Benjamin Shih

1) What is the functional difference between a fuel gas and oxygen?
Fuel gas provides the organic compound for burning, while oxygen provides the oxidizing agent that causes the burning that reduces the number of electrons available in the fuel gas.

2) How can you tell the difference between the regulators for acetylene and oxygen?
Some regulator companies paint the acetylene regulators red and the oxygen regulators green, so that the color of the regulator matches the color of the hose. In addition, the knobs for each regulator turn in different directions, and only the oxyfuel regulator can screw into the oxygen hose (vice versa for the acetylene).

3) Brass is the primary metal used in oxyfuel torch components. Why?
Brass is the primary metal used in oxyfuel torch components because it is a relatively soft metal, which means that it can conform to other surfaces and is more easily moldable. This characteristic allows brass to form a tight seal and to prevent leaking, since the ratio of gases in oxyfuel welding is very important.

4) What is mill scale?
Mill scale is the flaky surface of hot rolled steel. It consists of iron oxides, hematite, and magnetite. It protects the covered surfaces from atmospheric corrosion. Prior to working with surfaces covered in mill scale, it must be removed.

5) Should you melt the base metal when braze welding?
When braze welding is a type of brazing where a bronze or brass filler rod is coated with flux to join steel workpieces, but with additional heat in comparison to brazing. Braze welding does not melt the base metal of the joint because the temperature is considerably lower. This technique is most similar to soldering because we do not want to melt the base metals.

6) How many front orifices does a standard welding/brazing tip have?
A standard welding/brazing tip has one front orifice for the flame.

7) What solid material is inside an acetylene tank?
The solid material inside is called a monolithic material. It is very porous, and its purpose is to provide stability for the acetone.

8) What liquid material is inside an acetylene tank?
The liquid material that is inside is acetone. It is a solvent that will dissolve acetylene gas, and the dissolving action stabilizes the acetylene so that it can be pressurized in the cylinder.

9) About how thick is the wall of the average oxygen tank?

An oxygen tank has a wall thickness of about ¾ inch. An acetylene tank has a wall thickness of a little less than that.

10) How can exposure to oxygen prove harmful to you even after you leave the welding shop?
Overexposure to oxygen can have long term harmful effects including cell damage and death, or other forms of damage to the central nervous system, lungs, and eyes.

11) Why should you never aim a stream of oxygen at a puddle of oil?
Pure oxygen, especially highly pressurized like from a stream, can react violently with oils and grease. It may also catch fire or explode.

12) What is the maximum recommended working pressure for acetylene?
The maximum safe working pressure for acetylene is 15 psi. At higher pressures, acetylene becomes unstable, and may ignite spontaneously or explode.

13) With what tool do you light an O/A torch?
In order to light an oxyacetylene torch, use a striker to create a spark that will ignite the gas at the tip of the torch.

14) Flux is used primarily to create attractive colorizations on metal surfaces. T or F
False. The primary purpose of flux in welding (and brazing, soldering) is to prevent oxidation of the base and filler materials, in order to allow the heated metals to flow more smoothly. Flux is a substance which is nearly inert at room temperature, but becomes strongly reducing at higher temperature in order to prevent the formation of metal oxides. In addition, the flux allows the filler metal to flow easily on the working piece, rather than forming multiple beads. In joining processes, flux serves a dual purpose: to dissolve the oxides on the metal surface, which facilitates wetting by molten metal; and acting as an oxygen barrier by coating the hot surface with reducing material, in order to prevent oxidation of the join.

15) Most brazing rod is made of _____with a flux coating.
A mixture of materials, typically called a bronze alloy.

16) Why can't you install an oxygen hose on an acetylene fitting?
The screw threading spins in the opposite direction, so that the two cannot accidentally be swapped. This reverse threading is done for safety purposes.

17) What is meant by 'bleeding the lines'?
Bleeding the lines means to remove gas pressure from all lines and equipment, such that no gas remains in the equipment. This is done to remove a potential safety hazard.

In addition, this website was useful for other terminology:

http://quizlet.com/3916263/ag-mech-unit-4-gas-welding-flash-cards/

18) The most common ratio of fuel gas to oxygen for welding and brazing is__ : __?
For oxyacetylene welding, the oxygen to acetylene ratio is approximately 1.1:1.
For oxyacetylene cutting, the oxygen to acetylene ratio is approximately 1.5:1.

