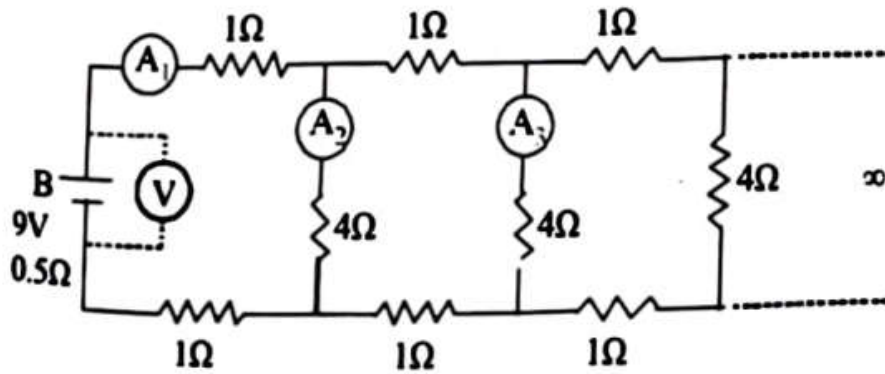**Q 01**

A 9 V battery with internal resistance of 0.5 Ω is connected across an infinite network as shown in the figure. All ammeters A_1, A_2, A_3 and voltmeter V are ideal.
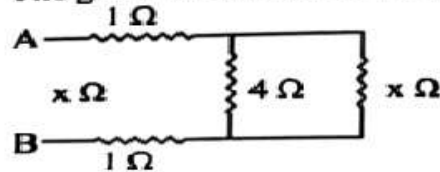
Choose correct statement.　　　　[Online April 8, 2017]
(a)　Reading of A_1 is 2 A　(b)　Reading of A_1 is 18 A
(c)　Reading of V is 9 V　(d)　Reading of V is 7 V

answer

(a)　The given circuit can be redrawn as,

as 4 Ω and x Ω are parallel $x' = \dfrac{1}{4} + \dfrac{1}{x} = \dfrac{(4+x)}{4x}$

$$x' = \dfrac{4x}{4+x}$$

& 1 Ω and 1 Ω are also parallel $x'' = 2\,\Omega$
Now equivalent resistance of circuit

$$x = \dfrac{4x}{4+x} + 2 = \dfrac{8+6x}{4+x}$$

$4x + x^2 = 8 + 6x$
$x^2 - 2x - 8 = 0$

$$x = \dfrac{2 \pm \sqrt{4 - 4(1)(-8)}}{2} = \dfrac{2 \pm \sqrt{36}}{2} = \dfrac{2 \pm 6}{2} = 4\,\Omega$$

Reading of Ammeter $A_1 = \dfrac{V}{(R+r)}$

$$A_1 = \dfrac{9}{4 + 0.5} = 2 \text{ Ampere}$$