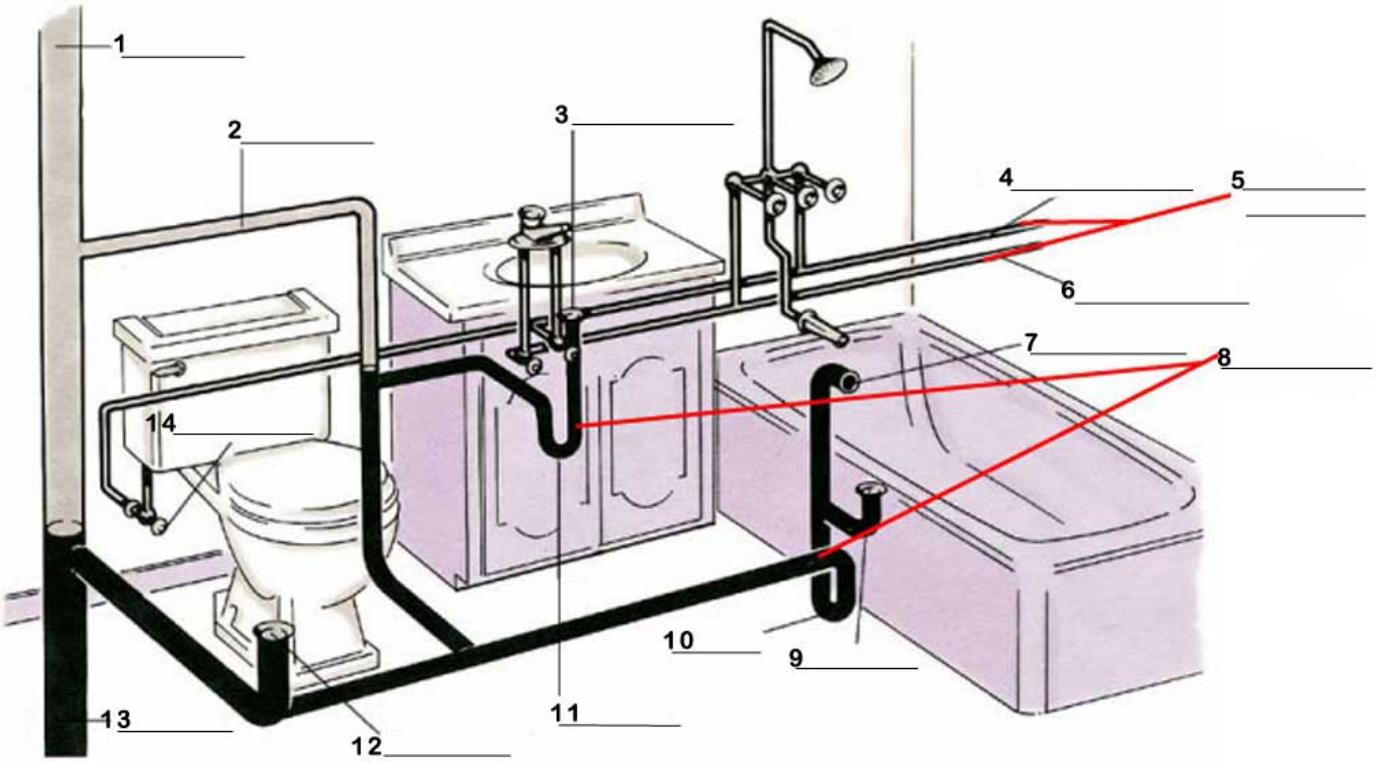
Home Construction Utilities

With the rough-in carpentry done, there are several utility resources used in the modern home such as electricity, data, plumbing, heating, ventilation, & air conditioning (HVAC), and gas. To align with hands-on project students will focus on some plumbing and electrical.

Plumbing



Plumbing systems feature **three main components**, the water supply (well or municipal supply), the drainage municipal sewer or local septic tank), and the appliance/fixtures (appliance that uses water). History of plumbing, piping was cast-iron drains and brass supply pipes. For the most part, PVC plastic, copper, and flexible cross-linked polyethylene, known as PEX which has increased flexibility and reduced cost, both in labour installation time and cost of materials. Whether the pipes are plastic, metal, or a combination of the two, it's the plumber's skill, design, and installation methods**,** that will determines **how well the system works**. Many methods of installation can cause a lot of future problems and just one leaky joint can cause thousands of dollars' worth of damage.

For **general installation and time lines**, sewer stubs are placed before pouring the concrete foundation, but the bulk of the plumbing takes place later. Large plumbing fixtures such as tubs and shower units are often too large to set once walls and doorways are framed in. For this reason they must be installed prior to framing the walls and cover them with cardboard or similar while construction continues to protect their surfaces from scratches and dents. After the rough-in framing is done but before the drywall installation, the ducting, rough-in plumbing, and electrical utilities are installed at the same time. Main drains are installed in floors and connected to the main plumbing stack. Next, rough-in drain fittings are installed for sinks and tubs. Water supply pipes or

tubing are installed and toilet flanges are set. Lastly, after finishing the walls, cabinetry, and flooring you can now place and connect sinks, toilets, and other plumbing related fixtures.