19) What is friction stir welding?
Friction-stir welding (FSW) is a solid-state joining process (metal is not melted). It is used when the original metal characteristics must remain unchanged as much as possible, and works by mechanically mixing the two pieces of metal at the joint, then softens the material so that the pieces remain joined via mechanical pressure. This technique is used primarily on aluminum, or larger pieces of metal that cannot be easily heat-treated after welding to recover temper characteristics. In other words, if the temper characteristics are important, than FSW is a good option to preserve the material's original state.

20) What happens if you try to use an acetylene tank on its side?
If you use an acetylene tank on its side, you may accidentally release some of the liquid acetone. Because the acetylene gas is stored by binding to the liquid molecules, a loss of acetone translate to a decrease in the maximum capacity of the tank.

21) Name another fuel gas other than acetylene .
In addition to acetylene, other gases that may be used are propylene, liquid petroleum gas (LPG), propane, natural gas, hydrogen, and metylacetylene-propadiene propane (MAPP).

22) On a cutting torch there are two types of orifices, the center cutting jet and the_____jets.
In addition to the center cutting jet (which uses oxygen), there are two or more preheating jets. The preheating jets heat up the material, while the cutting jet is triggered, releasing a burst of oxygen that cuts the material.

23) A properly balanced flame is called a _____flame.
A properly balanced flame is called a "neutral flame", in which a balanced mixture of oxygen and acetylene is burned. The neutral flame is an important composition because it does not alter the composition of the base metal to any great extent when melting, and thus is suited for most metals.

24) A flame with excessive acetylene is called a _____flame.
A flame with excess acetylene being burned is called a "carburizing flame". This type of flame is typically used when welding nickel alloys. A carburizing flame can be represented by three distinct colors: bluish-white inner core, white intermediate cone, and light-blue outer flame.

A flame with excess oxygen being burned is called an “oxidizing flame”. This type of flame is typically used for welding bronze or fusing brass and bronze. An oxidizing flame has the general appearance of a neutral flame, but the inner cone is shorter, slightly pointed, and has a purplish tinge. The flame hisses audibly, and you can tell if you have an oxidizing flame when welding ferrous metals because numerous sparks will be thrown off as the metal melts and foam will form on the surface.

25) A stick welding machine uses a constant current power supply. What other arc welding process uses this?
GTAW (TIG) welding also uses a constant current power supply. This means that the current, and thus the heat, remains relatively constant, even if the arc distance or voltage change. This property of the constant current power supply is important because most applications of GTAW are manual or semiautomatic, which requires that an operator hold the torch, so it is safer to not have rapid changes in temperature.

26) SMAW is strictly DC. T or F
False. In general, DC is the preferred polarity with all electrodes. However, you may want to use AC if you are using a power source with AC output only, or to remedy arc blow problems – a phenomenon in which the arc wanders or blows out of the joint. This is more common when using large diameter electrodes at higher current levels.

27) In the designation E6011, what does the first ‘1’ mean?
The E stands for arc welding electrode. The rest of the digits are referred to as the designation.

The next two (if the total designation has 4 digits) or the next three (if the total designation has 5 digits) indicate the minimum tensile strength of the weld that the rod will produce, in thousands of pounds per square inch. It represents the amount of strength that can be relieved. In this case, the 60 (two digits, since the designation only has 4), represents 60,000 psi.

The second-to-last digit indicates the position that the electrode can be used in. 1 indicates use in all positions. 2 indicates use in flat and horizontal positions. 3 indicates use for flat welding.

The last two digits together indicate the type of coating on the electrode, and subsequently the welding current that the electrode can be used with. This implies that the current type affects the allowable welding positions.

This website has a lot of information on what electrodes to use for what purposes, and the corresponding current types:
http://www.metalwebnews.com/howto/weldrod.html

28) How does the flux coating on a 7014 differ from a 6010?
The 7014 is best for beginners because it is easy to use and works on either material. The tradeoff is that it does not have good penetration into metal. It has a

thicker flux coating than 6010 so that the filler metal flows more easily onto the weld face.

