

# Franklin County School District

## School Closure Packet

Week One: March 23-27

### Career & Technical Center

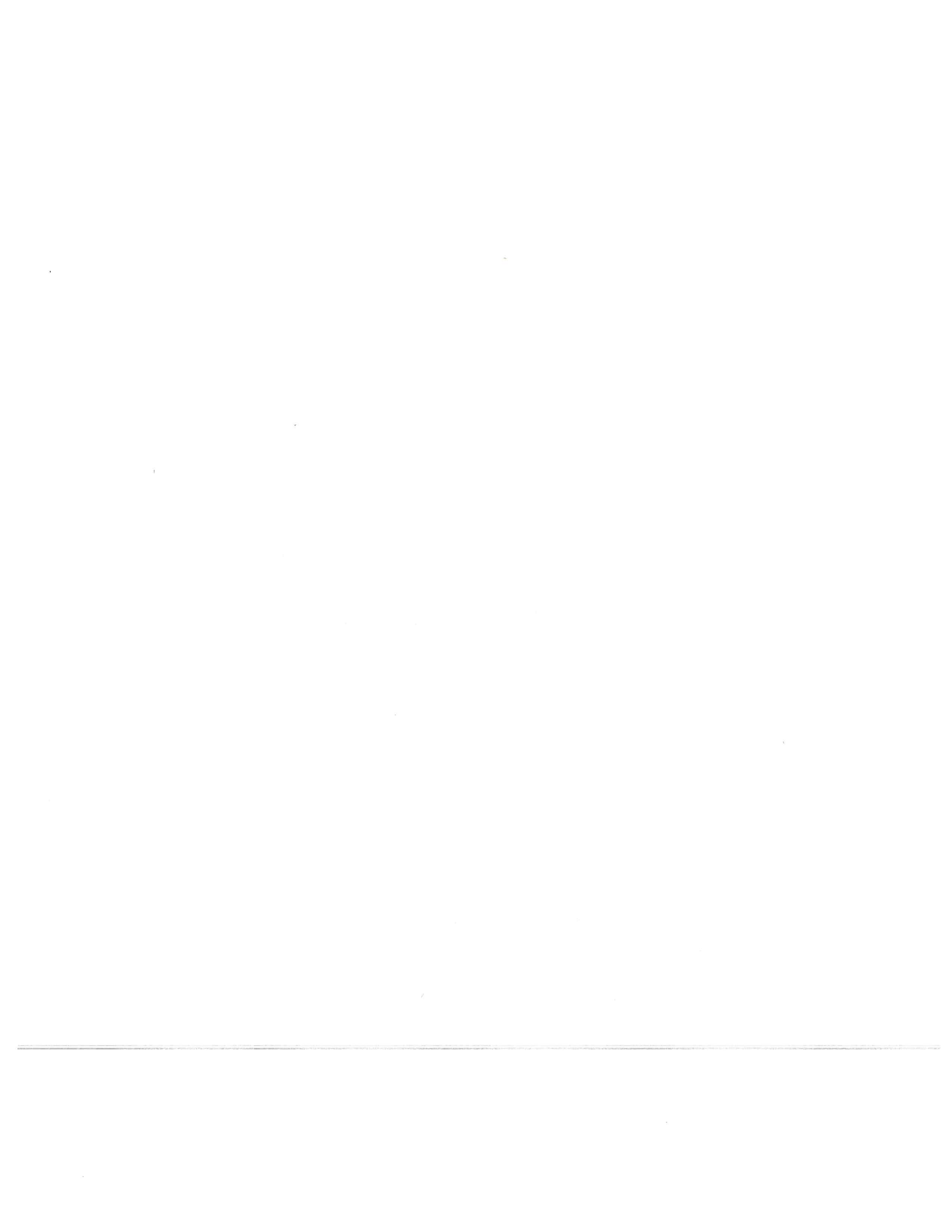
Please find the pages that are for your program.

Name:

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Career-Tech Teacher:

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Health 4<sup>th</sup> and 5th Periods

Good Morning! Please take all precautions! I MISS all of you!!

Log onto your ICEVonline.com account

You will be completing the "Nutrition & Wellness Diseases: Eating Disorders" Unit this week. All of it needs to be completed by Friday, March 27<sup>th</sup>.

Using the Powerpoint, you will complete the "Student Notes" for each section and then complete each "Assessment." You may refer to your "Student Notes" to complete the "Assessments." This is an opportunity for you to have really good grades this nine weeks. Please finish strong!!!

- ✚ Eating Disorders - An Overview - Student Notes and Assessment I
- ✚ Eating Disorders - Types of Disorders - Student Notes and Assessment II
- ✚ Eating Disorders - Treatment - Student Notes and Assessment III
- ✚ Eating Disorders - Vocabulary (use Vocabulary sheet)
- ✚ Eating Disorders - Assessment IV

IF YOU HAVE ANY PROBLEMS COMPLETING THESE ASSIGNMENTS, EMAIL ME!!!! [JFMullins@fcsd.k12.ms.us](mailto:JFMullins@fcsd.k12.ms.us)

Resource Management 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup> Periods

Good Morning! Please take all precautions! I MISS all of you!!

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You will be completing the "Earning Interest" Unit this week. All of it needs to be completed by Friday, March 27<sup>th</sup>.

Using the Powerpoint, you will complete the "Student Notes" for each section and then complete each "Assessment." You may refer to your "Student Notes" to complete the "Assessments." This is an opportunity for you to have really good grades this nine weeks. Please finish strong!!!

- ✚ Earning Interest - Introduction - Student Notes and Assessment I
- ✚ Earning Interest - Types of Interest - Student Notes and Assessment II
- ✚ Earning Interest-Annual Percentage Yield-S Notes and Assessment III
- ✚ Earning Interest - Vocabulary (use Vocabulary sheet)
- ✚ Earning Interest - Assessment IV

IF YOU HAVE ANY PROBLEMS COMPLETING THESE ASSIGNMENTS, EMAIL ME!!!! [JFMullins@fcsd.k12.ms.us](mailto:JFMullins@fcsd.k12.ms.us)

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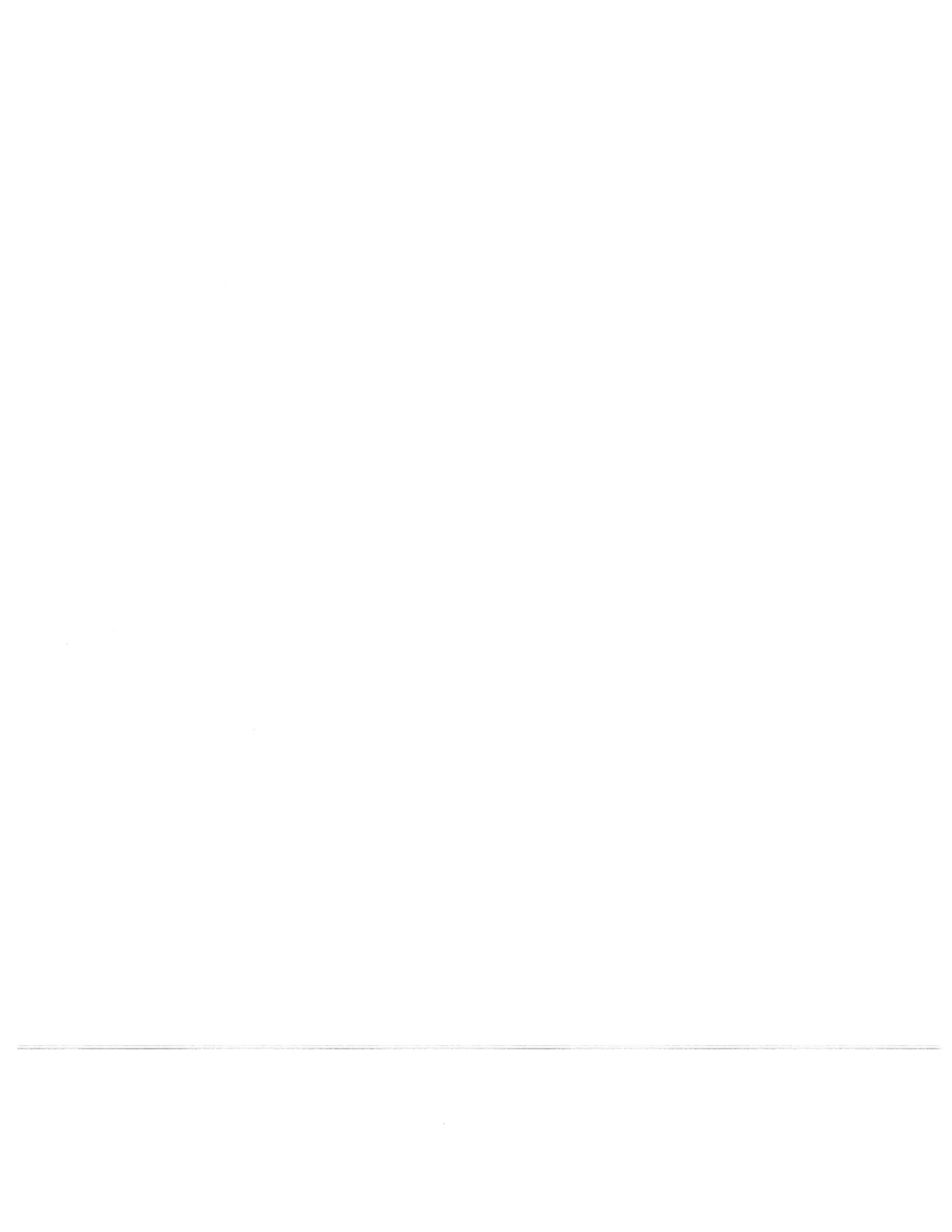


## Health Science 1

March 23<sup>rd</sup> through March 27<sup>th</sup>

### Urinary System

1. Urinary system powerpoint
2. Aeseducation.com lesson- go to aeseducation.com (your username is your student ID and password is learning) choose anatomy and physiology, then choose urinary system. Open the electronic worksheet that you can fill out. Watch both lessons and take the quiz at the end.
3. Quizlet.com-my username is angiekentHS choose urinary system to review terms. You can play games and take a test to help you learn the urinary system.
4. You can reach me through remind. Send a text to 81010 and text this message @akd8ad





## 1 URINARY SYSTEM

### 2 Urinary System

- Removes certain wastes & excess water
- 
- 
- Maintaining acid-base balance
- 
- 
- 2 kidneys, 2 ureters, bladder, one urethra

### 3 Kidneys

- 
- Each kidney enclosed in mass of fatty tissue, called adipose capsule
- 
- Each kidney covered externally by a tough, fibrous tissue called renal fascia

