S-II

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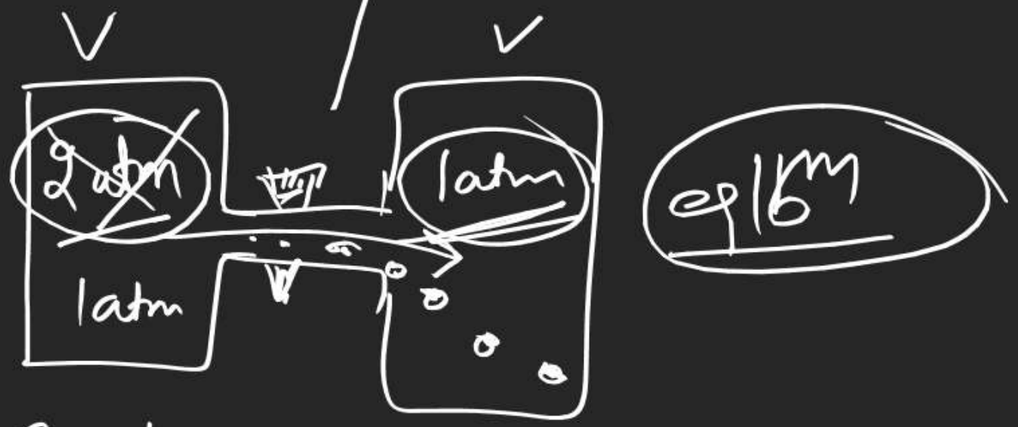
$PV = nRT$ ideal gas



$T = \text{Const}$

$$P_1V_1 = P_2V_2$$

$$2 \times V = P \times 2V$$

$$1 = P$$

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Reversible Rxn

Extent $(0 < \alpha < 1)$

Irreversible Rxn

extent $\alpha \simeq 1$

1. Select the **INCORRECT** statement -

(A) A crystalline solid possess long range order while amorphous solid has only short range order.

(B) Crystalline solids have definite & characteristic heat of fusion and melting temperature while amorphous solids do not have definite heat of fusion and soften over a range of temperature

(C) When polyurethane and benzoic acid are cut with sharp edge tool former has irregular cleavage surface while later has smooth surface.

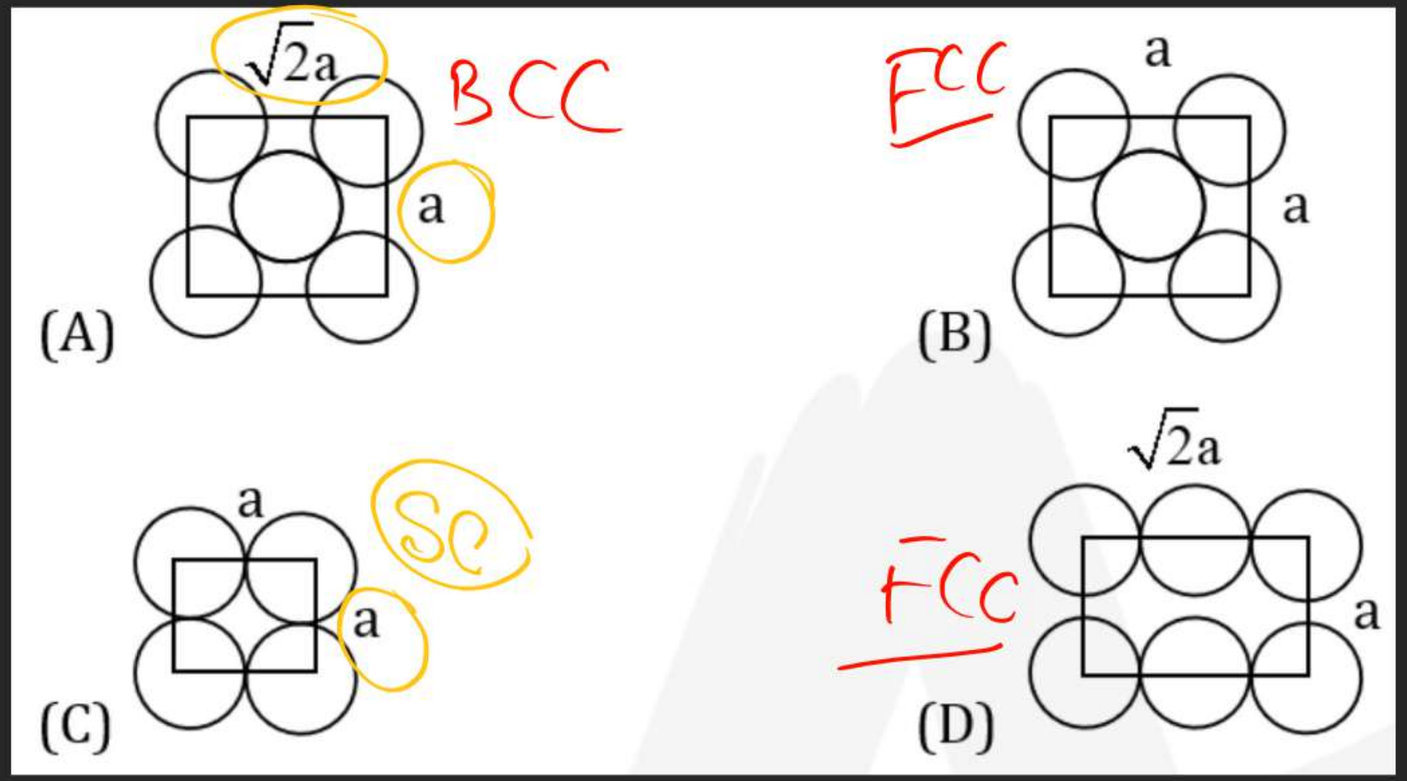
(D) Quartz (crystalline) is isotropic while quartz glass is anisotropic in nature. aria