29) If you were trying to run a 1/8" 6010 on 100Amps AC and it wasn't working what would most likely be the problem?
In this situation, the cause is probably the polarity of the machine.

30) Which welding position is not considered 'out of position'?
Flat-positioned welding is considered to not be 'out of position'.
Welding out of position requires additional precautions, because gravity can work against you and pull the puddle down towards where you are standing. To adjust for the different direction of gravitational pull, it may help to use less voltage or a slower wire feed speed in order to maintain control and create a smaller puddle. In addition, reverse polarity may be helpful to concentrate the head to the tip of the electrode and make the work cooler, which allows the puddle to cool faster and drip less.

31) What is a weld bead called when there is no transverse oscillation?
Transverse oscillation describes the amount of side-to-side movement used by the welder. The amount of oscillation is directly proportional to the size of the weld (narrow vs. wide). A weld bead made with little weaving motion is called a stringer bead, and is narrow. On the other hand, a weld bead made with side-to-side oscillation is called a weave bead, and is wide.

32) If you are trying to SMAW two pieces of 1/2" steel plate with a 1/16 7014 electrode and it isn't working, what is probably the cause?
In this situation, the cause is probably a faulty filler metal and/or flux.

33) Which of these is considered 'arc welding'?
    1) SMAW
    2) GTAW
    3) GMAW
    4) All of the above

All of them are considered arc welding:
SMAW = shielded metal arc welding
GTAW = gas tungsten arc welding
GMAW = gas metal arc welding

34) What's a 'root pass'?
A root pass is the first layer of a multi-layer weld. The root pass is the most important layer of a weld because it is the most susceptible to slag inclusion (and other forms of contamination) as well as cracking.

This website was very helpful for welding terminology:
http://www.toolingu.com/definition-650280-84048-weld-face.html

35) Where is the face of the weld?
The weld face is the exposed surface of a weld on the side from which the welding was done.

This website was very helpful for welding terminology:
http://www.toolingu.com/definition-650280-84048-weld-face.html

36) What is undercut on a weld bead?
The undercut on a weld bead is a groove melted into the base metal at the weld toe or weld root that is left unfilled by weld metal. The groove concentrates stress on the weld, and could result in a defect.

This website was very helpful for welding terminology:
http://www.toolingu.com/definition-650280-84048-weld-face.html

37) What is an inclusion?
An inclusion is a discontinuity resulting from the mutual dissolution of flux and nonmetallic impurities in some welding process. Inclusions can affect the strength and integrity of a weld. The name refers to the inclusion of contaminants in a weld.

This website was very helpful for welding terminology:
http://www.toolingu.com/definition-650280-84048-weld-face.html

38) Why would you want to preheat a piece before welding it?
Preheating the piece slows the cooling rate in the weld area (because by increasing the overall temperature of the piece, there is less heat transfer between the weld and non-weld areas. Preheating may be necessary to avoid cracking of the weld metal or heat-affected zone. The need for preheat increases with steel thickness, weld restraint, the carbon/alloy content of the steel, and the diffusible hydrogen of the weld metal.

39) Why is it generally a bad idea to quench a hot weld?
In general, it is a bad idea to quench a hot weld because the metal will harden and become more brittle if quenched rapidly.

40) How can UV hurt you?
Small amounts of UV are beneficial for people and essential in the production of vitamin D. However, prolonged exposure to UV radiation can result in sunburn; degenerative changes in skin cells, fibrous tissue and blood vessels; photodermatose and actinic keratose; and inflammatory reactions of the eye. In addition, it can cause cancer and cataracts.

41) Which is faster, SMAW or GMAW?
High-quality welds can be produced much faster with GMAW than SMAW.

42) Which is faster, GTAW or GMAW?
GMAW is a much faster welding process than GTAW.

43) What percentage of argon must be present to use spray transfer mode in GMAW?
Modes of metal transfer:
Short circuit: 75% argon, 25% CO_2
Globular: >= 80%
Spray arc: >= 80%
Pulsed spray: >= 80%

44) What is a good rule of thumb to determine the gap between two pieces of base metal in a butt joint?
The gap between the two pieces of base metal in a butt joint should be at least the width of the filler metal. Keep in mind that the width will shrink while welding, so a little bit of additional room can come in handy.