### 4 Kidneys divided into 2 parts

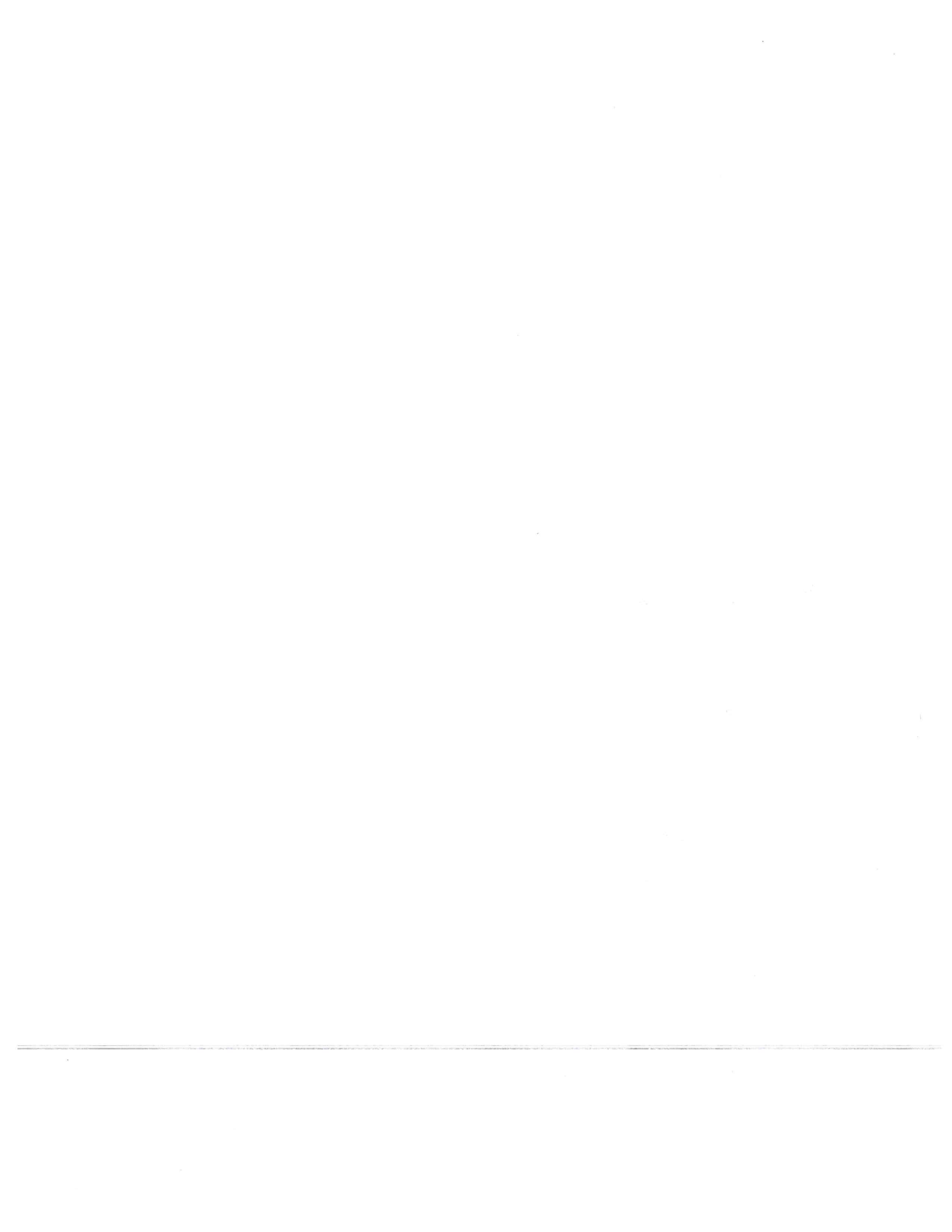
- CORTEX
  - Outer section of kidney
  - Contains most of nephrons, aid in production of urine
- 
- MEDULLA
  - Inner section of kidney
  - Contains most of collecting tubules, carry the urine from the nephrons through the kidney

### 5 NEPHRONS

- Microscopic filtering units of kidneys
- 
- The parts of the nephron are:
  - Glomerulus
  - Bowman's capsule
  - Proximal convoluted tubule
  - Distal convoluted tubule
  - Collecting tubule
  -

### 6 GLOMERULUS

- Cluster of capillaries
- 
- As blood passes through the glomerulus water, salt, sugar, metabolic products and other substances filtered out through blood



- 
- RBC and proteins are not filtered out

7 

- Filtered blood (cleaned blood) leaves glomerulus and carried to renal vein, which carries it away from the kidney
- 
- Substances filtered out of the blood from the glomerulus enter the Bowman's capsule

8  **BOWMAN'S CAPSULE**

- C-shaped structure that surrounds the glomerulus
- 
- Picks up materials filtered from the blood in the glomerulus and passes them to convoluted tubule
- 
- Substances that are needed by the body are reabsorbed

9  **What makes up urine?**

- Excess sugar and salts
- Some water
- Wastes (urea, uric acid, creatinine)
- 
- 
- Enters tubules located in medulla which empty into renal pelvis (1<sup>st</sup> section of ureter)

10  **URETERS**

- 2 muscular tubes, 10-12 inches long
- 
- One ureter extends from the renal pelvis of each kidney to the bladder
- 
- Peristalsis is what moves urine through ureter from kidney to bladder

11  **BLADDER**

- Hollow muscular sac
- 
- Has lining of mucous membrane arranged in series of folds called rugae
- 
- Rugae disappear as muscles of the bladder allow it to expand to fill with urine

12  **Functions of Bladder**

- Receives urine from ureters
- 
- Stores urine until eliminated from the body
-

- Urge to urinate occurs when bladder contains 250cc (1 cup) of urine

### 13 **Circular sphincter muscles**

- Control the bladder opening to prevent emptying
- 
- Bladder is full, receptors in bladder wall send out a reflex action that opens these muscles
- 
- Reflex action cannot be controlled by infants that is why they can not control urination

### 14 **URETHRA**

- Tube that carries urine from bladder to outside
- 
- External opening is called the urinary meatus
- 
- Urethra is different in males and females

### 15 **URETHRA**

- FEMALES
  - Tube 1 ½ inches long(shorter than males) which is why females have more urinary tract infections
  - Opens in front of vagina
  - Carries only urine to outside
- MALES
  - S shaped tube about 8 inches long
  - Passes through prostate gland out through penis
  - Carries urine and semen but not at same time

### 16 **URINE**

- Liquid waste product -1, 500 to 2,000 cc (1 ½ to 2 quarts) of urine produced daily
- 
- 95% water
- 
- Waste products dissolved in water are urea, uric acid, creatinine, mineral salts, various pigments
- 
- Sugar in urine can indicate disease like diabetes

### 17 **Conditions affecting urination**

- POLYURIA-excessive urination
- 
- OLIGURIA-below normal urination
- 
- ANURIA-absence of urination

- 
- HEMATURIA-blood in the urine

18  **Conditions affecting urination**

- NOCTURIA-urination at night
- 
- DYSURIA-painful urination
- 
- RETENTION-inability to empty the bladder
- 
- INCONTINENCE-involuntary urination

19  **DISEASES of URINARY SYSTEM**

20  **CYSTITIS**

- Inflammation of bladder
- 
- More common in females due to shortness of urethra
- 
- S/S-frequent urination, dysuria, burning urination, hematuria, fever
- 
- Tx: antibiotics, increase fluids

21  **GLOMERULONEPHRITIS**

- Inflammation of glomerulus of kidney
- 
- Acute
  - Usually follows strep infection
  - Chills, fever, fatigue, edema, oliguria, hematuria
  - Rest, restrict salt, diuretics, antibiotics

22

- Chronic
  - Progressive disease that causes scarring and sclerosing of glomeruli
  - Hematuria, HTN, albuminuria, leading to renal failure and death
  - Treatment-low sodium diet, b/p pills, dialysis, kidney transplant
- 

23  **PYELONEPHRITIS**

- Inflammation of kidney tissue and renal pelvis
- 
- 
- Usually caused by pus forming bacteria

➤

24  **RENAL CALCULUS**

- Kidney stone
- 
- Signs & symptoms
  - Sudden intense pain
  - Hematuria, urinary retention
- Treatment
  - Increase fluids, pain meds, strain urine, surgery
  - Lithotripsy-crush stones with shock waves

25  **RENAL FAILURE**

- Kidneys stop functioning
- 
- Acute renal failure
  - Oliguria or anuria, an ammonia odor to breath, edema, cardiac arrhythmias
  - Dialysis, restrict fluid intake

26  **RENAL FAILURE**

- Chronic
  - From progressive loss of kidney function
  - Nausea, vomiting, diarrhea
  - Decreased mental ability
  - Ammonia smell of breath and perspiration
  - Coma and death in later stages
  - 
  - Dialysis, control fluid intake
  - Kidney transplant only cure

27  **UREMIA**

- Toxic condition that occurs when kidneys fail and urinary waste products are present in bloodstream
- 
- Headache, dizziness, N/V, ammonia odor to breath, oliguria, coma, death
- 
- Treatment
  - Restricted diet
  - Dialysis until kidney transplant

28  **URETHRITIS**

- Inflammation of urethra
-

- Signs and symptoms
  - Frequent and painful urination
  - Redness and itching at urinary meatus
  - Purulent discharge
- Treatment
  - Sitz baths, warm moist compresses, antibiotics, increased fluid intake

29  **Normal Urine**

- 1500 to 2000cc per day
- 
- No odor
- 
- Yellow, straw, amber colored
- 
- clear

30  **Normal Urine**

- Specific gravity
  - 1.002 to 1.040
- 
- 
- pH
  - 4.8-7.4 (average 6)

31  **Abnormal Urine**

- Sweet odor-sugar in urine
- 
- Offensive odor-bacteria
- 
- Ammonia-old specimen
- 
- Red-blood