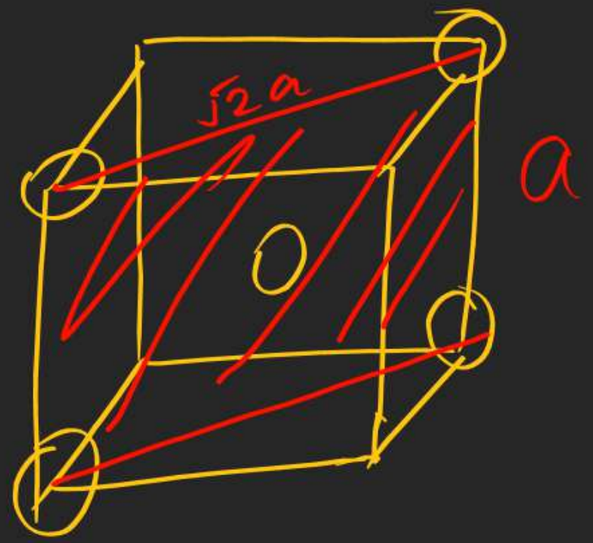
False

2. Ratio of volume of tetragonal edge length (a.a.c) & hexagonal unit cell edge length (a.a.c)

(A) $2 : \sqrt{3}$ (B) $4 : \sqrt{3}$ (C) $6 : \sqrt{3}$ (D) $8 : \sqrt{3}$

3. Which of the following represents a plane in bcc metallic crystal , where 'a' is edge length of cube-





4. Number of 3rd nearest neighbour atom in a FCC unit cell are -

(A) 8 (B) 24 (C) 16 (D) 12

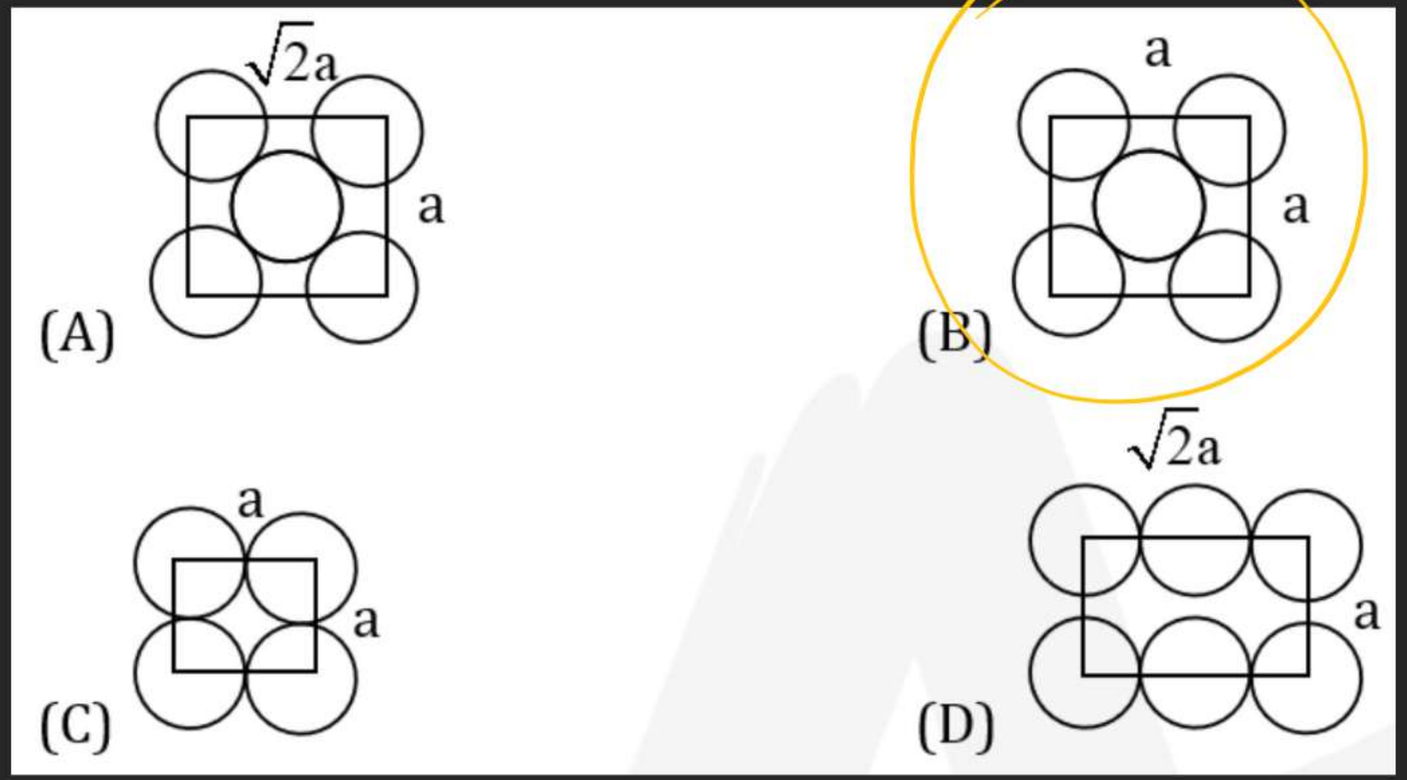
$a/\sqrt{2}$ — 12

a — 6

$\sqrt{1.5}a$ — 24

$\sqrt{2}a$ — 12

3. Which of the following represents a plane in bcc metallic crystal , where 'a' is edge length of cube-



$$\frac{2 \times \pi r^2}{a^2} \times 100$$

$$\sqrt{2}a = 4r$$

$$a = 2\sqrt{2}r$$

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Test-1 Date JEEMain

	objective (20)		Numerical (5)
	Attempt	correct -ive	
Phy			
Maths			
Chem PC			
Chem OC			
Chem IO			
Total marks =			
-ive marks			

PC — Wrong ——— ✓

Not attempted ———

5. Percentage area of each face covered by atoms in a FCC unit cell is -

(A) 60.4% (B) 68% (C) 74% (D) 78.5%

6. Select the correct statement -

(A) Frenkel defect is a non-stoichiometric defect F

(B) F-centres are due to Frenkel defect F

(C) ZnO shows yellow colour on heating due to metal excess defect T

(D) Schottky defect is more probable if difference in radius of cation and anion are large. F