45) In SMAW how does the arc length relate to its temperature ?
The shorter the arc (the closer you are to the metal), the higher the temperature.

46) Where does the filler metal come from in SMAW?
In SMAW, the filler metal is an external rod that is covered in some type of flux depending on the weld materials, temperature, and polarity.

47) What's the correct name for 'weaving' while welding?
The correct name for "weaving" while welding is transverse oscillation. The amount of transverse oscillation (back and forth movement by the welder) is directly proportional to the size of the weld bead.

48) How short should the SMAW electrode be when it is to be discarded?
The SMAW electrode should be discarded when the electrode almost cannot get any closer to the weld. However, make sure the number printed on the electrode is still visible – this implies that when you start using the electrode, make sure the side without the printed number is facing down.

49) If you switch the leads on an AC SMAW welder does it change the polarity?
The leads on the AC SMAW welder do not matter since AC is an alternating signal, but the phase of the signal may be offset.

50) Where does the filler metal come from in GMAW?
In GMAW, the filler metal comes out of the spool gun, which is fed wire through the hose from the machine.

51) Why do you need shielding gas?
Shielding gas consists primarily of inert gases whose purpose is to protect the weld area from atmospheric contamination from gases such as oxygen, nitrogen,

and water vapor. The contaminants can weaken the weld or increase the difficulty of the welding process.

52) What type of feed system is used to deliver wire to the torch in GMAW?
In GMAW, a spool inside the machine feeds wire through a hose to the torch. A button on the torch causes the wire to be fed and the wire comes out from the torch.

53) What is FCAW?
Flux-Cored Arc Welding (FCAW, or just FCA) is a semi-automatic or automatic arc welding process.

54) What polarity do you run FCAW on?
FCAW is run on DCEP.

55) What is the main difference between the two types of wire in GMAW and FCAW?
FCAW wire is flux-cored, whereas GMAW is a solid wire.

56) Is FCAW 'arc welding'?
FCAW = flux-cored arc welding.

57) What is meant by 'multipass' welding?
A multipass welding is used when plate thicknesses exceed the limitation of two pass techniques, or where inability to provide accurate joint fit-up prevents the use of high current. In this case, multiple pass submerged arc welding should be used.

58) Can you MIG aluminum?
You can MIG aluminum, but it requires changes to polarity, voltage, temperature, electrodes – as with most changes between welding different types of materials.

59) What is a 'spool gun'?
A spool gun takes the spool feeder from the machine and places it on the gun. It is slightly more unwieldy compared to the regular gun with the external spool.

60) What are the little brown shiny globs on the surface of a MIG bead?
The little brown shiny globs on the surface of a MIG bead are silicon globs.

61) What is standard MIG gas for mild steel comprised of?
The standard MIG gas for mild steel consists of some mixture of argon and CO_2 depending on the usage.

62) What's meant by stickout in MIG?
In MIG, the stickout is the length of the unmelted electrode extending from the tip of the contact tube. Changing the stickout length, which occurs with variations in

the distance of the contact tube to the workpiece (how far away you are from the welding surface), can result in the voltage and amperage to vary as well as differences in the shape of the weld bead.

63) MIG stands for what?
Metal Inert Gas

64) Name an inert gas used in welding processes.
Nitrogen

65) Name another.
Argon

66) Name a non-inert gas (reactive) gas other than oxygen used in welding processes.
Carbon Dioxide (CO_2) is a reactive gas. It dissociates into carbon monoxide and free oxygen when heated by the arc. The oxygen then combines with elements transferring across the arc to form oxides from the weld pool in the form of slag and scale.

This website also describes many other gases used in welding:
http://www.praxair.com/praxair.nsf/1928438066cae92d85256a63004b880d/f406fc8ace133364852565610077 5f5a!OpenDocument

67) Why would you want to add helium to your shielding gas mixture?
It is possible to increase welding speeds with helium in some circumstances by using mixtures, depending on if the material is suitable. Helium content gases are usually more expensive, but are required for GMAW welding on thicker materials and GTAW welding with DCEN.

68) Why is a higher flow rate necessary for helium?
Helium has a lower density than argon, so higher flow rates are needed when welding with helium in order to obtain the same amount of shielding.

