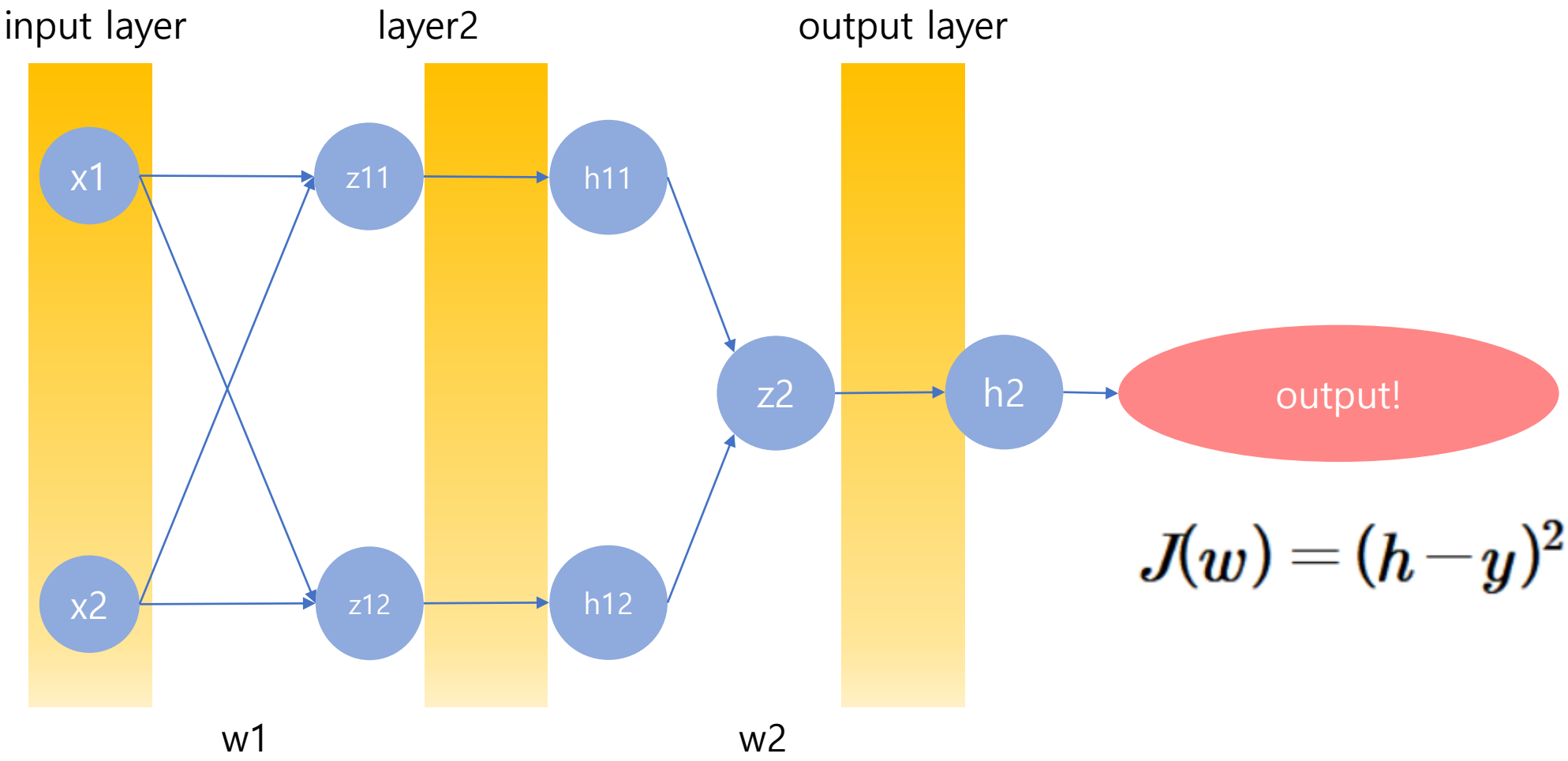
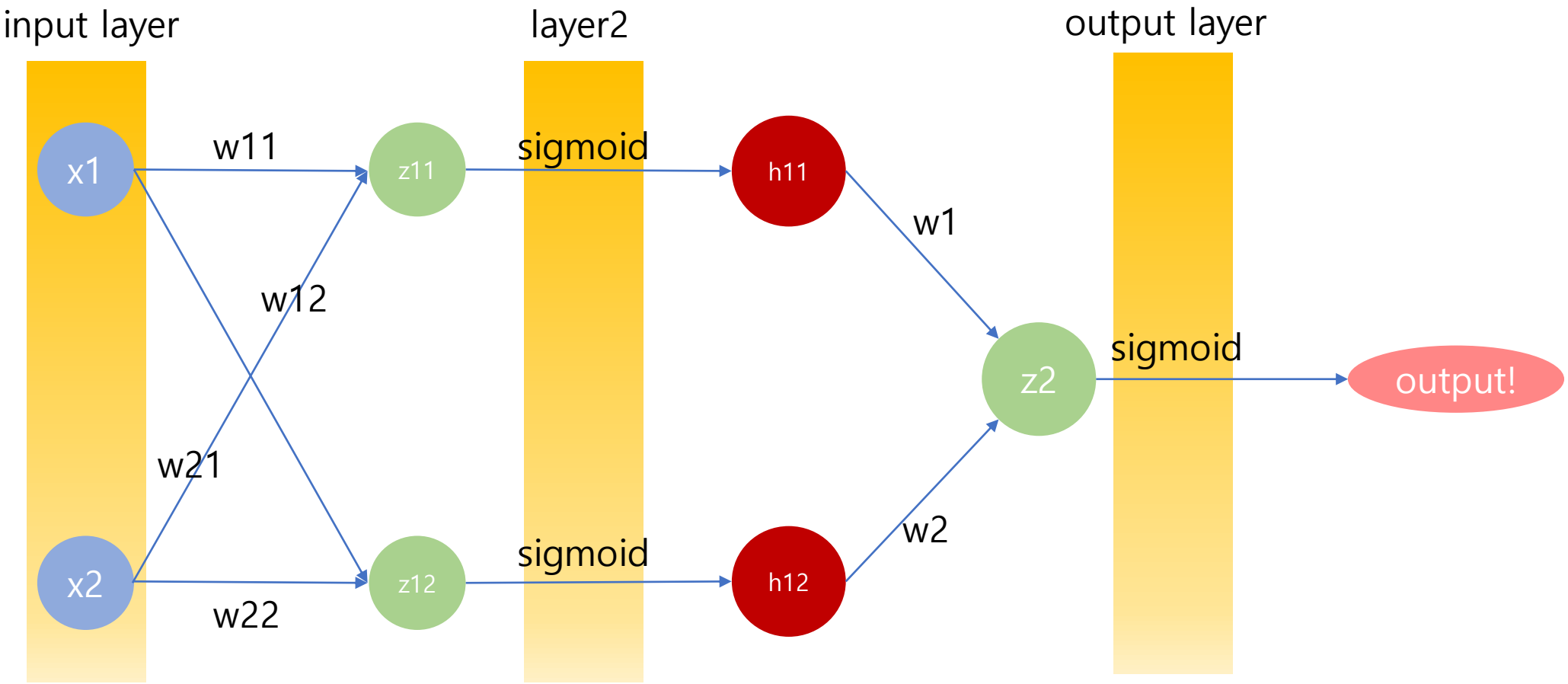