7. Select the correct statement -

(A) In semiconductors, valence band is partially filled. F

(B) Si dopped with group 15 elements shows n-type semi conductance T

F (C) Cobalt shows ferrimagnetic nature.

(D) Diamagnetic character of a substance is due to presence of unpaired electron. F

8. Morphine ($C_{17}H_{19}NO_3$) is administered medically to relieve pain. If a tablet containing 2.85 gm morphine is burnt in presence of excess oxygen. Calculate the weight of CO_2 (in gm) produced. Fill your answer by multiplying it with 100.

$$C_{17}H_{19}NO_3 + O_2 \longrightarrow 17\,CO_2 + H_2O + \frac{19}{2}N_2$$

$\frac{2.85}{M}$

$17 \times \frac{2.85}{M}$

9. In an ionic solid $r_{(+)} = 1.6$ Å and $r_{(-)} = 1.864$ Å. Use the radius ratio rule to determine the edge length of the cubic unit cell in Å.

$\frac{1.6}{1.864} = 0.858$

Cubic void

$\sqrt{3}a = 2r_+ + 2r_-$

10. 280 g of a mixture containing CH_4 and C_2H_6 in 5 : 2 molar ratio is burnt in presence of excess of oxygen. Calculate total moles of CO_2 produced.

$5x \times 16 + 2x \times 30 = 280$

$80x + 60x = 280$

$140x = 280$

$x = 2$

$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$

$5x \quad 10x \quad 5x$

$C_2H_6 + 3.5\,O_2 \longrightarrow 2CO_2 + 3H_2O$

$2x \quad 3.5 \times 2x = 7x \quad 4x$

$n_{O_2} = 10x + 7x = 17x$

$n_{CO_2} = 9x$