With **water supply systems**, the main pressurized water supply line enters the house with a pressure of about 50-60 psi (pounds per square inch, which is a measurement of pressure) below frost line, through a water meter, then splits into two lines with one supplying the cold water and the other connecting to the hot water heater. From there, the two lines supply hot and cold water to each fixture and/or appliance. Modern homes have a water supply manifold system featuring a large frame - blocked in PEX distribution panel with red (hot water) and blue (cold water) flow valves. Each valve can control individual hot or cold tube distribution or additional manifolds that supplies water to fixtures. Using a manifold system like this makes it simple to control the flow and/or shut off the water supply to one fixture without shutting off water supply to the whole house giving the homeowner flexibility.

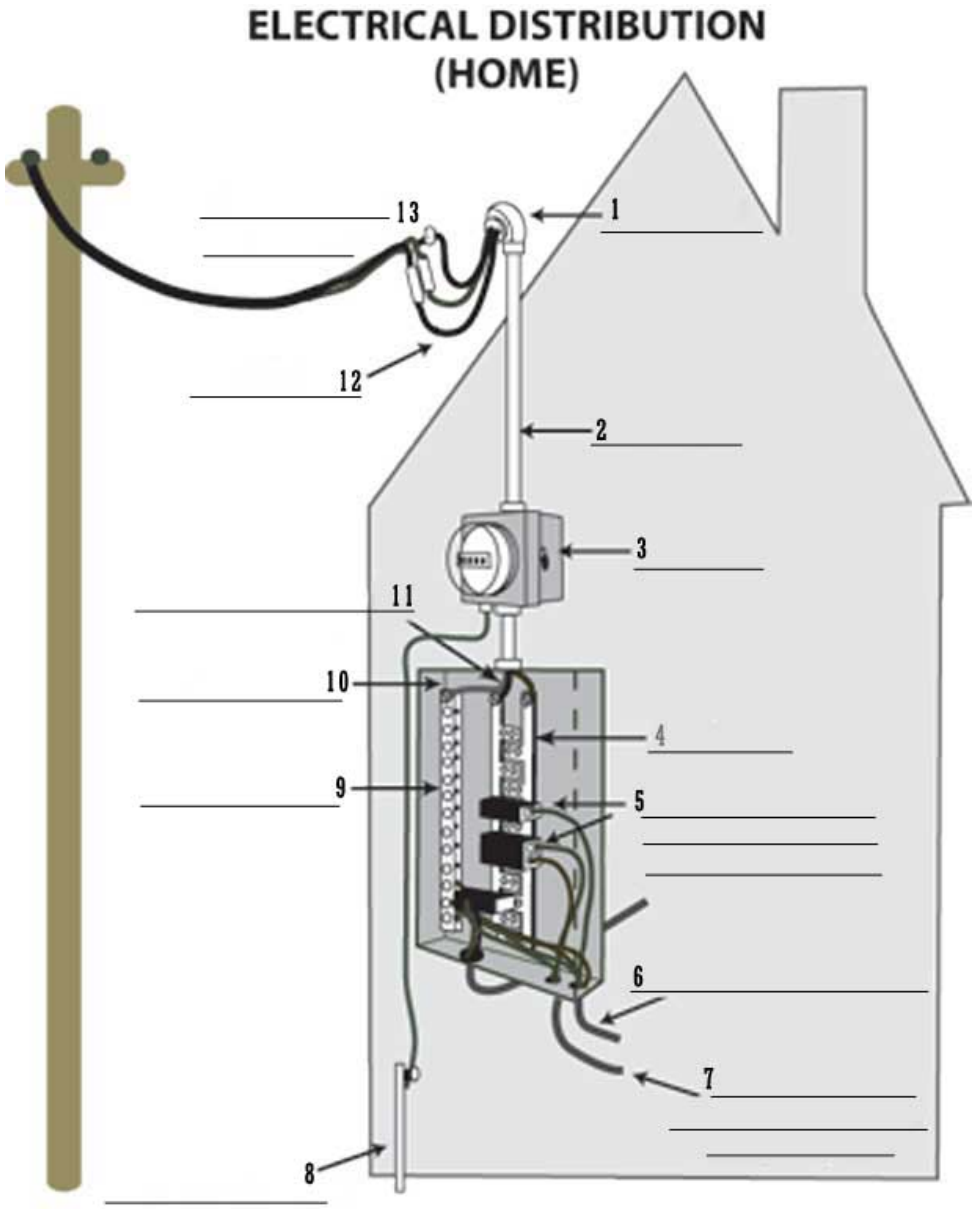
Drainage is another important part of the plumbing. A main stack connects all drainage and venting to roof. The main soil or waste **stack**, usually 4” size in diameter, is gravity fed from all drains in the home, and runs vertically from beneath the ground floor to above the roof line. The waste drains connect to the stack, directing waste downward to the main sewer drain, which then exits the home below frost line and ties into the municipal sewer system or runs to a personal septic system. Plumbing fixtures usually will have both a drain trap and vent. The **drain trap** is a u-shaped pipe that connects to the bottom of a sink, shower, or tub which retains a small amount of water that prevents the smelly sewer gasses from backing up into the house. All plumbing fixtures require drain traps except the toilets, which comes with an internal trap built into their base. **Vents** allow the pressure to equalize on both sides of a trap, allowing the trap to hold the water effectively and avoid "trap suck-out" which otherwise might occur if not in place. For these drains to work optimal, a constant source of air through vents will prevent water locks causing clogs. All drains require ventilation, but a single vent, usually installed behind a sink, can serve additional fixtures and appliances that connect within 10 feet of a common drain line. Vent pipes, are generally 1.5 to 2 inches in diameter and connect to the stack in the attic. When a fixture sits too far from a common vent, it requires an additional vent piping, to connect to the stack or may exit the roof separately, depending on the home's layout.

