37. The number of vectors perpendicular to the vector $\mathbf{a} = \hat{\mathbf{i}} + \hat{\mathbf{j}} + \hat{\mathbf{k}}$ is equal to

    (A) one.

    (B) two.

    (C) three.

    (D) infinity.

38. The rank of the matrix

$$\begin{pmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{pmatrix}$$

    is

    (A) zero.

    (B) one.

    (C) two.

    (D) three.

39. 'Hot water stirred into cold water produces warm water. But this does not separate into hot and cold parts even if we stir the warm water in the opposite direction.' This is a statement of :

    (A) The conservation of angular momentum.

    (B) The First Law, that says not all heat can be converted into work.

    (C) The Second Law, that says entropy cannot decrease.

    (D) The property of water as a universal solvent.

40. An ideal gas is in equilibrium at temperature T_0, and each molecule has average kinetic energy K_0. If the temperature of the gas is doubled, the new average kinetic energy K per molecule will be

    (A) $K = K_0$, by energy conservation.

    (B) $K = 2K_0$ by equipartition.

    (C) $K = K_0/2$ by equal a priori probabilities.

    (D) $K = (K_0 + 2K_0)/2 = 3K_0/2$ by averaging procedure.