32  **Abnormal urine**

- Brown-bile
- 
- 
- Orange, blue-medications
- 
- 
- Cloudy-pus, bacteria, fat

33  **Abnormal Urine**

- Increased specific gravity

- dehydration
- 
- 
- Decreased specific gravity
  - diuresis

34  **Abnormal urine**

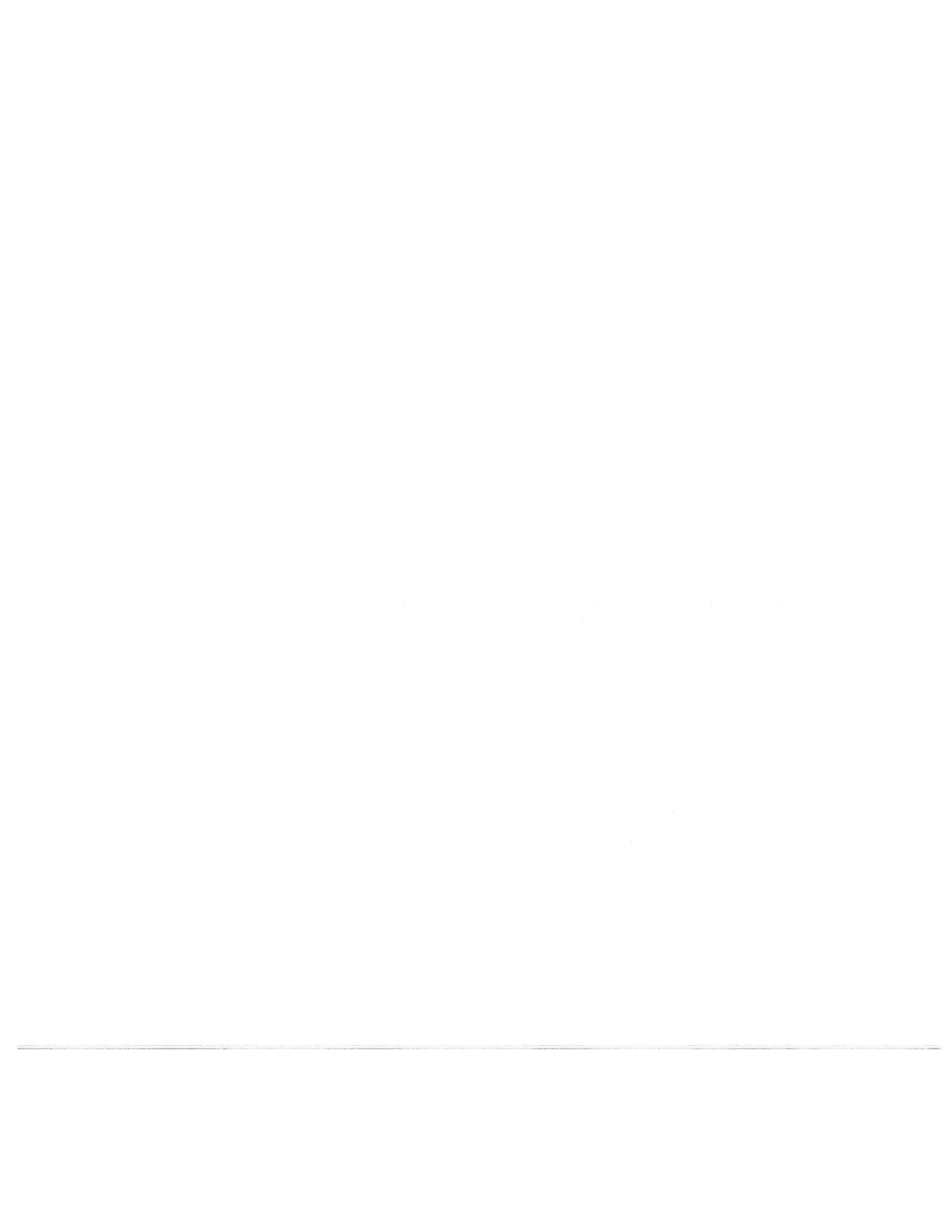
- Sugar (glycosuria)-diabetes
- Protein (albuminuria)-renal disease
- ketones-diabetes
- Blood-infection, injury
- Pus (pyuria)-infection
- Bacteria-infection



Health Science 2  
March 23<sup>rd</sup> through March 27<sup>th</sup>

CNA Skills

1. Read over Quick notes on CNA skills that are included on handout. You can watch any of the CNA skills on youtube.com
2. Go to the aeducation.com site (your username is your student ID and your password is learning) Choose Health Science 2 and then choose Unit 1 Patient comfort. Watch the PowerPoints for lesson 1, 2, and 3 and you can fill out the electronic student worksheet that is available. Take the quiz at the end of this lesson.
3. Go to aeducation.com site and choose Unit 5 hand and foot care. There are two very short lessons for this unit. Fill out the electronic student worksheet for this unit. Take the quiz at the end of this lesson. You can watch the skill of hand and nail care by going to youtube.com and typing in hand and nail care CNA skill new for a visual of how to perform hand and nail care.
4. Go to aeducation.com site and choose Unit 6 hair care. There are 4 shorts lessons on this unit. Fill out the electronic student worksheet for this unit. Take the quiz at the end of the lesson. You can watch these skills by going to youtube.com and choosing hair care and shampooing and also choose shaving.
5. If you have any questions you can contact me on remind. If you have not joined you can do so by sending a text to 81010 and text this message @83e8g39. I can also be reached by email at [akent@fcsd.k12.ms.us](mailto:akent@fcsd.k12.ms.us)
6. Please contact me if you participated in the fund raiser. It is very important that we get the orders turned in for those people that have paid you. I know some have collected orders and money and this must be turned in. Email me this information. Thank you!



# CNA SKILLS

## 1. Handwashing

- a. most effective method for preventing spread of infection
- b. know when to wash your hands
- c. remove any rings and push wristwatch up above your wrist
- d. use warm water
- e. use soap because pathogens are trapped in suds
- f. use friction at least 40-60 seconds Happy Birthday twice
- g. clean all areas of hands, palms, backs and tops of hands, and areas between fingers
- h. fingertips pointed downward
- i. dry paper towel to turn the faucet on and off
- j. clean fingernails because nails harbor germs
- k. waterless hand cleaning-for example germ X-can be used when hands are not visibly dirty and not contaminated, rub until dry, after 6-10 cleanings with germ-X must wash hands

## 2. Applying knee high elastic stocking

- a. Support or compression hose
- b. Support the veins of legs and increase circulation
- c. Prevent formation of blood clots
- d. Needs Dr's order
- e. Knock on door, introduce yourself, identify patient, explain procedure
- f. Check to make sure hose are clean and correct size
- g. Use measuring tape and instructions that came with the hose for correct size
- h. Start with surgical hose. Insert hand into top of hose. Turn hose so smooth side is on the outside. (rough edge is on the outside of the foot)
- i. Grasp the heel area of the hose. Smoothly tuck the foot portion back into the stocking
- j. Stretch hose open at the heel
- k. Grasp the top of the stocking, pull it over the foot,

- l. Begin gently pulling the hose up the leg to area below the knee
- m. Remove the hose at least once every 8 hours

3. Ambulating with transfer belt

- a. around patient's waist
- b. proper size (3-4 fingers under the belt to make sure it is not too tight)
- c. underhand grasp at the back
- d. walk slightly behind patient-walk on patient's weak side
- e. over patient's clothing
- f. starts to fall-gently ease patient to floor

4. Assisting with use of bedpan

- a. Terms for emptying bladder-urinate, micturate, or void
- b. Urinal for men
- c. Bedpan-female patients, and men with BM
- d. Defecate-Bowel movement
- e. Bring bedpan as soon as patient requests
- f. Check to see if specimens needed and if I&O recorded
- g. Use standard precautions
- h. Never place bedpan on overbed table
- i. After use-rinse and clean and disinfect
- j. If metal-run under hot water to warm
- k. If too weak roll patient on to side-place bedpan under buttocks and roll patient back onto bedpan
- l. Have fracture bedpans that are lower
- m. Don't use tissue if on I&O or specimen is needed
- n. After fill basin with water at 105-110 degrees
- o. Wipe patient front to back

5. Cleaning dentures

- a. Patients may be sensitive about having dentures
- b. Use tissues or gauze sponge to grab dentures between your thumb and index finger, apply downward and forward pressure to loosen and remove the top denture
- c. Be careful they can break
- d. Place dentures in denture cup
- e. Line sink with paper towels-cushion if you drop dentures

- f. Apply toothpaste-hold dentures in palm of one hand and hold under lukewarm or cool water and brush all surfaces-DON'T use hot can cause them to break
  - g. Can rinse in soaking solution
  - h. Rinse with cool water
  - i. Patient may want to brush gums
  - j. Nurse should wear gloves
6. Oral care for helpless patients
- a. Have them lay on the side facing you
  - b. Clean mouth, gums, tongue, and roof of mouth and teeth
7. Vital signs
- a. T, P, R, BP
  - b. Temperature-measurement of balance between heat lost and heat produced
  - c. Ways to measure temperature- orally (mouth), rectum (rectum), axillary (under arm pit), aural (ear), or by the temporal artery (forehead temple area)
  - d. Normal body temperature 97-100 degrees
  - e. Body temperature lower in morning, higher in evening
  - f. Most common-oral
  - g. If taking oral nothing to eat or drink or no smoking for 15 minutes before
  - h. Rectal temperatures-most accurate
  - i. Rectal temperatures usually taken on infants, small children, and patients with hypothermia
  - j. Increased body temperature-illness, infection, exercise, excitement, high temperatures in environment
  - k. Decreased body temperatures-starvation, fasting, sleep, decreased muscle activity, mouth breathing, exposure to cold, certain diseases
  - l. Hypothermia-low body temperatures below 95 rectally
  - m. Fever, pyrexia, and febrile all mean fever
  - n. Fever is temp above 101
  - o. Afebrile-no fever
  - p. Hyperthermia-temperature above 104
  - q. Oral thermometer blue tip
  - r. Rectal thermometer red tip
  - s. Cover with disposable sheaths when using thermometer

- t. Cleaning thermometers-glass-wash and rinse with cool water, soak in disinfectant for 30 minutes
  - u. Pulse-pressure of the blood against the walls of an artery
  - v. Pulse record rate, rhythm, and volume
  - w. Rate-number
  - x. Rhythm-regular or irregular
  - y. Volume-strength
  - z. Pulse sites-temporal-side of head, carotid-side of neck, brachial-inner aspect of forearm, radial-thumb side, femoral-groin, popliteal-behind knee, dorsalis pedis-top of foot arch, posterior tibial-bony part of ankle
  - aa. Normal pulse 60-100, faster in infants take apical pulse
  - bb. Apical pulse-over chest listen with stethoscope
  - cc. Bradycardia-slow pulse less than 60
  - dd. Tachycardia-fast pulse above 100
  - ee. Arrhythmia-irregular rhythm
  - ff. Increased pulse-exercise, stimulant drugs, excitement, fever, dehydration, shock, nervousness,
  - gg. Decreased pulse-sleep, depressant drugs, heart disease, coma, physical training
  - hh. Most common pulse site is radial
  - ii. Respirations=one inhale, one exhale
  - jj. Normal RR is 12-20
  - kk. Dyspnea-difficult breathing
  - ll. Apnea-no respirations
  - mm. Tachypnea-fast breathing above 25
  - nn. Bradypnea-slow breathing less than 10
  - oo. Orthopnea-severe dyspnea in which breathing is very difficult in any position other than sitting or standing
  - pp. Cheyne stokes-periods of dyspnea followed by apnea, seen in dying patients
  - qq. Rales-bubbling, crackling, or noisy sounds caused by fluids or mucus in the lungs
  - rr. Wheezing-difficult breathing with a high pitched whistling sound, seen in asthmatics
  - ss. Cyanosis-bluish discoloration
  - tt. Do not tell patient you are counting respirations
-