69) If a tank of argon is left open where will the gas cloud accumulate?
Argon will accumulate close to the ground, because it has a heavier molecular weight than oxygen.

70) Why is argon dangerous in a closed room?
Argon is dangerous because even though it is not toxic, it is 25% denser than air. In a closed room, where the argon cannot escape, a buildup of argon will result in asphyxiation. What makes it even more dangerous is that it is colorless, odorless, and tasteless, so while in a closed room you may not know that it is building up.

71) What is the difference between short circuit transfer and spray transfer?
Short circuit transfer requires lower temperature and results in less splatter, while spray transfer requires high voltage and temperature and is based on splattering.

72) In GMAW, what polarity would you run solid wire on?
In GMAW, solid wire should be run on DCEP polarity.

73) On a vertical fillet weld, will you get better penetration uphill or downhill?
On a vertical fillet weld, you will get better penetration uphill because a downhand fillet is going to have no root penetration.

74) How can you tell when you run out of shielding gas?
Without shielding gas, it will be very difficult to establish a weld arc. In addition, any weld bead formed will appear to be in very poor condition because of contamination from the atmosphere.

75) TIG stands for_____.
Tungsten Inert Gas

76) The primary metallic element in the GTAW electrode is_____.
The primary metallic element in the gas tungsten arc welding electrode is tungsten, which is a rare metallic element. The TIG process relies on tungsten's hardness and high temperature resistance to carry the welding current to the arc. It is used for this purpose because it has the highest melting point of any metal of 3410 degrees C.

77) The optimal polarity for manual welding aluminum with TIG is_____.
The optimal polarity for manual welding aluminum with TIG is high frequency AC.

78) In AC TIG welding there is a cleaning cycle and a _____ cycle.
The AC TIG welding process' cleaning cycle is complimented by a penetration cycle. The cleaning cycle (the electrode positive portion of the AC cycle, where current flows from the work to the electrode) blasts off surface oxides. The penetration cycle (the electrode negative portion of the AC cycle, where current flows from the tungsten into the work) melts the base metal and fuses the join.

79) Name an element that can be added to tungsten to improve welding performance?
Lanthanum. Lanthanated tungsten electrodes, color coded gold, contain a minimum of 97.8 percent tungsten and 1.3 percent to 1.7 percent lanthanum (also called lanthana). This type of electrode has an excellent arc starting, a low burnoff rate, good arc stability, and excellent re-ignition characteristics – many of the same traits as ceriated electrodes.

Pure tungsten electrodes contain approximately 99.5 percent tungsten, and have the highest consumption rate of all electrodes. They are also typically less expensive than their alloyed counterparts (discussed above and below). This type of electrode forms a clean, balled tip when heated and provides great arc stability for AC welding with a balanced input wave. Pure tungsten is not typically used

for DC welding because it does not provide the strong arc starts associated with thoriated or ceriated electrodes.

80) And another?
Zirconium. Zirconiated tungsten electrodes contain a minimum of 99.1 percent tungsten and 0.15 to 0.4 percent zirconium. This type of electrode produces an extremely stable arc and resists tungsten spitting. It is ideal for AC welding because it retains a balled tip and has a high resistance to contamination. Under no circumstances is zirconiated recommended for DC welding.

81) And another?
Cerium. Ceriated tungsten electrodes contain a minimum of 97.3 percent tungsten and 1.8 to 2.2 percent cerium and are referred to as 2 percent ceriated. These electrodes perform best in Dc welding at low current settings, but can also be used in AC processes. It is especially good for low amperages because the arc is easy to start. Higher amperages is not recommended because higher amperages cause the oxides to migrate quickly to the heat at the tip, removing the oxide content and nullifying its process benefits.

Rare-earth oxides.

Thorium. Thoriated tungsten electrodes contain a minimum of 97.3percent tungsten and 1.7 to 2.2 percent thorium and are called 2 percent thoriated. They are the most commonly used electrodes today and are preferred for their longevity and ease of use. Because the electrode operates far below its melting temperature, it has a much lower rate of consumption and more stability due to reduced arc wandering. These electrodes are primarily for specialty AC welding and DC welding.