input layer
layer2
output layer
x1
x2
z11
z12
h11
h12
z2
h2
output!
w1
w2

$$J(w) = (h - y)^2$$

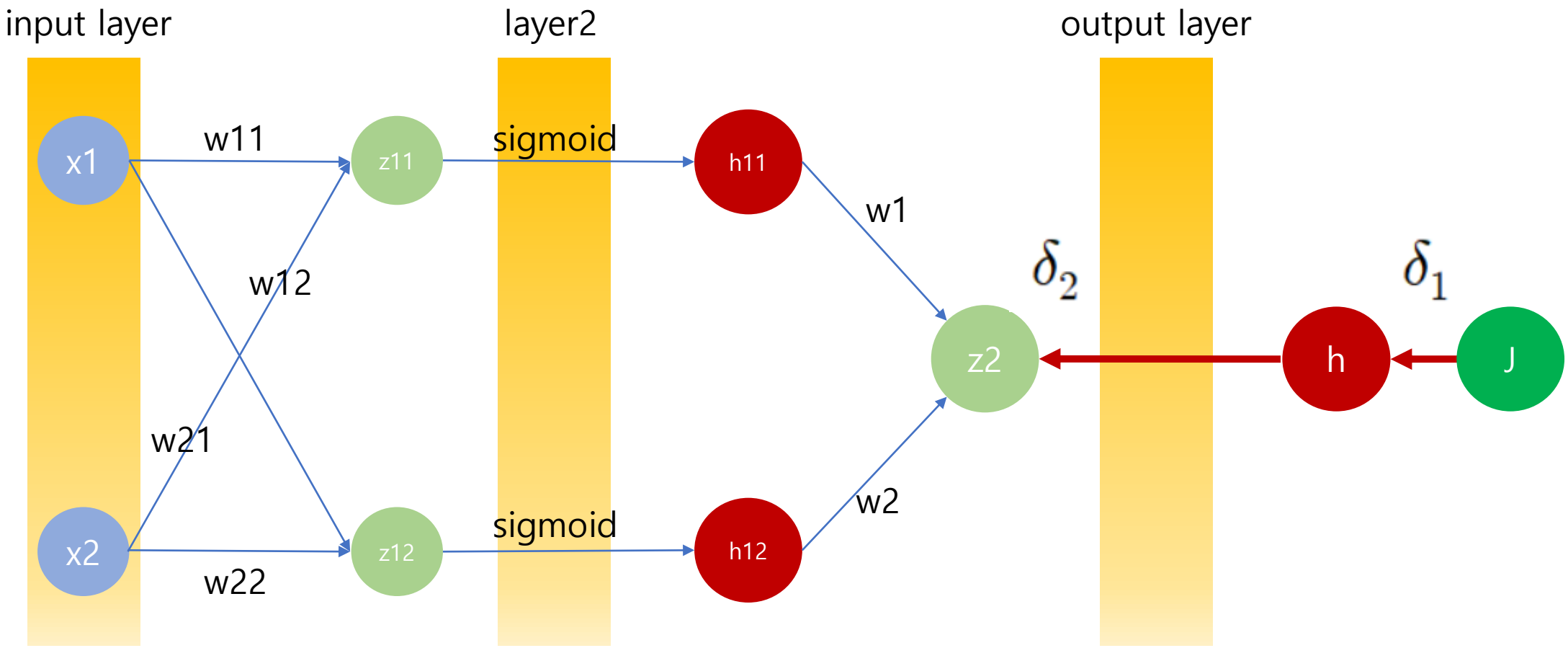


$$z_{11} = w_{11}x_1 + w_{12}x_2$$
$$z_{12} = w_{12}x_1 + w_{12}x_2$$

$$h_{11} = sigmoid(z_{11})$$
$$h_{12} = sigmoid(z_{12})$$

$$z_2 = w_1 h_{11} + w_2 h_{12}$$