- uu. Graphic charts for recording VS are a visual diagram of variations in Pt's VS
- vv. Apical pulse usually taken for patients with irregular heartbeats, hardening of the arteries, weak or rapid pulses, and children and infants
- ww. Pulse deficit-apical pulse – radial pulse
- xx. Apical pulse place stethoscope over apex of heart at the 5<sup>th</sup> intercostal space by midclavicular line
- yy. Blood pressure-measurement of the pressure that the blood exerts on the walls of the arteries during the different stages of the heart's activity
- zz. BP cuff is sphygmomanometer
- aaa. Systolic- occurs in the walls of the arteries when the left ventricle of the heart is contracting and pushing blood into the arteries
- bbb. Diastolic-constant pressure in the walls of the arteries when the left ventricle of the heart is at rest, or between contractions
- ccc. Systolic top number, diastolic bottom number
- ddd. Pulse pressure-systolic-diastolic
- eee. Hypertension-high blood pressure greater than 140/90
- fff. Hypotension low blood pressure
- ggg. Orthostatic hypotension-BP drops when standing
- hhh. Increased BP-excitement, anxiety, nervous, exercise, eating, pain, obesity, smoking, stimulant drugs
- iii. Decreased BP-rest of sleep, depressant drugs, shock, dehydration, hemorrhage, fasting
- jjj. BP cuff too small gives inaccurate high reading
- kkk. BP cuff too big gives inaccurate low reading

8. Donning and removing PPE

- a. PPE-personal protective equipment
- b. Gloves-remove rings, change between patients, if torn-wash hands and put on new gloves, don't wash or reuse, know how to remove them
- c. Gowns-wear if something could splash on clothes
- d. Masks-any procedures with splashes, dental procedures, use once and throw away, change every 30 minutes
- e. Sharps-put in sharps container, don't bend or reuse, don't recap

9. Dressing client with weakened arm

- a. Remove gown from uninjured or strong arm first
- b. Then put clean clothing on affected arm first and then unaffected arm
- c. Remember-put clothing on affected or weak side first and remove it from affected or weak side last

10. Feeding patient

- a. most people prefer to eat with others-those who eat alone have poor appetites and poor nutrition
- b. bedpan or urinal or bathroom before meal
- c. let patient wash hands and face
- d. oral hygiene
- e. sitting position
- f. if meal will be delayed because of tests inform patient
- g. check tray to see if it matches name and diet ordered
- h. help patient cut meats, opening drinks, butter bread if can feed self
- i. blind or visually impaired-explain plate compared to clock
- j. test temperature of hot foods-place small amount on wrist
- k. never blow on food
- l. alternate foods with sips of liquid in between
- m. straws unless patient has dysphagia, if dysphagia no straws can choke easily
- n. small bites of food-fill fork or spoon 1/3 to 1/2 full
- o. hold spoon or fork to right angles of mouth
- p. give time to chew, encourage to eat, don't hurry
- q. always be aware of choking
- r. if patient had stroke and one side affected feed patient to unaffected or good side

11. Giving modified bed bath (face, one arm, hand, and underarm)

- a. warm water 105-110 degrees
  - b. eyes first
  - c. always dry
  - d. remove soap so doesn't dry out skin
-



- e. peri area-female-front to back cleanest to least clean
- f. male peri area tip of penis with circular motion

#### 12. Making occupied bed

- a. Patient is in bed
- b. Mitered corners-hold linen in place
- c. Don't shake linens
- d. Cover patient with bath blanket

#### 13. Measuring and recording urinary output

- a. Intake-oral, tube feedings, IV, and tubes and drains
- b. Output-BM, emesis, urine, tubes and drains
- c. NG tube-through nose, down the esophagus, and into the stomach
- d. Gastrostomy-surgically inserted into the skin and into the stomach
- e. After tube feedings head of bed 30-45 degrees and for 30-60 minutes
- f. Graduate-container hold at eye level or place on solid surface and view at eye level to get accurate readings
- g. 1 ml=1 cc
- h. 1 ml=15 gtts
- i. 5 ml=1 tsp
- j. 15 ml=1 tablespoon
- k. 30 ml=1 ounce
- l. 240 ml=1 cup (8 oz)
- m. 500 ml=1 pint (16 oz)
- n. 1000 ml=1 quart (32 oz)

#### 14. Measuring and recording weights

- a. Same scale, scale is balanced same time each day, same amount of clothing, empty bladder
- b. Infants-height, weight, head circumference, chest circumference,
- c. Infants head circumference- tape around head above ears
- d. Infants length-mark the paper baby is laying on and measure the marks
- e. Toddler-hold child, subtract child's weight from mother's
- f. 1 kg=2.2 lbs
- g. 1 inch=2.5 cm

#### 15. PROM exercises

- a. Abduction-moving away from midline
- b. Adduction-moving toward midline
- c. Flexion-bending a body part

- d. Extension-straightening a body part
- e. Hyperextension-excessive straightening
- f. Rotation-moving part body around on its axis, shaking head no
- g. Circumduction-moving in a circle on a joint
- h. Pronation-turning body part downward, turning palm down
- i. Supination-turning body part upward, turning palm up
- j. Opposition-touching each fingers with the tip of the thumb
- k. Inversion-turning body part inward
- l. Eversion-turning a body part outward
- m. Dorsiflexion-bending backward-bending the foot toward the knee
- n. Plantar flexion-bending forward-straightening the foot away from the knee
- o. Radial deviation-moving toward the thumb side of the hand
- p. Ulnar deviation-moving toward the little finger side
- q. Movements should be slow, smooth, gentle
- r. If pain-stop
- s. Perform each movement 3-5 times
- t. Support above and below joint

#### 16. Positioning patient on side

- a. Turn every 2 hours
- b. Use draw sheets

#### 17. Catheter care

- a. Urethral or straight-used for sterile specimens, placed in bladder but not left in the bladder
- b. Foley or indwelling-inserted into the bladder and left in the bladder, inflate balloon once inside bladder and deflate when removing
- c. Condom catheters-remove at least every 24 hours check for skin irritation
- d. Catheter must be kept sterile
- e. Connection between catheter and drainage unit is secure
- f. Tubing free of kinks and bends
- g. Drainage bag below level of bladder
- h. Urine flows freely
- i. Catheter secured to leg
- j. Drainage unit emptied frequently every 8 hours
- k. Drainage bag and tubing not lying on the floor
- l. No loops of the tube are below the drainage bag

- m. Report any complaints of burning, pain, or irritation or tenderness
- n. Catheter care-at least once every 8 hours-disposable pad under buttocks
- o. Female-separate labia, wipe front to back
- p. Male-draw foreskin back, wipe from meatus down the shaft
- q. Clean catheter down about 4 inches
- r. Drainage bag attached to bed frame
- s. Once every 8 hours
- t. Micturate and void mean to urinate
- u. Defecate is a bowel movement
- v. Bed pan if patient can not raise self to get on bedpan roll them to the side

#### 18.Fingernail care

- a. Don't cut without dr's order
- b. wear gloves
- c. soak nails for 5-10 minutes in detergent with water of 105 to 110 degrees
- d. use orange stick to clean under nails
- e. emory board to file nails-short strokes-side of the nail to the top of the nail
- f. some places only licensed personnel are allowed to cut fingernails
- g. if allowed, use nail clippers to clip the nails straight across
- h. file the nails straight across to remove rough edges
- i. never cut toenails but file toenails straight across
- j. diabetes nail care may be contraindicated

#### 19.Foot care

- a. never cut toenails
- b. no lotion between toes due to possible fungal growth

#### 20.Mouth care

- a. At least 3 times a day
- b. Special oral hygiene for semiconscious or unconscious may need extra care-toothettes may be used but no mouthwash

#### 21.Peri-care for female patient

- a. Wear gloves
- b. Dorsal recumbent position
- c. Wash front to back, cleanest area to least clean

- ✓ d. Separate labia and wash front to back

#### 22. Peri-care for male patient

- a. If man not circumcised retract foreskin
- b. Clean in circular motion with downward strokes

#### 23. Transfer from bed to wheelchair using transfer belt

- a. Make sure wheelchair is locked
- b. Have patient sit on side of bed
- c. Put shoes/socks on patient and gait belt
- d. Put wheelchair on patient's strongest side

#### 24. Shaving

- a. Check to see if on anticoagulants if on anticoagulants use electric razor
- b. Rub razor over gauze pad to check for damage
- c. Towel on chest
- d. Warm water 105-110 degrees
- e. Apply lather to one area of the face at a time
- f. Hold skin taut (stretched tightly) to prevent cuts
- g. Shave in direction of hair growth
- h. Wear gloves

#### 25. Hair Care

- a. Brushing stimulates circulation to the scalp and helps prevent scalp disease
- b. Shampooing must be approved by doctor
- c. Dry hair-baby oil
- d. Oily hair-alcohol on hands and rub through hair

#### 26. Transferring patient with mechanical lift

- a. to transfer weak or paralyzed patients
- b. Read directions on how to use lift
- c. Put mechanical sling under the client
- d. Lower edge of lift should reach underneath the client's knees
- e. Cross patient's arms over his or her chest
- f. Pt's are scared-reassure them
- g. Keep open ends of hooks away from patient

---

#### 27. Positioning patients

- a. Trochanter rolls to prevent external rotation of hips

- b. Foot board to prevent plantar flexion (foot drop)
- c. Sim's –left side for rectal temps, enemas, rectal exams
- d. Trendelenburg-circulatory shock, lay flat feet raised 12 inches
- e. Prone-on stomach
- f. Supine-on side

g. Lithotomy-on back feet in stirrups

h. moving patient up in bed lay bed flat as patient can stand and use drawsheet to move patient up in bed

### 28. Pressure sores

- a. Stage I-red or blue discoloration
- b. Stage II-abrasions, bruises, open sores due to damage to dermis and epidermis
- c. Stage III-deep crater forms when all skin layers are destroyed
- d. Stage IV-extends into muscle, tendon, bone, and tissues
- e. Turn patient every 2 hours
- f. Good skin care
- g. Massage in a circular motion around a reddened area

