

## Building Science Education Solution Center – Introduction to Heat Pumps

### Problem Set 1.1:

- 1) Which of the following can air source heat pumps be used for?
  - a. Cooling a household in the summer.
  - b. Heating a household in the winter.
  - c. Heating a household in an extreme cold climate
  - d. All of the above.

Answer: 1 – d

### Problem Set 1.2:

- 1) Match the terms with the correct definition.

Definition	Key Term
1) Nominal output of heat pump at 47°F (Btu/hr) as tested.	a. Design Heating Capacity
2) Heat pump's output at the winter design temperature (Btu/hr).	b. Design Heating Load
3) Lowest possible output at a given temperature.	c. Displacement Heating
4) Maximum heating capacity when the outdoor temperature is 5°F.	d. Heating Capacity @ 5°F
5) Heating need at the target minimum winter temperature (Btu/hr).	e. Minimum Heating Capacity
6) A design strategy where the heat pump is only intended to cover <i>part</i> of the home's annual load, displacing heat that would otherwise come from another heating system.	f. Multi, Mini, Package, Split
7) A chemical compound that readily absorbs and releases heat using a phase change. Common heat pump refrigerants include R410a, R32, R134a, R744 (CO <sub>2</sub> ), R22 (phased out).	g. Rated Heating Capacity
8) System type descriptions.	h. Refrigerant

Answers:

1. G
2. A
3. E
4. D
5. B
6. C
7. H
8. F

**Problem Set 1.3:**

- 1) Which of the following would not be a good reason to install a heat pump in an existing home.
  - a. The homeowner needs a new HVAC system and wants to have air-conditioning
  - b. The home is being renovated and there is not space for ductwork
  - c. Heat pumps have more heating capacity than furnaces or boilers
  - d. Heat pumps come in small capacities appropriate for small additions
  
- 2) Why is there current interest in fuel switching from fossil-fuel heating sources to electric heat pumps?
  - a. Health and safety concerns with fossil fuel combustion in the home
  - b. Environmental concerns with how fossil fuels are extracted
  - c. Homeowners want to stabilize their utility costs
  - d. All of the above

Answers: 1 – c, 2 – d

**Problem Set 2.1:**

- 1) Which of the following components are in both heat pumps and air conditioners?
  - a. Compressor
  - b. Indoor coil
  - c. Expansion valve
  - d. All of the above
  
- 2) Why do most heat pumps have auxiliary heat?
  - a. Auxiliary heat is more efficient
  - b. Heat pumps cannot provide enough heat if the outdoor temperature is too low
  - c. Heat pumps are prone to failure
  - d. Auxiliary heat still works if there is a power outage

Answers: 1 – d, 2 – b

**Problem Set 2.2:**

- 1) Which of the following choices is not a typical option when installing a heat pump in a home currently heated by a furnace or boiler?

- a. Replace an existing ducted furnace system with a ducted heat pump
- b. Install a heat pump as the primary heating system but keep the existing furnace or boiler as backup
- c. Install a ductless heat pump system to address a single isolated zone
- d. Install a heat pump to provide cooling when the furnace overheats the house

Answer: 1 – d

**Problem Set 3.1:**

- 1) Which of the following should be assessed before installing a heat pump?
  - a. Is the electrical panel sized to accommodate the heat pump?
  - b. Is there space to locate the outdoor unit so it gets proper airflow?
  - c. Is there a location for the outdoor unit where noise will not be bothersome?
  - d. All of the above

Answer: 1 – d

**Problem Set 3.2:**

- 1) Which of the following statements is not true when replacing a ducted furnace with a ducted heat pump?
  - a. The ductwork should be assessed to ensure it is properly sized for the new equipment
  - b. Air conditioning will not increase the risk of condensation on the ducts
  - c. The existing ductwork should be assessed to ensure it is properly insulated and sealed
  - d. Properly insulating ductwork will reduce the risk of condensation on the ducts

Answer: 1 - b