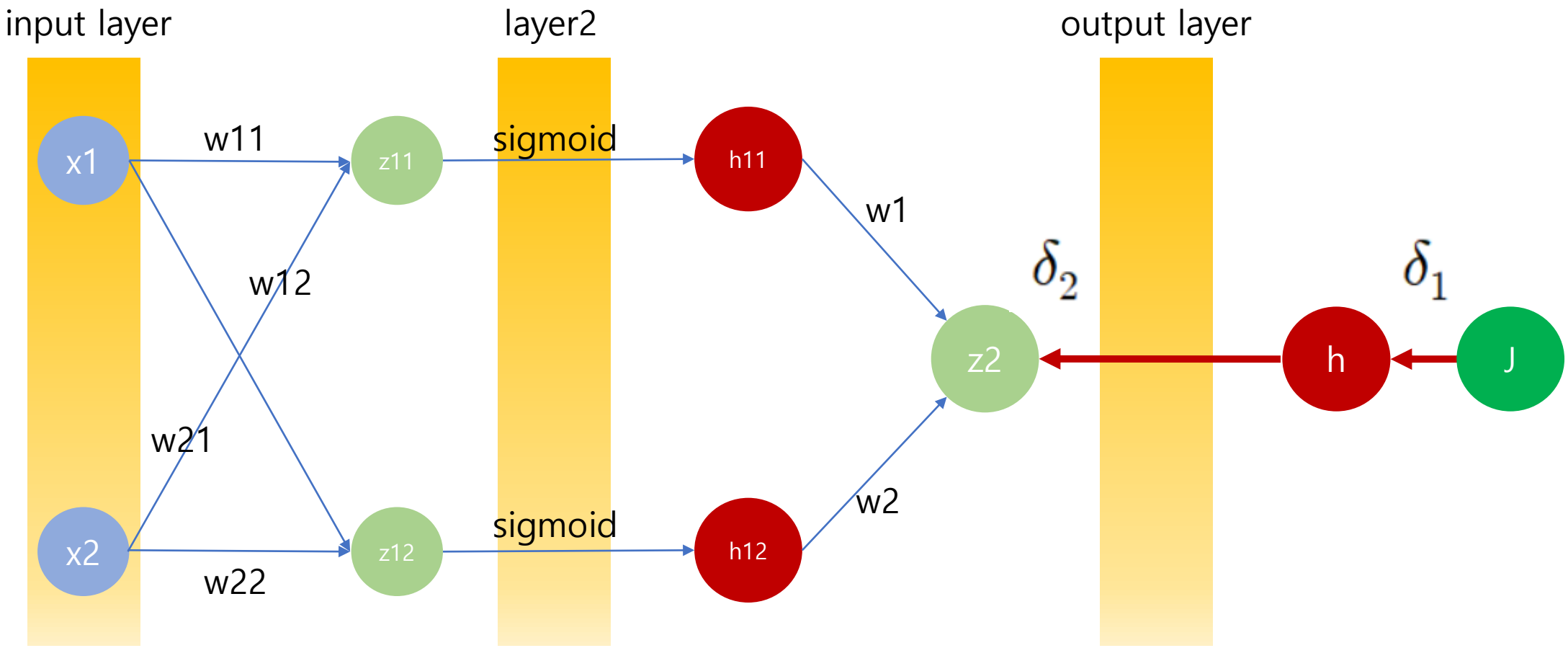
$$output = sigmoid(z_2)$$



$$J(w) = (h(w) - y)^2$$

$$\delta_1 = \boxed{\frac{\partial J}{\partial h}} = 2(h - y)$$

$$\delta_2 = \frac{\partial J}{\partial z_2} = \boxed{\frac{\partial J}{\partial h}} \cdot \frac{\partial h}{\partial z_2}$$



