

# Quiz 1

It is easy to see that all the circuit diagrams shown on the right are electrically equivalent although their physical layouts seem different. This is because the nodes C, E, and D are all at the same potential. Also, the nodes A, F, G, and H are all at the same potential. The KVL for the loop HCEFH gives us the equation,

$$4i_1 + 2i_1 - 16i_2 = 0 \Rightarrow 6i_1 = 16i_2 \Rightarrow i_1 = \frac{8i_2}{3}.$$

The KVL for the loop ABEFA gives us the equation,

$$v_x - 2 - 16i_2 = 0 \Rightarrow v_x = 2 + 16i_2.$$

The KCL at the node C=D=E gives us the equation,

$$3i_2 - i_1 - i_2 + 2 = 0 \Rightarrow 2i_2 - i_1 = -2.$$

Substituting  $i_1 = \frac{8i_2}{3}$  into the above equation, we get

$$2i_2 - \frac{8i_2}{3} = -2 \Rightarrow \boxed{i_2 = 3 \text{ Amps}}.$$

This in turn yields,  $\boxed{i_1 = \frac{8i_2}{3} = 8 \text{ Amps}}$  and  $\boxed{v_x = 2 + 16i_2 = 50 \text{ Volts}}$ . The power is generated by the 2A independent source and it equals  $50 \times 2 = 100 \text{ Watts}$ .

**Home-work** As an exercise, compute the power generated or consumed by each element and then verify that the total power generated equals the total power consumed.