### 29. Giving a backrub

- a. Every 8 hours if confined to bed
- b. Usually done with bed bath
- c. Stimulates circulation, prevents ulcers, leads to relaxation and comfort

### 30. Transfer belt

- a. Over clothing, around waist
- b. Underhand grasp
- c. Walk on patient's weak side
- d. Start to fall assist to floor

### 31. Bedmaking

- a. Bed cradle to keeps linen off legs and feet
- b. Mitered corner-keeps linen in place

### 32. Gynecological exams

- a. Pap smear-used to detect cervical cancer
- b. Lithotomy position
- c. Gown open to front

- d. Mayo stand-movable stainless steel instrument tray on a stand to hold supplies
- e. Fixative-make sure cells stick to slide
- f. Cytology-science that deals with the function, formation, and structure of cells
- g. Hold fixative 6 inches from slide before spraying

33.Obtaining throat culture

- a. Gloves
- b. Do not contaminate applicator
- c. Touch only back of throat concentrating on areas that are red or white
- d. Tongue depressor goes into biohazard (red bag) bag

34.Clean Catch Urine specimen

- a. Clean each side of urinary meatus from front to back while holding the labia apart
- b. Urinate a small amount into toilet
- c. Place sterile container to collect specimen
- d. Fill cup ½ to 1/3 full

35.Applying bandages

- a. Bandages hold dressings in place or provide support to injured area
  - b. When applying start at distal end of extremity or point farthest away from the body and go to the proximal or nearest
  - c. Check for signs of impaired circulation-swelling, numbness, throbbing, or tingling, bluish discoloration
-

Robotics Year I  
Unit 1 Quiz Week I: March 23 – 27, 2020

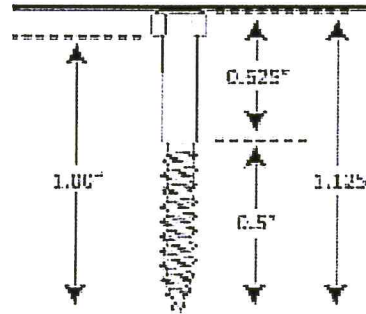
Please refer back to the Mobile Robotics Technology Unit 1 Robotics on the Learnmate website [fcctc.intelitek.com](http://fcctc.intelitek.com).

1. \_\_\_\_\_ are used to protect your eyes.
  - a. Safety glasses
  - b. Eyeglasses
  - c. Contact lenses
  - d. Sunglasses
2. Which of the following is not a component of a robotic system?
  - a. Teach Pendant
  - b. Battery
  - c. Program
  - d. Controller
3. How many programs can be stored in the Vex controller's memory?
  - a. Two
  - b. Unlimited
  - c. One
  - d. Four
4. A \_\_\_\_\_ is a device used to connect the transmitter directly to the Vex controller.
  - a. tether
  - b. antenna
  - c. receiver module
  - d. PWM cable
5. Which of the following is not a step of the engineering design cycle?
  - a. Prototype
  - b. Iteration
  - c. Analysis
  - d. Testing and Optimizing

Robotics Year I  
Unit 1 Quiz Week I: March 23 – 27, 2020

6. What is the length of the screw shown?

- a. 1.125"
- b. 1"
- c. 0.5"
- d. 0.625"



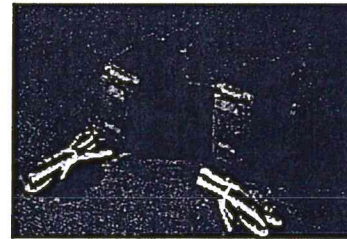
7. Identify the Vex component shown.

- a. Wifi Key
- b. Controller
- c. Joystick
- d. Tether



8. You should never operate a Vex motor without a \_\_\_\_\_.

- a. axle
- b. clutch
- c. wheel
- d. gear box

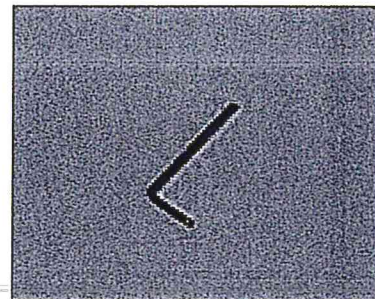


9. The \_\_\_\_\_ step of the engineering design cycle allows designers to be creative and think outside of the box.

- a. Problem Identification
- b. Brainstorming
- c. Prototype
- d. Analysis

10. Identify the Vex component shown:

- a. Open-ended wrench
- b. Hex wrench
- c. Nut holder
- d. L-wrench

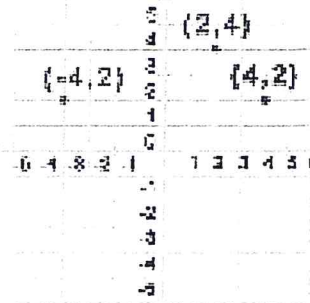




Robotics Year II  
CNC Quiz Week I: March 23 – 27, 2020

Please refer back to the Machining CNC Milling Technology on the Learnmate website [fcctc.intelitek.com](http://fcctc.intelitek.com).

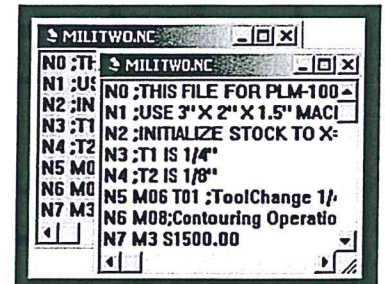
1. What is a coordinate?
  - a. A location on a map.
  - b. One of a set of numbers that describes the location of a point on a plane or flat surface.
  - c. None of the answers are correct.
  - d. The distance of a point from another known point.



2. What is the purpose of the clearance left behind the cutting edge?
  - a. To cool down the cutting area.
  - b. To ensure only the cutting edge makes contact with the workpiece.
  - c. To clear the way for the cutting edge.
  - d. To keep the cutting edge sharp.

3. Which of the following are types of instructions used in an NC part program?  
Select one or more:

- a. Instructions that specify machine operations.
- b. Instructions that specify the operator.
- c. Instructions that determine material from which the stock is made.
- d. Instructions that specify the tool path.



4. Which of the following M-codes can be used in the same block as the code M03?

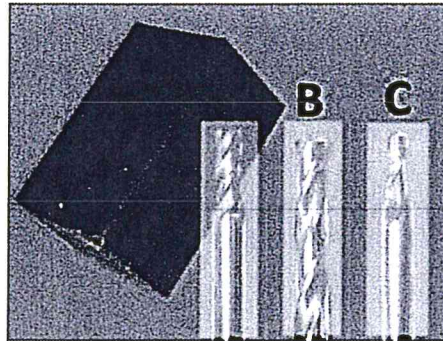
- a. M04
- b. M02
- c. M05
- d. None of the answers are correct.

Code	Meaning
M0	Program stop. Press Cycle Start button to continue.
M1	Optional stop. Only executed if Op Stop switch on the CNC control is turned ON.
M2	End of program.
M3	Spindle on Clockwise.
M4	Spindle on Counterclockwise.
M5	Spindle stop.
M6	Change tool.
M8	Coolant on.
M9	Coolant off.
M30	End program and press Cycle Start to run it again.

Robotics Year II  
CNC Quiz Week I: March 23 – 27, 2020

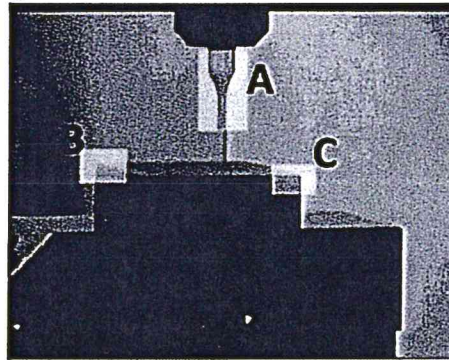
5. Indicate which is the flat end mill.

- A.
- B.
- C.



6. Indicate the position usually defined as the workpiece origin.

- A.
- B.
- C.



7. The cutting tool on a vertical mill can only move \_\_\_\_\_.

- a. from left to right
- b. from front to back
- c. up and down

8. The R word specifies the size of the arc \_\_\_\_\_.

- a. range
- b. radius
- c. ratio
- d. roundness

9. Which of the following are performed to check an NC part program before it is run?  
Select one or more:

- a. A drawing of the part.
- b. A dry run of the program.
- c. An estimate of the time required to run the program.
- d. A graphical verification of the program.

10. A ball mill is used for:

- a. Flattening surfaces.
- b. Making holes in the workpiece.
- c. Creating surfaces with contoured edges.
- d. Performing basic mill operations.

# Teacher Academy I

## March 23<sup>rd</sup> – 27<sup>th</sup>

**A NOTE FROM MRS. LARKIN:** Hello everyone! Let me first say that I already miss you guys terribly and these are truly unprecedented times, but your health and welfare are what is most important to me and I want you to promise me that you will take care of yourselves! Though I know these are stressful times, please take time while you are home to do things that might enrich your lives, such as spending time with family, reading, drawing, making a list of your goals, journaling etc. We are going to get through this together and be stronger on the backside. Until then, I am including items below for you to do while you are out. None of these items are dependent on technology, ☺ Take care of yourselves and I will see you soon! If you have any questions, please email me at [blarkin@fcsd.k12.ms.us](mailto:blarkin@fcsd.k12.ms.us) Mrs. Larkin

### **\*\*Monday\*\***

- Look up [www.quizlet.com](http://www.quizlet.com)
- in the search box type Teacher Academy Chapter 10
- you will see the vocabulary, 15 words and my name blarkin73
- read over and review these vocabulary words

**facilitator** One who creates situations that help students learn by developing activities that actively involve students in learning, rather than just presenting information.

**assessment** Determining how much a student or class has learned or is in the process of learning.

**ethics** Conduct based on moral principles.

**organizational culture** The "personality" of an organization based on the assumptions, values, standards, behaviors, and actions of people, as well as the tangible signs of an organization.

**mission statement** The official version of an organization's purpose and goals, along with policies and procedure.

**chain of command** The official organizational structure that tells who reports to whom.

**lifelong learners** People committed to staying up to date in their knowledge and skills.

**professional development** Taking part in professional organizations, attending seminars and conferences, pursuing an advanced degree, or other activities meant to improve one's professional knowledge and skills.

**mixed message** When there is a discrepancy between verbal and nonverbal messages.

**active listening** Asking questions and restating ideas to discover the true message of the sender by giving verbal feedback.

**assertive communicator** One who expresses thoughts, ideas, and feelings in respectful ways.

**aggressive communicator** One whose verbal or nonverbal communication aims to hurt or put other people down in a disrespectful way.

**passive communicator** One who is unwilling to say what he or she feels, things, or desires in order to avoid conflict.

