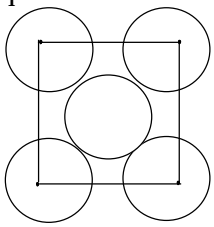
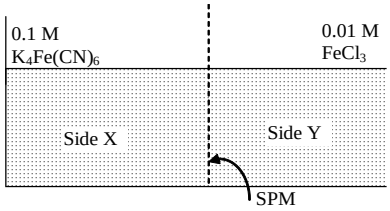
1. Which of the following statements is/are true for any possible series combination of inductors, capacitors and resistors across an ac voltage source?
   (a) If the current and voltage are in the same phase the circuit must be purely resistive (i.e. there are no inductors and capacitors connected)
   (b) If the current and voltage are in the same phase, increasing the resistance will result in decreasing the current drawn from the source.
   (c) If the current and voltage have a non-zero phase difference there must be atleast a single capacitor or inductor connected.
   (d) If the current and voltage are in the same phase (for a given circuit) then increasing or decreasing the resistance (keeping all other components the same) will result in a phase difference appearing between current and voltage.

2. The packing efficiency of the two-dimensional square unit cell shown below is



(A) 39.27% (B) 68.02% (C) 74.05% **(D) 78.54%**

3. $FeCl_3$ on reaction with $K_4[Fe(CN)_6$ in aqueous solution gives blue colour. These are separated by a semi permeable membrane AB as shown. Due to osmosis there is



(A) blue colour formation in side X

(B) blue colour formation in side Y

(C) blue colour formation in both of the sides X and Y

(D) no blue colour formation

4. Matrix – 1

Column – I	**Column – II**
(A) Depression of freezing point	(P) The vapour pressure of a solution is less than that of the pure solvent
(B) Elevation of boiling point	(Q) Only solvent molecules solidify at the freezing point.
(C) Elevation of freezing point	(R) Addition of $K_4[Fe(CN)_6]$
(D) The van't Hoff factor may be less than or greater than one	(S) During complexation

Matrix – 2

Column – I	**Column – II**

(A) Negative deviation from Raoult's law		(P)	Benzene-methanol system
(B) Positive deviation from Raoult's law		(Q)	Acetone-ethanol system
(C) Minimum boiling azeotrope		(R)	Water-hydrochloric acid system
(D) Maximum boiling azeotrope		(S)	$\Delta H_{mix} > 0$ and $\Delta V_{mix} > 0$

Answer:. **A** – P, Q, R : **B** – P,R: **C** – S : **D** – R ,S 2. **A** – Q, R: **B** – P,S : **C** – P,S : **D** – Q, R

5. If A, B and C are any three sets, then $A - (B \cup C)$ is equal to

(a) $(A - B) \cup (A - C)$ **(b)** $\boldsymbol{(A - B) \cap (A - C)}$

(c) $(A - B) \cup C$ (d) $(A - B) \cap C$

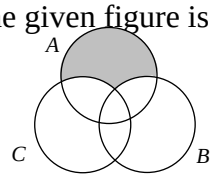
6. The shaded region in the given figure is

(a) $A \cap (B \cup C)$

(b) $A \cup (B \cap C)$

(c) $A \cap (B - C)$

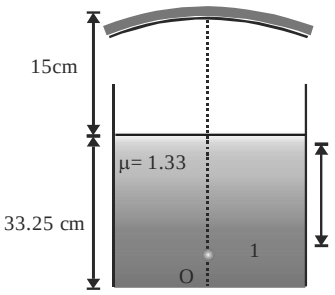
(d) $\boldsymbol{A - (B \cup C)}$



7. A container is filled with water up to a height of 33.25 cm. A concave mirror is placed 15 cm above the water level and the image of an object placed at the bottom is formed 25 cm below the water level.
Focal length of the mirror is

(a) 10 cm (b) 15 cm

(c) 20 cm (d) 25 cm

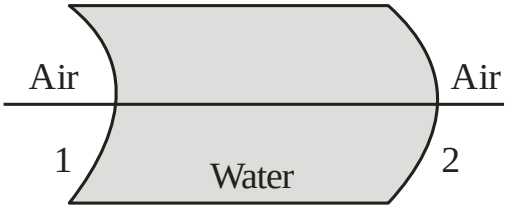


8. A person runs with a speed u towards a bicycle moving away from him with speed v. The person approaches his image in the plane mirror fixed at the rear of bicycle with a speed of

a. $u - v$ b. $u - 2v$

c. $2u - v$ **d. $\boldsymbol{2(u - v)}$**

9. All objects referred to the subsequent problems lie on the principle axis



If light is incident on surface 1 from left, the image formed after the first refraction is definitely

(a) Real for a real object
(b) Real for a virtual object
(c) **Virtual for a real object**
(d) Virtual for a virtual object

10. If $x + \frac{1}{x} = 2\cos\theta,$ then x is equal to

(a) $\cos\theta + i\sin\theta$ (b) $\cos\theta - i\sin\theta$
(c) $\cos\theta \pm i\sin\theta$ (d) $\sin\theta \pm i\cos\theta$