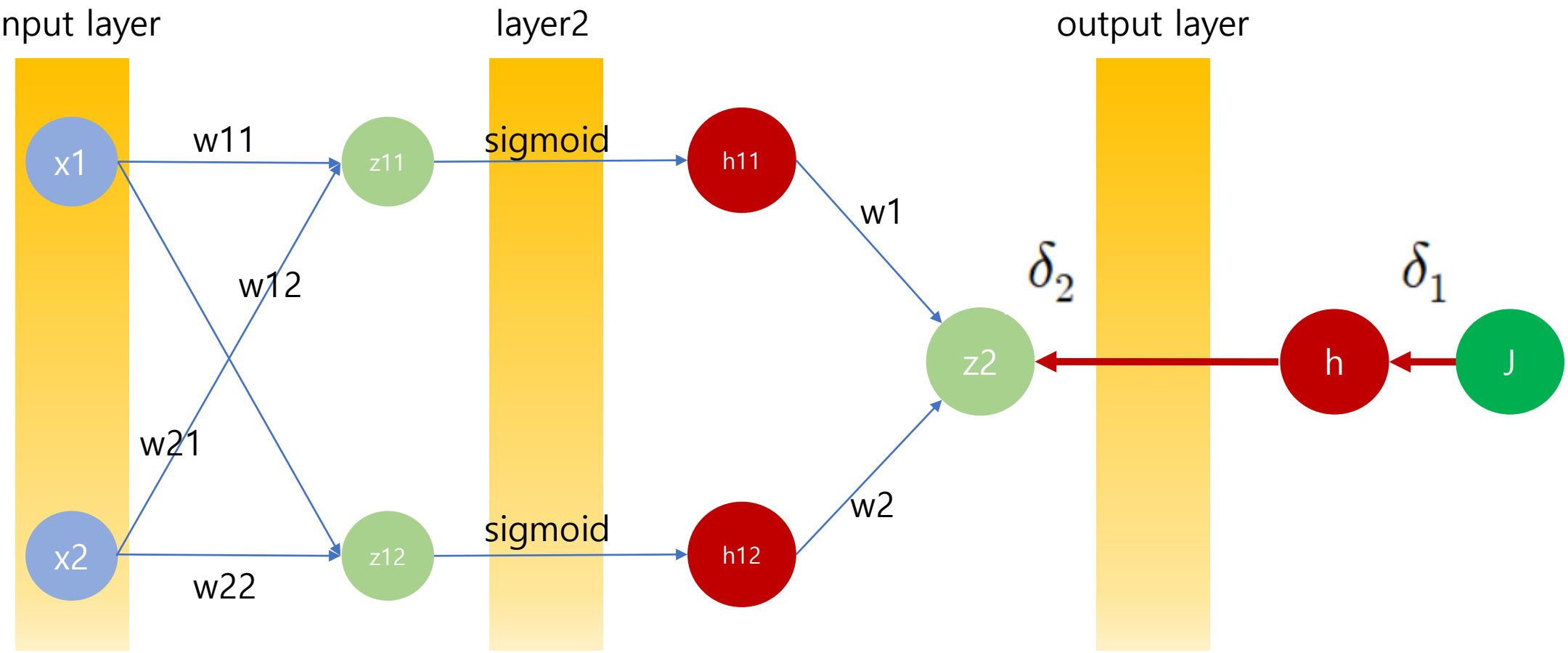
$$J(w) = (h(w) - y)^2$$

$$\delta_1 = \frac{\partial J}{\partial h} = 2(h - y)$$

$$\delta_2 = \frac{\partial J}{\partial z_2} = \frac{\partial J}{\partial h} \cdot \frac{\partial h}{\partial z_2}$$

$$h = sigmoid(z_2)$$

$$\frac{\partial h}{\partial z_2} = h(1 - h)$$



