

# Soft Skills

## Review Questions

The ability to utilize all types of communication skills is \_\_\_\_\_ to the HVAC technician.

- a. Not as important as “hands on” technical skills
- b. Somewhat important
- c. Unimportant
- d. Very important

It is important to be \_\_\_\_\_ in filling out service orders so that office staff, other technicians, and customers will know what work you completed on the job.

- a. Clear
- b. Complete
- c. Concise
- d. All of the above

Listening carefully to what a customer is telling you \_\_\_\_\_

- a. Can help you diagnose the problem.
- b. Is a waste of time.
- c. Is not necessary.
- d. Often will only confuse you.

What is the volume of a room that measures 10 ft by 20 ft with an 8-ft ceiling?

- a. 800 ft<sup>3</sup>.
- b. 1,600 ft<sup>3</sup>.
- c. 2,400 ft<sup>3</sup>.
- d. 3,200 ft<sup>3</sup>.

Before leaving a service call, you should be sure to \_\_\_\_\_

- a. Ask the customer for referrals.
- b. Collect payment in cash if possible.
- c. Demonstrate system operation and describe basic maintenance procedures to the customer.
- d. Try to sell the customer an equipment upgrade.

What is the cfm requirement for an 1,800-ft<sup>2</sup> house with 8-ft ceilings, if five air changes per hour are needed?

- 400 cfm.
- 1,200 cfm.
- 1,600 cfm.
- 2,400 cfm.

$\frac{cfm_n}{cfm_o} = \frac{rpm_n}{rpm_o}$	cfm and rpm are interchangeable (o = old, n = new)	$cfm_n = cfm_o \times \frac{rpm_n}{rpm_o}$	$rpm_n = rpm_o \times \frac{cfm_n}{cfm_o}$
$\left(\frac{cfm_n}{cfm_o}\right)^2 = \frac{SP_n}{SP_o}$ or $\frac{cfm_n}{cfm_o} = \sqrt{\frac{SP_n}{SP_o}}$		$cfm_n = cfm_o \times \sqrt{\frac{SP_n}{SP_o}}$	$SP_n = SP_o \times \left(\frac{cfm_n}{cfm_o}\right)^2$
$\left(\frac{cfm_n}{cfm_o}\right)^3 = \frac{bhp_n}{bhp_o}$ or $\frac{cfm_n}{cfm_o} = \sqrt[3]{\frac{bhp_n}{bhp_o}}$		$cfm_n = cfm_o \times \sqrt[3]{\frac{bhp_n}{bhp_o}}$	$bhp_n = bhp_o \times \left(\frac{cfm_n}{cfm_o}\right)^3$
Hydronics: cfm = gpm, rpm = gpm, $\Delta P = SP$ (static pressure)			
$\%OA = \frac{RAT - MAT}{RAT - OAT} \times 100$	$OAT = \frac{(MAT \times 100) - (\%RA \times RAT)}{\%OA}$	A = air M = mixed O = outside R = return T = temperature	
$MAT = \frac{(\%OA \times OAT) + (\%RA \times RAT)}{100}$	$RAT = \frac{(MAT \times 100) - (\%OA \times OAT)}{\%RA}$		
$cfm = \frac{\text{air changes per hour} \times \text{volume}}{60 \text{ min}}$	$V = 4005 \times \sqrt{V_p}$	$V_p = \left(\frac{V}{4005}\right)^2$	V = flow velocity V <sub>p</sub> = velocity pressure
insulation R value = $\frac{^\circ\text{F air in duct} - ^\circ\text{F air outside duct}}{15}$			
pressure (psi) = 0.433 × head (feet of water)	pressure <sub>1</sub> × volume <sub>1</sub> = pressure <sub>2</sub> × volume <sub>2</sub>		
area = π × radius <sup>2</sup>	1 in. w.g. = 0.0360 psi		
A <sup>2</sup> + B <sup>2</sup> = C <sup>2</sup>	1 psi = 27.7612 in. w.g.		
diameter = $\frac{\text{circumference}}{\pi}$	Btuh (sensible) = 1.08 × cfm × ΔT		
	Btuh (latent) = 0.68 × cfm × Δgrains		
	Btuh (total) = 4.5 × cfm × Δenthalpy		
	Btuh = 500 × gpm × ΔT		
cfm (at altitude) = $\frac{\text{sea level flow rate}}{\text{density ratio}}$	cfm = velocity (ft/min) × duct area (ft <sup>2</sup> )		
friction rate (FR) = $\frac{\text{available static pressure (ASP)} \times 100}{\text{total effective length (TEL)}}$ (expressed as in. w.g. per 100 ft of duct)			

A flaring tool is used to \_\_\_\_\_

- a. Make a mechanical joint in tubing.
- b. Measure pipe diameters.
- c. Remove burrs from piping.
- d. Separate pipe fittings.