**mediator** A neutral person who oversees conflict resolution in order to help others reach a peaceful settlement.

**mediation** The process of bringing about agreement or reconciliation between opponents in a dispute.

### **\*\*Tuesday\*\***

An **assertive communicator** freely expresses their thoughts, ideas, and feelings, but they do so respectfully and allow others to do the same. **Aggressive communicators** aim to hurt or put down other people and are disrespectful. **Passive communicators** are unwilling to say what they feel, think, or desire and avoid all conflict.

**Journal:** In a journal, write down what kind of communicator you believe that you are and why. Explain the drawbacks of being a teacher who is an aggressive and passive communicator.

### **\*\*Wednesday\*\***

Electronic communication is something that is extremely prevalent right now and is continually growing. We use text messaging, Face Book, Instagram, Snap Chat and the list just goes on and on. Think about all of the ways that you and those around you communicate electronically and answer the questions below.

1. Do you pay attention to your grammar and/or punctuation when you are communicating electronically? Why or why not? Why do you think it is or isn't important?
  2. What is a benefit of electronic communication?
  3. What is a drawback of electronic communication?
-

### **\*\*Thursday\*\***

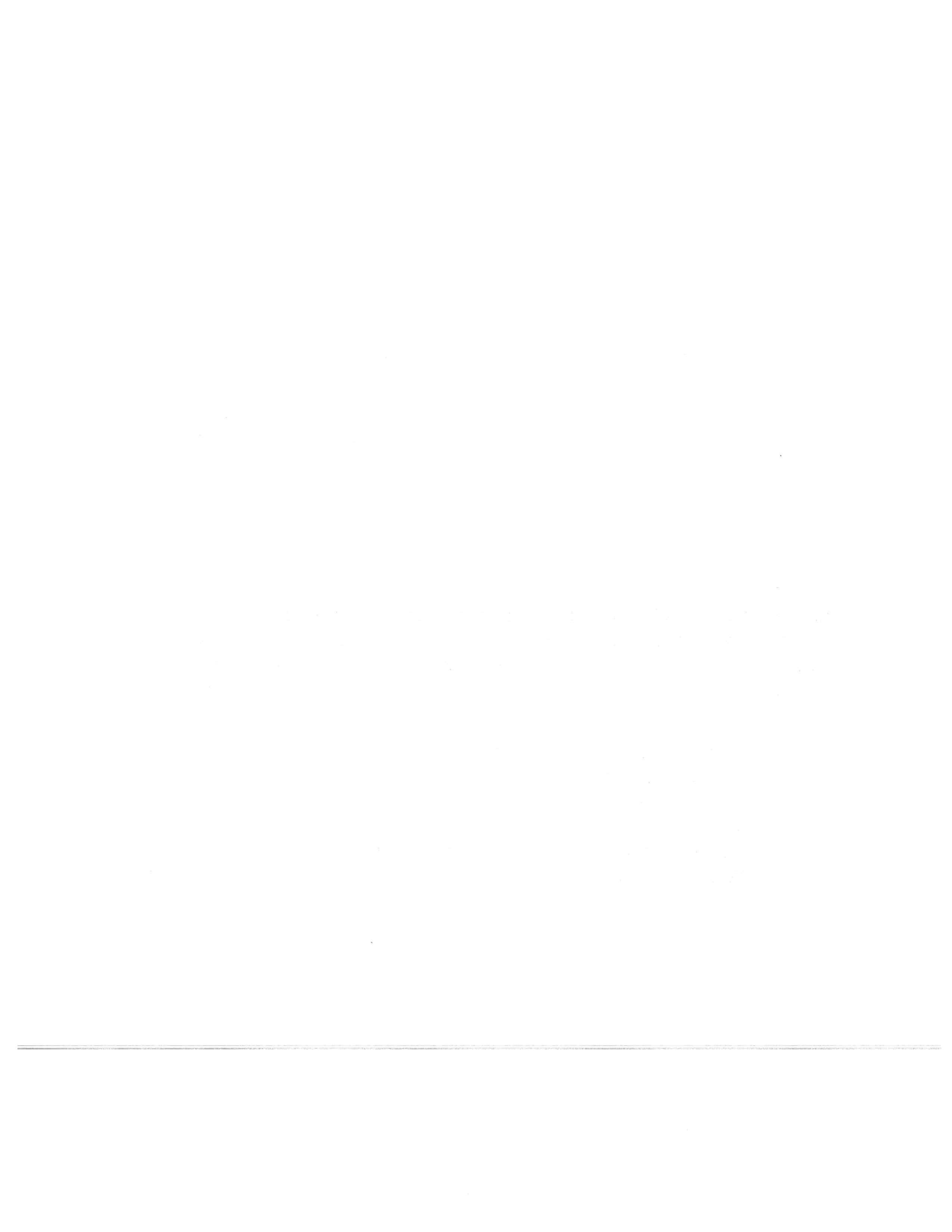
While our words are powerful in communication, our nonverbal communication is equally important. Nonverbal communication are your facial expressions, body posture and movements, you tone of voice, and appearance. Have you ever been frustrated at your parents and the next thing you here is, "I'm not going to put up with you acting like that!" and then you may have said, "I didn't even say anything to you!". The chances are that your "nonverbal" communication, your facial expressions and body language, spoke for you. Think about the different ways that people communicate with you using nonverbal communication and answer the following questions.

1. Do you think that even though you may be saying one thing with your mouth, that your body can communicate a different message? Explain...
2. Do you think that people in general should be held responsible for their body language or only their words? Explain...
3. The tone of your voice is "HOW" you say things. Do you think that you can say nice things and still be disrespectful with your tone? Explain...

### **\*\*Friday\*\***

Chapter 10 teaches that teachers should be role models. I absolutely agree with this. Think about how you think teachers can assure that they are good role models. Think about dependability, being responsible, committed, respectful, a team player, and having a positive attitude. Journal and answer to each of these questions.

- How does dependability of a teacher affect students?
- How does being responsible as a teacher affect students?
- What does it mean for a teacher to be committed?
- Why is it important for a teacher to be respectful?
- How do teachers have to be team players in their job?
- How does a positive attitude as a teacher make them good role models?



# Teacher Academy II

## March 23<sup>rd</sup> – 27<sup>th</sup>

**A NOTE FROM MRS. LARKIN:** Hello everyone! Let me first say that I already miss you guys terribly and these are truly unprecedented times, but your health and welfare are what is most important to me and I want you to promise me that you will take care of yourselves! Though I know these are stressful times, please take time while you are home to do things that might enrich your lives, such as spending time with family, reading, drawing, making a list of your goals, journaling etc. We are going to get through this together and be stronger on the backside. Until then, I am including items below for you to do while you are out. None of these items are dependent on technology, ☺ Take care of yourselves and I will see you soon! If you have any questions, please email me at [blarkin@fcsd.k12.ms.us](mailto:blarkin@fcsd.k12.ms.us) Mrs. Larkin

### **\*\*Monday\*\***

Take time and read over definitions daily.

- **Anticipatory set:** A brief activity or event at the beginning of the lesson that effectively engages all students' attention and focuses their thoughts on the learning objectives.
- **Assessment:** A measure of the degree to which instructional objectives have been attained.
- **Bloom's Taxonomy:** A system for categorizing levels of abstraction of questions that commonly occur in educational settings. Includes the following competencies: knowledge, comprehension, application, analysis, synthesis, and evaluation.
- **Closure:** How an activity will end.
- **Competency:** A set of standards to show a level of mastery.
- **Course plan:** A detailed outline of what a particular teacher will teach throughout a course or year based on curriculum but adapted to the characteristics of the teacher, students, and teaching circumstances. It typically includes a series of instructional units.
- **Curriculum:** A prescribed course of study in an educational program
- **Developmentally appropriate practice:** Tasks that are suitable to a child given his/her age and interests.
- **Educational standards:** Statements of what students are expected to know and be able to do at certain points.
- **Independent practice:** Work that students complete on their own to reinforce what they have learned.
- **Instructional objectives:** A statement of skills or concepts that students should master after a given period of instruction
- **Instructional units:** Related topics that are grouped and taught together over a period of time.
- **Learning activities:** The learning experiences used to help students learn the content and reach the instructional objectives.

- **Lesson plans:** Detailed outlines for teaching a specific topic or skill, including what will be taught, how it will be taught, why it is being taught, and how learning will be evaluated.
- **Materials:** A list of items, including equipment that will be used during a lesson.
- **Objective:** Expectation statement for student learning that is stated in behavioral terms
- **Pacing:** Managing the rate at which a teacher moves through a lesson
- **Procedure:** A written, detailed plan of action.
- **Standard/goal:** a criterion that explains what teachers are required to teach and what students are required to learn
- **Teach the lesson:** the teacher presents the lesson using instructional materials while conducting instructional strategies/activities
- **Transitions:** Smooth ways to move from one part of a lesson to the next.
- **Webb's Depth of Knowledge:** a hierarchy of four levels based on complexity of concepts, sophistication of activities and prior opportunities for learning, teachers use these behavioral terms when planning instruction.

### **\*\*Tuesday\*\***

An **anticipatory set** is something that you do at the beginning of a lesson to grab the student's attention and hold it. Below, journal what type of exercises would best hold student's attention at various levels.

Elementary

Middle School

High School

### **\*\*Wednesday\*\***

Closure is when you summarize and "wrap up" a lesson is. Why do you think closure is such an important part of a lesson? What can a teacher learn about the lesson through closure?

### **\*\*Thursday\*\***

Materials are comparable to the ingredients of a lesson. If you think good on your feet as a teacher, is it really necessary to have a detailed list of what you need for a lesson? Why or why not?

### **\*\*Friday\*\***

Pretend that you are a teacher in an elementary classroom. You are tasked with having to teach math, science, social studies, and reading through a unit such as "Ocean Animals", "Zoo Animals", or "Wild Animals". Choose one of the topics and come up with something that students in that grade will be tasked with doing in the areas of math, science, social studies, and reading.