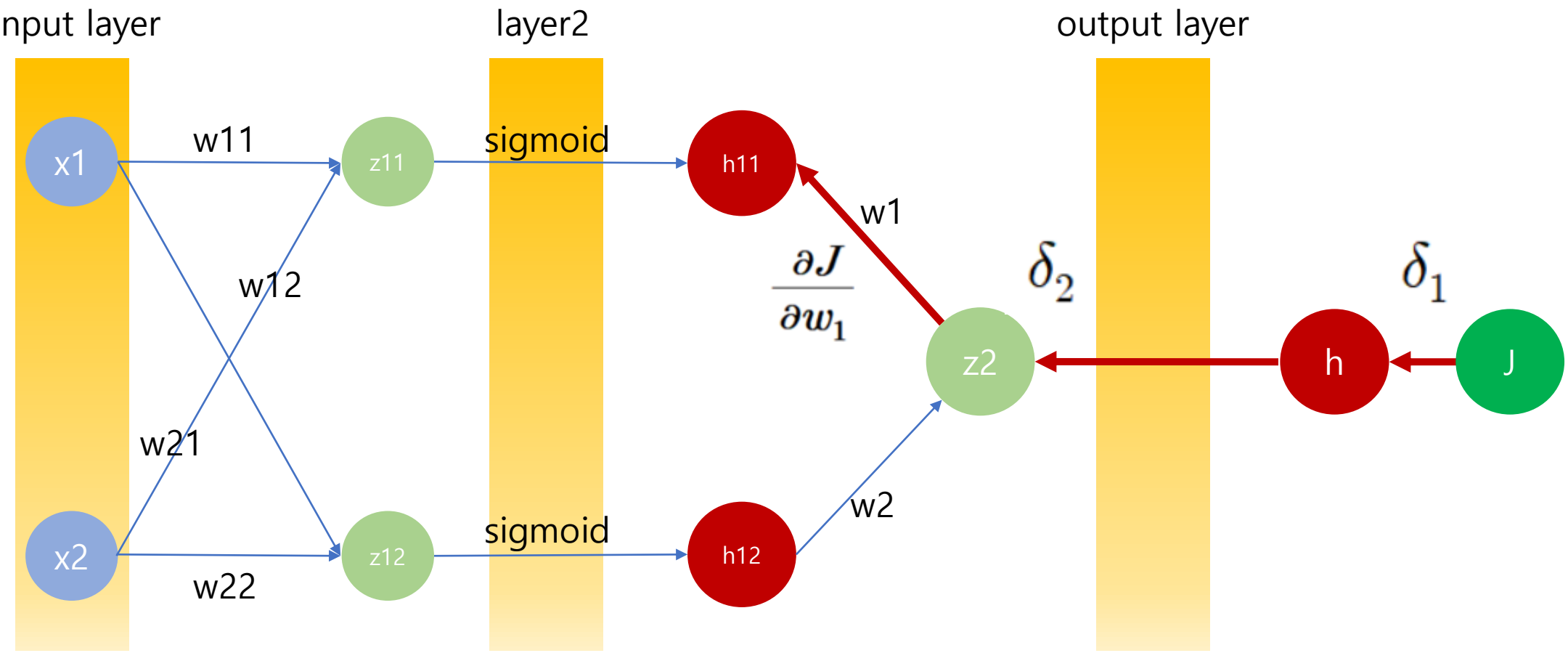
$$J(w) = (h(w) - y)^2$$

$$\delta_1 = \frac{\partial J}{\partial h} = 2(h - y)$$

$$\delta_2 = \frac{\partial J}{\partial z_2} = \frac{\partial J}{\partial h} \cdot \frac{\partial h}{\partial z_2} = \delta_1 \cdot h \cdot (1 - h)$$

