45. What is the minimum energy that must supplied to a deuteron in order to separate it into a neutron and a proton? $m_n = 1.00866$ amu, $m_p = 1.00728$ amu, $m_d = 2.01355$ amu.

(A) 2.23 MeV

(B) 2.23 GeV

(C) 22.3 MeV

(D) 2.23 keV

46. Materials that are good electrical conductors also tend to be good thermal conductors because

(A) they have highly elastic lattice structures

(B) they have energy gaps between the allowed electron energy bands

(C) impurities aid both processes

(D) conduction electrons contribute to both processes

47. A point particle has x and y coordinates that vary with time as $x = 2\sin\omega t$ and $y = 3\cos 2\omega t$. The trajectory of the particle is

(A) an interval of a straight line

(B) an interval of a circle

(C) an interval of a parabola

(D) an interval of an ellipse

48. Consider the matrix $A = \begin{pmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{pmatrix}$. The eigenvalues of A are

(A) 0,1,2

(B) 0,0,3

(C) $0,0,\sqrt{3}$

(D) 1,1,1

49. A box has ten red and ten blue socks. The minimum number of socks drawn out at random to guarantee that we get two socks of the same colour is

(A) 2

(B) 3

(C) 11

(D) ${}^{20}C_2$

50. The derivative w.r.t. x of the product $(1+x)(1+x^2)(1+x^4)\ldots(1+x^{2n})$ at $x=0$ is

(A) 0

(B) 1

(C) n

(D) $2n$