**Example:**

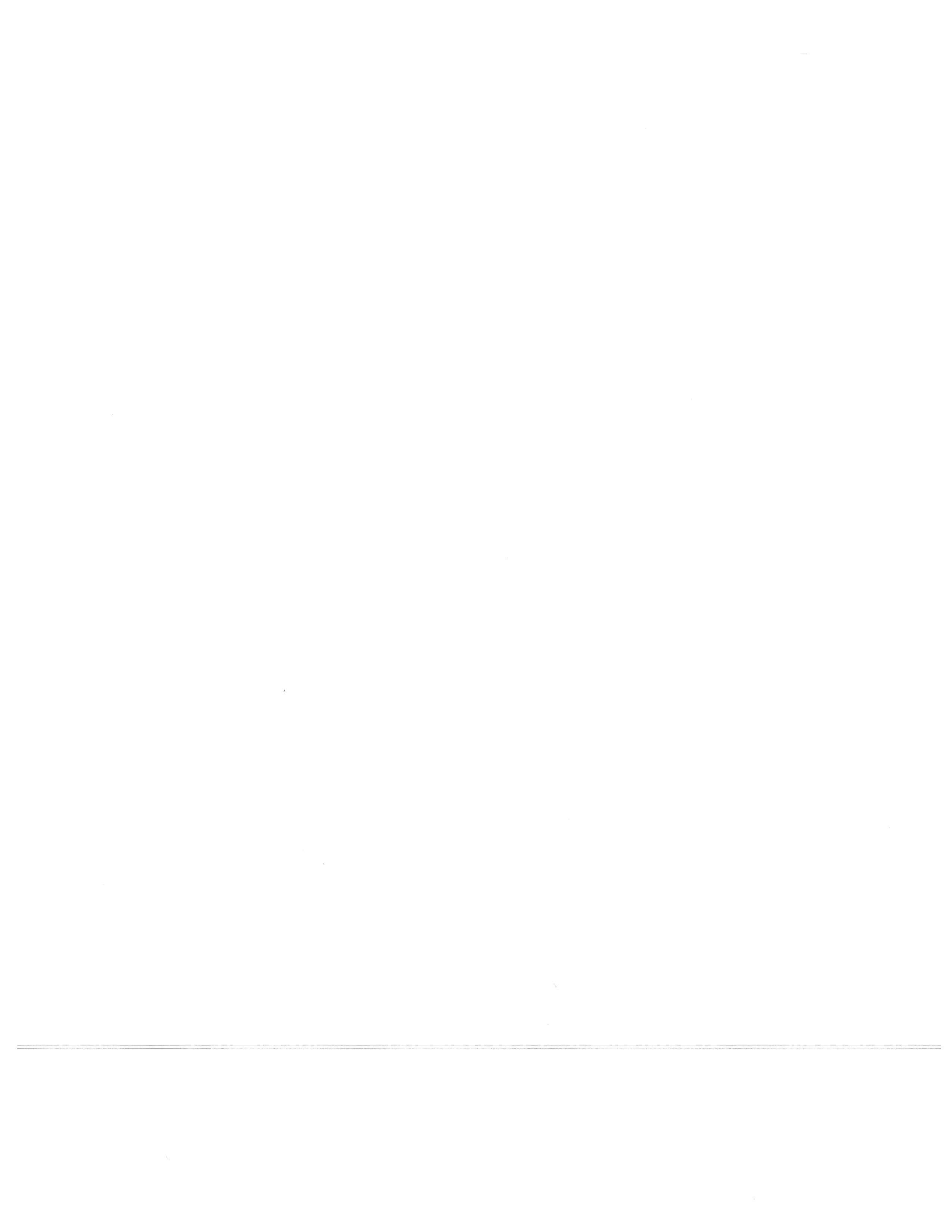
Unit: Food Pyramid

Math: Students will add a variety of calories together to calculate caloric intake.

Science: Students will, using magazines, clip out examples of each category of the food pyramid.

Social Studies: Students will read about the diet of people from different cultural backgrounds.

Reading: Students will work in groups to create a persuasive letter to encourage students to eat healthier. The groups will then read their products to the class.



## SECTION ONE

### 1.0.0 WELDING CODES AND PROVISIONS

#### Objective

Identify and describe the various code organizations that apply to welding and their basic elements.

- a. Identify the various welding code organizations and their sponsoring organizations.
- b. Identify and describe the basic provisions of welding codes.

#### Trade Terms

**Brazing:** A method of joining metal using heat and a filler metal with a melting point above 842°F (450°C). Unlike welding, the base metal is not melted during the brazing process.

**Code:** A document that establishes the minimum requirements for a product or process. Codes can be, and often are, adopted as laws.

**Essential variable:** Items in a welding procedure specification (WPS) that cannot be changed without requalifying the WPS.

**Non-essential variable:** Items in a welding procedure specification (WPS) that can be changed without requalifying the WPS.

**Notch toughness:** The ability of a material to absorb energy in the presence of a flaw such as a notch.

**Procedure qualification record (PQR):** The document containing the results of the nondestructive and destructive testing required to qualify a welding procedure specification (WPS).

**Specification:** A document that defines in detail the work to be performed or the materials to be used in a product or process.

**Standard:** A document that defines how a code is to be implemented.

**Supplemental essential variable:** The variables that must be considered when notch toughness requirements are invoked.

**Welding procedure qualification:** A demonstration through testing that welds made following a specific process can meet prescribed standards.

**W**<sup>Welding 1</sup>elding criteria have been established in codes and standards produced by a number of organizations. In addition, each country may have its own welding standards. Welding codes govern welding activities, qualification requirements, and tests that can be performed on weldments to identify imperfections in welds. Standards define how the code requirements are to be achieved. Welders must be familiar with the codes and standards that apply to their work.

#### 1.1.0 Codes and Standards Governing Welding

Welding work is governed by codes, standards, and specifications. A welding code is a set of requirements covering permissible materials, service limitations, fabrication, inspection, testing procedures, and qualification of welders. Welding codes ensure that safe and reliable welded products are produced and that persons associated with the welding operation are safe. Codes are often adopted into law. A standard is a document that defines how a code is to be implemented. Standards are developed by organizations that bring together professionals from all areas of an industry to create standards for that industry. Specifications are detailed instructions for producing a product or performing a particular task. One important difference to note is that standards represent the cooperative effort of people from all parts of an industry, and are published and maintained by organizations established for that purpose. Specifications, on the other hand, can be produced by an individual company or organization without industry consensus and can apply to a single project.

Clients specify in the contract the codes, standards, and specifications that will be used on the project. Since there are a number of codes and each is updated periodically, welders must know which welding codes and code year apply to the project on which they are working. In addition to codes and standards, there are generally specifications that apply to each job. A specification is a document that defines in detail how the work is to be performed, but it is not intended to replace codes and standards.

Codes and standards that apply to welding safety and quality have been developed and are published by a number of nationally recognized agencies. To eliminate the necessity of writing a code for each new job, sections of these

existing codes are referenced by the project contract. Agencies and societies that have established widely used welding codes and standards in the United States include the following:

- American Society of Mechanical Engineers (ASME)
- American Welding Society (AWS)
- American Petroleum Institute (API)
- American National Standards Institute (ANSI)

It is beyond the scope of this module to present all the details of the codes and standards organizations mentioned here. However, some of the most important will be discussed along with their impact on the industry. There are also a number of other organizations that have developed codes and standards used internationally. Some of those organizations will also be introduced in this section.

### 1.1.1 American Society of Mechanical Engineers

The American Society of Mechanical Engineers publishes two codes that welders must be aware of: the *ASME Boiler and Pressure Vessel Code* and *ASME B31, Code for Pressure Piping*. Both of these codes are endorsed by the American National Standards Institute.

The *ASME Boiler and Pressure Vessel Code (BPVC)* contains eleven sections. The sections most frequently referenced by welders are as follows:

- *Section II, Material Specifications* – This section contains the specifications for acceptable ferrous (Part A) and nonferrous (Part B) base metals and for acceptable welding and brazing filler metals and fluxes (Part C). Many of these specifications are identical to and have the same number designation as AWS specifications for welding consumables. This section is used to match base metals and filler metals.

- *Section V, Nondestructive Examination* – This section covers the methods and standards for nondestructive examination of boilers and pressure vessels.
- *Section IX, Welding and Brazing Qualifications* – This section covers the qualification of welders, welding operators, brazers, and brazing operators. It also covers the welding and brazing procedures that must be used for welding or brazing boilers or pressure vessels. This section of the code is often cited in other codes and standards as the welding qualification standard.

*ASME B31, Code for Pressure Piping*, consists of eight sections. Each section gives the minimum requirements for the design, materials, fabrication, erection, testing, and inspection of a particular type of piping system. In particular, *B31.1, Power Piping*, covers power and auxiliary service systems for electric generation stations. *B31.3, Process Piping*, covers chemical plant and petroleum refining piping. Other sections include the following:

- *B31.2, Fuel Gas Piping*
- *B31.4, Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids*
- *B31.5 Refrigeration Piping and Heat Transfer Components*
- *B31.8 Gas Transmission and Distribution Piping Systems*
- *B31.9 Building Services Piping*
- *B31.11 Slurry Transportation Piping Systems*

All sections of *ASME B31, Code for Pressure Piping*, require qualification of the welding procedures and testing of welders and welding operators. Some sections require these qualifications to be performed in accordance with Section IX of the *ASME Boiler and Pressure Vessel Code*, while in others it is optional.

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## The Importance of Welding Inspection

It is important that you learn to recognize the various types of weld discontinuities and identify their causes so that you can be the first line of defense against problem welds.

Welding is used to join metals in many critical applications, including buildings, bridges, pipelines, motor vehicles, and heavy machinery. Failure of a weld in any of these applications could mean loss of life or major property damage. For this reason, welding inspectors will frequently check your work to make sure your welds meet the standards established for the project. The greater the potential hazard or cost risk, the more frequent and intense the inspections will be.



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## Inspection Standards

Among the many documents and standards published by the American Welding Society are documents covering weld inspection. These include the following:

- *AWS B1.10, Guide for the Nondestructive Inspection of Welds*
- *AWS B1.11, Guide for the Visual Inspection of Welds*
- *AWS B5.1, Specification for the Qualification of Welding Inspectors*
- *AWS Welding Inspection Technology*

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### 1.1.2 American Welding Society

The American Welding Society publishes numerous welding-related documents. These documents include codes, standards, specifications, recommended practices, and guides. *AWS D1.1, Structural Welding Code – Steel*, is the code most frequently referenced. It covers welding and qualification requirements for welded structures of carbon and low-alloy steels. It is not intended to apply to pressure vessels, pressure piping, or base metals less than  $\frac{1}{8}$ " (<3.2 mm metric plate) thick. Other commonly used AWS welding codes include the following:

- *AWS D1.2 Structural Welding Code – Aluminum*
- *AWS D1.3 Structural Welding Code – Sheet Steel*
- *AWS D1.6 Structural Welding Code – Stainless Steel*
- *AWS D1.5 Bridge Welding Code*

### 1.1.3 American Petroleum Institute

The American Petroleum Institute (API) publishes numerous documents in all areas related to petroleum production. *API 1104, Standard for Welding of Pipelines and Related Facilities*, applies to arc and oxyfuel gas welding of piping, pumping, transmission, and distribution systems for petroleum. It presents methods for making acceptable welds by qualified welders using approved welding procedures, materials, and equipment. It also presents methods for ensuring proper analysis of weld quality.