A swaging tool is used to \_\_\_\_\_

- a. Cut copper tubing.
- b. Make a mechanical joint in tubing.
- c. Remove burrs from piping.
- d. Solder tubing without the use of couplings.

In discussing human comfort, the temperature most commonly referred to is \_\_\_\_\_

- a. Dew point.
- b. Dry-bulb.
- c. Wet-bulb.
- d. Fahrenheit.

A sling psychrometer uses two glass-stem thermometers. One measures dry-bulb, and the other measures \_\_\_\_\_

- a. Dew point.
- b. Enthalpy.
- c. Relative humidity.
- d. Wet-bulb.

What is the best tool for removing moisture and noncondensibles from a system before adding refrigerant?

- a. Manifold gauge.
- b. Micron analyzer.
- c. Recovery machine.
- d. Vacuum pump.

What is one of the advantages of using silver brazing rods for copper-to-copper joints?

- a. A lower melting temperature is required.
- b. A propane torch is normally used.
- c. No flux is required.
- d. No nitrogen purge is needed.

What type of eye protection should you wear when drilling overhead?

- a. Face shield.
- b. Goggles.
- c. Side shields.
- d. Spectacles.

What agency regulates cylinders and chemicals transported in a service vehicle?

- a. ASHRAE.
- b. DOT.
- c. EPA.
- d. OSHA.

What is the maximum safe storage temperature of a refrigerant cylinder filled to 80% capacity by weight?

- a. 120°F.
- b. 125°F.
- c. 130°F.
- d. 135°F.

Which of the following classifications of fire extinguishers should be used for electrical fires?

- a. A.
- b. B.
- c. C.
- d. D.

If a ladder is placed against a wall that is 20 ft tall, what is the proper distance away from the wall for the base of the ladder?

- a. 3 ft.
- b. 4 ft.
- c. 5 ft.
- d. 6 ft.

When does a ground fault circuit interrupter open an electric circuit?

- a. When current travels through a ground path other than the neutral.
- b. When the circuit is overloaded.
- c. When there is a short circuit.
- d. All of the above.

# Heat and Matter

## Review Questions

A natural cooling process produced by moisture on the skin changing to low-pressure steam is called \_\_\_\_\_

- a. conduction.
- b. convection.
- c. evaporation.
- d. radiation.

All matter can exist as a \_\_\_\_\_

- a. liquid.
- b. solid.
- c. gas.
- d. all of the above.

Stored energy is called \_\_\_\_\_ energy.

- a. controlled
- b. kinetic
- c. potential
- d. quantum

Heat that you can feel and measure directly with a thermometer is called \_\_\_\_\_ heat.

- a. absolute
- b. latent
- c. sensible
- d. super

The heat energy change associated with a phase (state) change is called \_\_\_\_\_ heat.

- a. absolute
- b. latent
- c. sensible
- d. super

The amount of heat (Btu) needed to raise the temperature of 1 lb of a substance  $1^{\circ}\text{F}$  is called the \_\_\_\_\_ heat of the substance.

- a. absolute
- b. latent
- c. sensible
- d. specific

When liquid and vapor phases of a substance exist together, and no more liquid can vaporize without more energy being added, the vapor is said to be \_\_\_\_\_

- a. saturated.
- b. stabilized.
- c. subcooled.
- d. superheated.

When a vapor is heated to a temperature higher than its saturation point, both the added heat and the temperature above saturation are called

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- a. latent heat.
- b. sensible heat.
- c. specific heat.
- d. superheat.

The process of molecules escaping from the surface of a liquid is called \_\_\_\_\_

- a. condensation.
- b. evaporation.
- c. saturation.
- d. subcooling.

The continuous movement of molecules within a liquid or gas is called \_\_\_\_\_ energy.

- a. atomic
- b. kinetic
- c. potential
- d. stored

An *ampere* is a measurement of \_\_\_\_\_

- a. electrical charge.
- b. electron flow rate.
- c. opposition to current.
- d. potential energy.