Electrical

Generally electrical supply is brought into a home by either an under-ground or above-ground wiring, then through a power kilowatt meter, and then to the service distribution panel. The meter is to measure/track how much power the homeowner is using. From the service distribution panel, circuit breakers protect individual circuits which are used to distribute power through-out the home, based on their amperage and type of power needed. For example a stove on its own will need 40 amp (Amperes – the amount of current or electricity the device uses) breaker which is designed to protect the #8 AWG (American Wire Gauge - a standard in wire sizing) wire from getting too hot which may cause a fire, if the stove draws too much current or there is a short. Code regulations dictate the safe amperage standards for electrical appliances and their circuits that they are used for.

The Canadian Electrical Code dictates standards and safety regulations so that electrical wiring and devices are safely installed for use by the homeowner. Electricians use **wiring diagrams** in the form of symbolic (flow with simple shapes related to location and devices), schematic (ladder diagram of wire connections), and layout (pictorial of devices, boxes, locations, and connections) to follow and wire up devices. After familiarizing and understanding the details with wiring and device connections, wiring circuit connections can be visualized and wire up circuits using just the wiring plans. **Device boxes** used to connect typical home electrical appliances come in many sizes and shapes with the three most common being the rectangular (for receptacles and switches), square (for junctions), and octagonal (for lamps). There are many rules and regulations, constantly being updated, to keep in mind when installing these devices. Generally boxes are mounted with the thickness of the finished wall, typically drywall, so that they are flush with finished edge (hydro code regulations), then electrical device is screwed to the box along with a device cover.

Three **typical devices** used are the receptacle, switch, and lamp holder. A typical duplex u-ground 120 volt (voltage – amount of pressure of electricity) receptacle outlet and similar devices are connected by a #14 AWG romex cable to the box and fed from the service distribution panel. **Wire preparation** must be carefully done to ensure excellent wire connections which commonly include; appropriate conductor length inside box, no nicks with wire stripped, tight marret connections, appropriate box fills, and excellent wire terminations on terminals of electrical devices for safe home use. Improper wiring methods can easily cause fires and cost a homeowner their home if not wired properly.



Review Questions

Answer questions neatly in the space provided with ½ a mark for quick points/descriptions and 1 full mark for each larger explanation/description.

1. What types of utility resources are found in the home?
   a. _____
2. Name and describe the three main components in a plumbing system?
   a. _____
3. Name 5 different materials that have been used for plumbing pipe.
   a. _____
4. What three key points make for a great plumbing system?
   a. _____
5. Describe the installation time lines for plumbing installation stages.
   a. _____
6. Describe how the water supply system enters the home and what new modern home plumbing component is used today?
   a. _____
7. Explain how the drainage stack, drains, drain trap, and vents operate in a home.
   a. _____

Mark Breakdown Column

Q#	A
1	2.5
2	3
3	2.5
4	1.5
5	4
6	3
7	4
8	4
9	3
10	3
11	3
12	2
13	2
14	2.5
D 1	5
D 2	5
T=	50

8. Describe how electricity is brought into the home and distributed?
   a. _____

9. Explain what a circuit breaker is, what it protects, and why.
   a. _____

Mark Breakdown Column

Q#	A
1	2.5
2	3
3	2.5
4	1.5
5	4
6	3
7	4
8	4
9	3
10	3
11	3
12	2
13	2
14	2.5
D 1	5
D 2	5
T=	50

10. Describe the three types of wiring diagrams and why they are used?
    a. _____

11. What are three common electrical box types and their uses?
    a. _____

12. Why are electrical boxes mounted or set a little further out from rough-in framed walls?
    a. _____

13. Explain what current and voltage are.
    a. _____

14. What factors ensure excellent and safe wire connections?
    a. _____