$$h = sigmoid(z_2)$$

$$\frac{\partial h}{\partial z_2} = h(1 - h)$$



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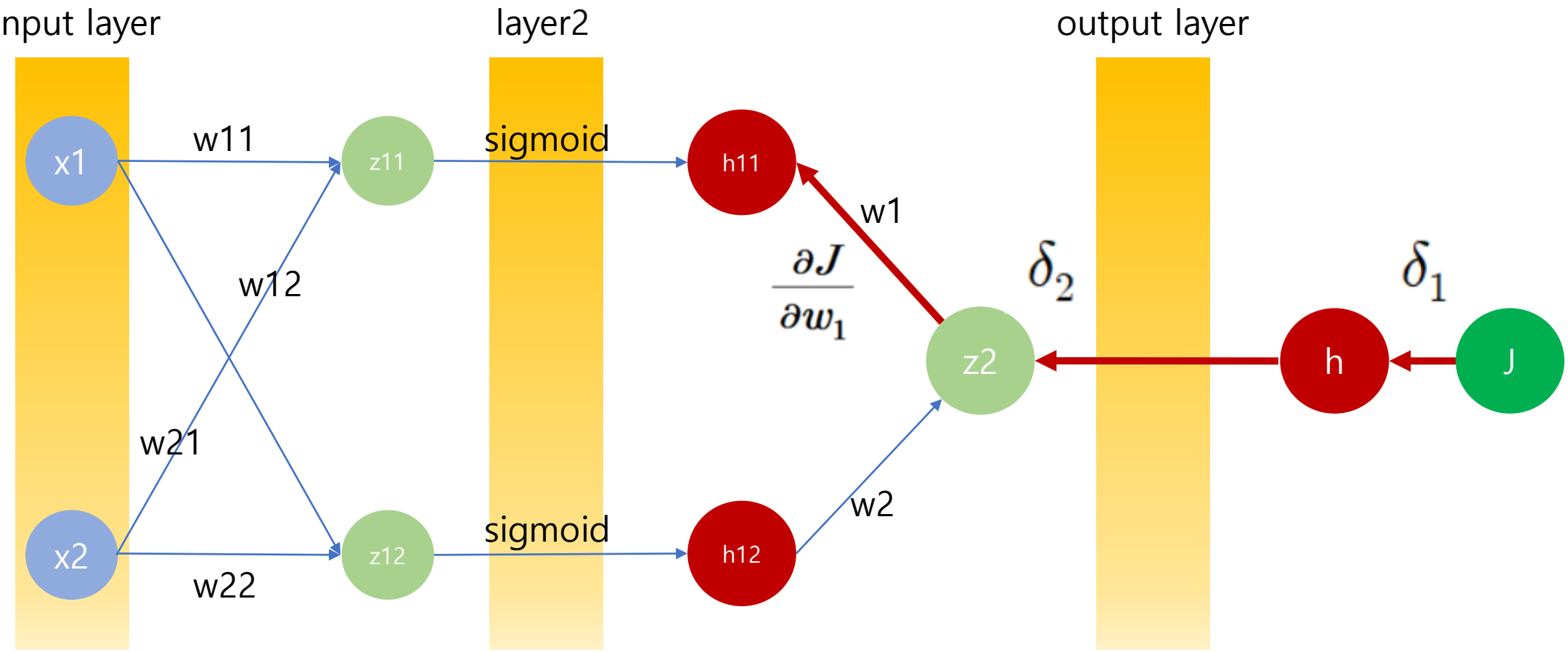
$$\delta_2 = \frac{\partial J}{\partial z_2} = \frac{\partial J}{\partial h} \cdot \frac{\partial h}{\partial z_2} = \delta_1 \cdot h \cdot (1 - h)$$

$$\frac{\partial J}{\partial w_1} = \frac{\partial J}{\partial z_2} \cdot \frac{\partial z_2}{\partial w_1}$$