Note: A balled tip is usually used on pure tungsten and zirconiated electrodes and is suggested for use with the AC process on sine wave and conventional square wave GTAW machines. To properly ball the tungsten tip, apply the recommended AC amperage for a given electrode diameter. Too large of a

Source for the last few pieces of information:
http://www.thefabricator.com/article/arcwelding/guidelines-for-tungsten-electrodes

82) How does the filler material get added to the weld in GTAW?
In GTAW, filler metal is added manually to the FRONT end of the weld pool as it is needed.

83) What is post-flow for?
“Post-flow” is the gas that continues to flow after the arc is stopped. It is used to cool off the weld and tungsten more quickly.

Helpful TIG website: http://www.projectguns.com/tig.html

84) At what temperature does aluminum oxide melt?
Aluminum oxide melts at 3762^{o}F, or 2072^{o}C.

85) At what temperature does aluminum melt?
Aluminum melts at 1221^{o}F, or 660.3^{o}C.

86) Why is it important to remove the oxide before welding aluminum?
When welding aluminum, be sure to scrub away any oxide using an aluminum-only brush, in order to reduce contamination.

87) What color is the band on a pure tungsten electrode?
The band on a pure tungsten electrode is color coded green.

88) What shielding gas do we use for aluminum GTAW?
For aluminum GTAW, we typically use pure argon as the shielding gas. For heavy sections, helium may be added up to 75%. The helium allows for a significantly better wetting than pure argon, and a more fluid puddle that allows more time for porosity-causing impurities to escape. At the same time, higher helium concentrations require significantly more voltage to operate in spray transfer than compared to pure argon.

89) What shielding gas do we use for steel GTAW?
For stainless steel GTAW, the most common shielding gases are argon/O2 and helium/argon/CO2 mixes.

For carbon steel GTAW, the most common shielding gases are argon/CO2, argon/O2, or argon/CO2/O2. Low CO2 is usually used for spray transfer on heavy materials or when low heat input and shallow penetration are required for thinner materials. High CO2 is used in short-circuit transfer, and can provide additional cleaning action or deep penetration in heavy materials.

90) Is CO2 a reactive or inert gas?
CO2 is a reactive gas. It dissociates into carbon monoxide and free oxygen when heated by the arc. The oxygen then combines with elements transferring across the arc to form oxides from the weld pool in the form of slag and scale.

91) Is it necessary wear heavy welding gloves for TIG welding?
TIG welding does not require heavy welding gloves.

On a related note, it is important to remove your gloves when grinding a tungsten tip, because you need to be aware of where your gloves are while grinding so that your hand does not get pulled into the machine.

92) TIG welding is generally a slow process. What process could you use to more quickly weld aluminum?
MIG is the fastest process for welding aluminum.

93) What is the high frequency setting used for on a GTAW machine?
The high frequency setting on a GTAW machine is used to strike the welding arc by providing an electric spark. This spark is a conductive path for the welding current through the shielding gas, and allows the arc to be initiated while the electrode and workpiece are separated (albeit close together, about 1.5 to 3 mm apart).

This high voltage, high frequency burst can be especially damaging to electronics, because induced voltages can also cause small conductive sparks within wiring and semiconductor packaging.

94) What happens when you touch an electrically live tungsten electrode to the work?
In GTAW, when either the electrode touches the weld pool, or when the electrode touches the filler rod, the tungsten usually becomes contaminated and resharpening of the tungsten tip is necessary before continuing. Contamination may weaken the weld bead, and may also make it harder to continue with welding.

95) And how do you repair the electrode in #94?
To repair the tungsten electrode, we need to grind it down to have a sharpened point.

96) Can a pure tungsten electrode maintain a sharpened point?
No, pure tungsten electrodes form a clean, balled tip when heated and provide great arc stability for AC welding with balanced waves.

97) What is a good angle to maintain between the torch and the filler rod in GTAW?
A good angle to maintain between the torch and the filler rod is 90 degrees.

98) 1/8" aluminum, base metal, 3/32" tungsten, ____" diameter filler rod.
1/16

99) Out of the four processes studied this semester, which is the preferred for precision welding, as in aerospace applications?
TIG welding is the slowest, but most precise and most controllable form of welding.

100) What polarity would you TIG weld steels with?
When TIG welding steels, you should use DC electrode negative. When TIG welding aluminum, you should use AC in order to remove oxides. The polarity is dependent on the base metal.