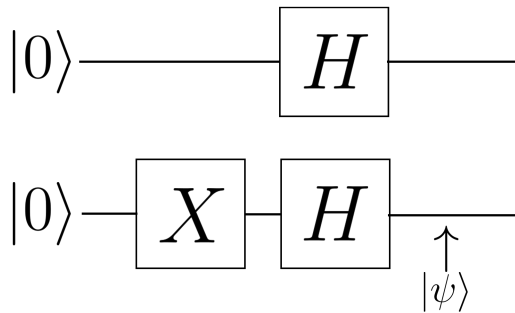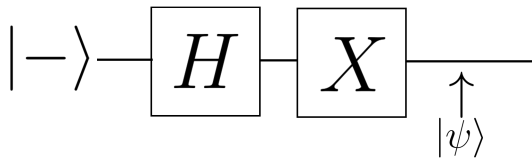# 2.2 Introduction to Quantum Circuits

1. In the quantum circuits below, find the state $|\psi\rangle$
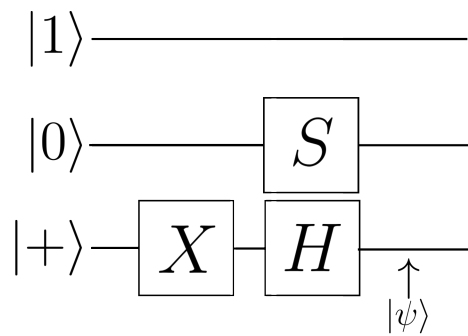
(a)

$$|0\rangle \text{———} \boxed{H} \text{———}$$

$$|0\rangle \text{—} \boxed{X} \text{—} \boxed{H} \text{—}$$
$$\uparrow$$
$$|\psi\rangle$$

(b)

$$|-\rangle \text{—} \boxed{H} \text{—} \boxed{X} \text{—}$$
$$\uparrow$$
$$|\psi\rangle$$

(c)

$$|1\rangle \text{——————}$$

$$|0\rangle \text{———} \boxed{S} \text{———}$$

$$|+\rangle \text{—} \boxed{X} \text{—} \boxed{H} \text{—}$$
$$\uparrow$$
$$|\psi\rangle$$

Answers

1.

(a) $|\psi\rangle = |+\rangle \otimes |-\rangle$ or expanding, $|\psi\rangle = \frac{1}{2}\Big(|00\rangle - |01\rangle + |10\rangle - |11\rangle\Big)$

(b) $|\psi\rangle = |0\rangle$

(c) $|\psi\rangle = |100\rangle$