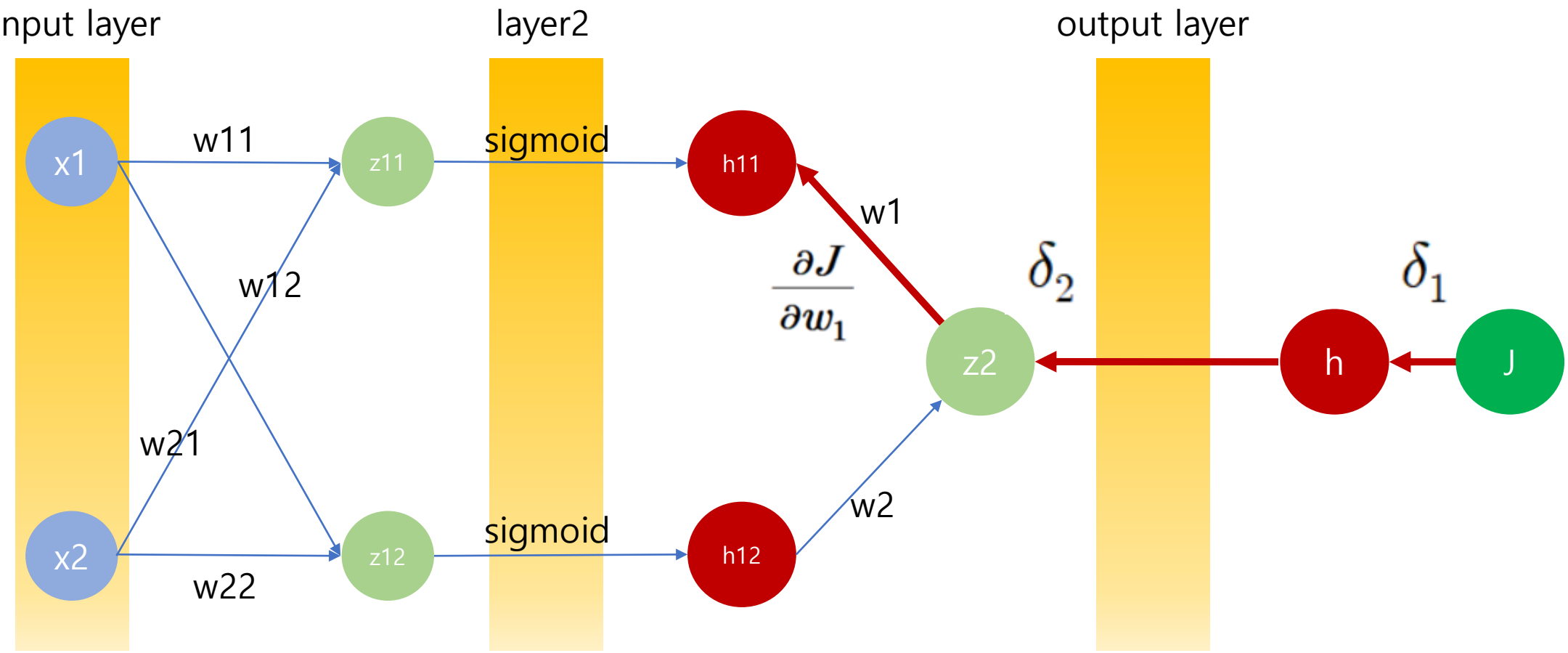
$$J(w) = (h(w) - y)^2$$

$$\delta_1 = \frac{\partial J}{\partial h} = 2(h - y)$$

$$\delta_2 = \frac{\partial J}{\partial z_2} = \frac{\partial J}{\partial h} \cdot \frac{\partial h}{\partial z_2} = \delta_1 \cdot h \cdot (1 - h)$$

$$z_2 = w_1 h_{11} + w_2 h_{12}$$

$$\frac{\partial J}{\partial w_1} = \frac{\partial J}{\partial z_2} \cdot \frac{\partial z_2}{\partial w_1} = \delta_2 \cdot h_{11}$$



$$\frac{\partial J}{\partial w_1} = \frac{\partial J}{\partial z_2} \cdot \frac{\partial z_2}{\partial w_1} = \delta_2 \cdot h_{11}$$

update

$$w_1 := w_1 - \alpha \frac{\partial J}{\partial w_1}$$