*Voltage* is best defined as the \_\_\_\_\_

- a. amount of power being used in a circuit.
- b. force that moves electrons through a circuit.
- c. magnetic field surrounding a conductor.
- d. resistance to the flow of electrons.

A substance that permits the free movement of electrons is called a(n) \_\_\_\_\_

- a. conductor.
- b. insulator.
- c. resistor.
- d. semiconductor.

What is the voltage of a circuit if the resistance is  $5 \Omega$  and the current is  $5 \text{ A}$ ?

- a.  $1 \text{ V}$
- b.  $2.5 \text{ V}$
- c.  $10 \text{ V}$
- d.  $25 \text{ V}$

A circuit has a voltage of 10 V and a current of 5 A. What is the resistance?

- a. 2  $\Omega$
- b. 15  $\Omega$
- c. 20  $\Omega$
- d. 50  $\Omega$

The load rating of a transformer is stated in

\_\_\_\_\_

- a. amperes.
- b. volts.
- c. volt-amperes.
- d. watts.

An ac induction motor consists of a stationary part called the \_\_\_\_\_ and a rotating part called the \_\_\_\_\_

- a. field, armature.
- b. primary winding, secondary winding.
- c. start winding, run winding.
- d. stator, rotor.

A centrifugal switch opens the start winding circuit when a capacitor-start motor reaches approximately \_\_\_\_\_ of its full speed.

- a. 50%
- b. 60 to 70%
- c. 75 to 80%
- d. 90 to 100%

How many functions is an individual circuit in a control system designed to control?

- a. One.
- b. Two.
- c. Three.
- d. Unlimited.

The five basic components common to all schematics are a power supply, a path, a load, a legend, and a \_\_\_\_\_

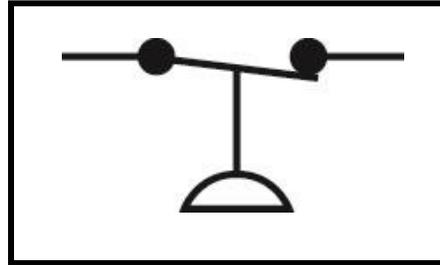
- a. contactor.
- b. relay.
- c. switch.
- d. thermostat.

Devices that consume power and convert it to some other form of energy, such as motion or heat, are \_\_\_\_\_

- a. contacts.
- b. fuses.
- c. loads.
- d. transformers

The symbol shown below represents a

\_\_\_\_\_



- a. pressure switch that opens on pressure fall.
- b. pressure switch that opens on pressure rise.
- c. temperature switch that opens on temperature fall.
- d. temperature switch that opens on temperature rise.

A(n) \_\_\_\_\_ circuit allows the same current to flow through all of the components.

- a. ac
- b. dc
- c. parallel
- d. series

What types of circuits are primarily used in control and safety applications?

- a. Continuous.
- b. Parallel.
- c. Series.
- d. Series-parallel.

# Test Instruments

## Review Questions

When testing with a voltmeter, you should place the meter \_\_\_\_\_

- a. in series with the circuit being tested.
- b. in parallel with the circuit being tested.
- c. on the highest possible setting.
- d. on the lowest possible setting.

When you use an ohmmeter, the circuit being measured must be \_\_\_\_\_

- a. energized.
- b. in use.
- c. isolated from all energy sources.
- d. at least 1.5 V.

When you test a switch with an ohmmeter, a reading of \_\_\_\_\_ indicates that the switch is closed.

- a.  $0 \Omega$
- b. 24 V ac
- c. 120 V ac
- d. infinity

When testing across a closed switch in an energized circuit, you should read \_\_\_\_\_

- a.  $0 \Omega$ .
- b. infinite resistance.
- c.  $0 \text{ V ac}$ .
- d.  $120 \text{ V ac}$ .

When testing compressor windings, you take the following readings:

C to R:  $2 \Omega$

C to S: infinite resistance

R to S: infinite resistance

What is the diagnosis?

- a. The compressor is good.
- b. The run winding is shorted.
- c. The start winding is shorted.
- d. The start winding is open.

When testing a thermostat wire that has been removed from the circuit, you measure  $0 \Omega$  between red and white. This indicates that

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- a. the transformer is bad.
- b. the wiring is good.
- c. there is high resistance in the wire.
- d. there is a short.