### 1.1.4 American National Standards Institute

The American National Standards Institute (ANSI) is a private organization that does not actually prepare standards. Instead, it adopts standards that it feels are of value to the public interest. ANSI standards deal with dimensions; ratings; terminology and symbols; test methods; and performance, as well as safety specifications for materials, equipment, components, and products in many fields, including construction. Many codes used today have been adopted as ANSI standards.

### 1.1.5 Other Standards Organizations

A number of national and international organizations publish standards and specifications governing welding. These organizations include the following:

- *International Standards Organization (ISO)* – This is an independent, non-governmental standards organization with 163 member countries. ISO identifies itself as the world's largest developer of voluntary standards, including nearly 300 welding standards.
- *ASTM International* – Formerly known as the American Society for Testing and Materials, ASTM International develops standards aimed at improving product quality and safety and facilitating market access and trade.
- *American Society for Nondestructive Testing (ASNT)* – ASNT is an organization for professionals involved in nondestructive testing. ASNT provides a forum for the exchange of NDT-related technical information; provides educational materials and programs; and publishes standards related to NDT. The key ASNT standards are as follows:
  - *ANSI/ASNT CP-189, ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel*
  - *ANSI/ASNT CP-105, ASNT Standard Topical Outlines for Qualification of Nondestructive Testing Personnel*

Many countries produce their own standards. Examples include the GOST in Russia; the Canadian Welding Bureau; the European Union (CEN), and many others.

## Did You Know?

### PHMSA

The US Department of Transportation (DOT) established the Pipeline and Hazardous Materials Safety Administration (PHMSA) in 2004 to develop and enforce regulations for the safe, reliable, and environmentally sound operation of the 2.6 million miles of pipeline operated by 3,000 companies in the United States. Among other PHMSA missions is the inspection of pipelines to ensure compliance with safety regulations.

### 1.1.6 Maritime Welding Guides and Specifications

The AWS website lists the guides and specifications associated with marine welds and provides the following summary statements for each code:

- *AWS D3.5-93R, Guide for Steel Hull Welding* – This guide provides information to users in the marine construction industry about the best and most practical methods to weld steel hulls for ships, barges, mobile offshore drilling units, and other marine vessels. It provides information on steel plates, shapes, castings, and forging, as well as their selection and weldability. It discusses welding processes and proper design for welding. Hull construction is presented in terms of preparation of materials, erection and fitting, and control of distortion. Qualification of procedures and personnel are outlined, and inspection methods are discussed. A common shipyard problem, stray current protection, is discussed as is the health and safety of the workforce. Supplementary non-mandatory appendices are provided for informational purposes.
- *AWS D3.6M, Specification for Underwater Welding* – This specification covers the requirements for welding structures or components under the surface of the water. It includes welding in both dry and wet environments. Sections 1 through 6 constitute the general requirements for underwater welding, while Sections 7 through 10 contain the special requirements applicable to four individual classes of weld: Class A – Comparable to above-water welding; Class B – For less critical applications; Class C – Where load bearing is not a primary consideration; and Class  $\odot$  – To meet the requirements of another designated code or specification.

- *AWS D3.7, Guide for Aluminum Hull Welding* – This guide provides information on the welding of seagoing aluminum hulls and other structures in marine construction. Included are sections on hull materials, construction preparation, welding equipment and processes, qualification requirements, welding techniques, and safety precautions.

Anyone involved in marine welding must be knowledgeable of these welding codes. When in doubt, find a current copy of the applicable code and review it. In addition, welders working on US Navy shipbuilding projects must recognize that the Navy has their own welding specifications, which can differ significantly from those used in commercial work. The main point to remember is to always ensure that the work is being done to the correct codes, standards, and specifications.

### 1.1.7 Quality Workmanship

The codes and standards discussed in this module were written to ensure that welders consistently make quality welds. Many weldments will be examined and tested. However, due to time and cost, it is not feasible to examine every one, so inspection is done on a sampling basis. Regardless, quality workmanship is expected in every weld a welder makes.

The welder should be able to work with site representatives to ensure that quality work is achieved. To do this, the site organizational structure needs to be understood. If quality problems arise, the welder needs to follow the appropriate chain of command to eliminate any problems. However, there may be instances when the welder should bypass the chain of command. Examples of such instances include the following:

- You have been directed to perform an unsafe act. If you cannot resolve the matter with your immediate supervisor, it is your responsibility to go to the general foreman, superintendent, project manager, or safety engineer.
- You have been directed to perform a weld that requires a specific certification, and you are not certified to perform it. If you cannot resolve the matter with your immediate supervisor, it is your responsibility to go to the general foreman, superintendent, project manager, or quality engineer.



## 1.2.0 Basic Provisions of Welding Codes

A major function of welding codes is to establish qualification for operators to perform a particular welding operation. All welding codes provide detailed information about qualification in the following general areas:

- Welding procedure qualification
- Welder performance qualification
- Welding operator qualification

Machine welding is covered in some codes but is not common to all codes. Each type of qualification mentioned is different and is subject to different requirements.

**NOTE**

The information in this module is provided as a general guideline only. Check with your supervisor if you are unsure of the codes and specification requirements for your project.

### 1.2.1 Welding Procedure Qualification

A welding procedure is a written document that contains materials, methods, processes, electrode types, techniques, and all other necessary and relevant information about the weldment. Welding procedures must be qualified before they can be used. Welding procedure qualification has nothing to do with the skills of the individual welder, but deals only with the process itself.

Welding procedure qualifications are limiting instructions written to explain how a welding operation will be done. These limiting instructions are listed in a document known as a welding procedure specification (WPS). *Figure 1* shows a sample WPS. The purpose of the WPS is to define and document in detail the variables related to project-specific welds. The WPS lists the following information in detail:

- Base metals to be joined by welding
- Filler metal to be used
- Range of preheat and postheat treatment
- Thickness and other variables for each welding process

WPS variables are identified either as essential or nonessential variables. Essential variables are items in the welding procedure specification that cannot be changed without requalifying the welding procedure. Supplemental essential variables are those variables that must be considered when notch toughness requirements are invoked.

Essential variables vary by code or welding process. Refer to the specific code or welding process for the relevant essential variables. The following are some of the essential variables in a welding procedure.

- Filler metal classification
- Material thickness
- Joint design
- Type of base metal
- Welding process
- Current type
- Pre- and post-heat treatment

Nonessential variables are items in the WPS that may be changed within a range identified by the code, but that do not affect the qualification status.

Examples of nonessential variables that may be changed without having to requalify the welding procedure include the following:

- Amperage
- Travel speed
- Shielding gas flow (if applicable)
- Electrode and filler wire size
- Rod travel angle

Do not change any essential or supplemental essential variable without discussing it with your supervisor.

The WPS is qualified for use by welding test coupons as the WPS instructs, and then by testing the coupons in accordance with the applicable code. A test weld is made and test coupons are cut from it. The test coupons are used to make tensile tests, root bends, and face bends as required by the code. The test results are then recorded on a document known as a procedure qualification record (PQR). This documents the tested specimen, testing method, and the results. If the weldment produced by the WPS-guided procedure meets the code requirements, the procedure becomes qualified. Under most codes, each WPS must have a matching PQR to document the quality of the weld produced. *Figure 2* shows a sample PQR.

The methods used to qualify procedures are more detailed and thorough than those used to qualify either welders or welding machine operators. This is because procedures must qualify physical and metallurgical properties.

ANNEX B—SAMPLE FORMS

**WELDING PROCEDURE SPECIFICATION (WPS) Yes**   
**PREQUALIFIED \_\_\_\_\_ QUALIFIED BY TESTING X**  
**or PROCEDURE QUALIFICATION RECORDS (PQR) Yes**

Company Name Red Inc.  
 Welding Process(es) FCAW  
 Supporting PQR No.(s) -

Identification # PQR 231  
 Revision 1 Date 12-1-07 By W. Lye  
 Authorized by J. Jones Date 1-18-08  
 Type—Manual  Semi-Automatic   
 Machine  Automatic

**JOINT DESIGN USED**

Type: Butt  
 Single  Double Weld   
 Backing: Yes  No   
 Backing Material: ASTM A131A  
 Root Opening 1/4" Root Face Dimension -  
 Groove Angle: 35° Radius (J-U) -  
 Back Gouging: Yes  No  Method -

**POSITION**

Position of Groove: 4G Fillet: -  
 Vertical Progression: Up  Down

**ELECTRICAL CHARACTERISTICS**

Transfer Mode (GMAW) Short-Circuiting   
 Globular  Spray   
 Current: AC  DCEP  DCEN  Pulsed   
 Other \_\_\_\_\_  
 Tungsten Electrode (GTAW)  
 Size: \_\_\_\_\_  
 Type: \_\_\_\_\_

**BASE METALS**

Material Spec. ASTM A131  
 Type or (Grade) A  
 Thickness: Groove 1" Fillet -  
 Diameter (Pipe) -

**TECHNIQUE**

Stringer or Weave Bead: Stringer  
 Multi-pass or Single Pass (per side) Multipass  
 Number of Electrodes 1  
 Electrode Spacing Longitudinal -  
 Lateral -  
 Angle -

**FILLER METALS**

AWS Specification A5.20  
 AWS Classification E71T-1

Contact Tube to Work Distance 3/4-1"  
 Peening None  
 Interpass Cleaning: Wire Brush

**SHIELDING**

Flux - Gas CO<sub>2</sub>  
 Composition \_\_\_\_\_  
 Electrode-Flux (Class) \_\_\_\_\_ Flow Rate 30-40 cfh  
 Gas Cup Size 5/8" or 3/4"

**POSTWELD HEAT TREATMENT**

Temp. N.A.  
 Time \_\_\_\_\_

**PREHEAT**

Preheat Temp., Min 75° Ambient  
 Interpass Temp., Min 75° F Max 350° F

**WELDING PROCEDURE**

Pass or Weld Layer(s)	Process	Filler Metals		Current		Volts	Travel Speed	Joint Details
		Class	Diam.	Type & Polarity	Amps or Wire Feed Speed			
1	FCAW	E71T-1	.045"	DC+	180	26	8	
2-8	"	"	"	"	200	27	10	
9-11	"	"	"	"	200	27	11	
12-15	"	"	"	"	200	27	9	
16	"	"	"	"	200	27	11	

Form E-1 (Front)

29106-15\_F01.EPS

Figure 1 Example of a welding procedure specification (WPS).





**Procedure Qualification Record (PQR) # 231**  
**Test Results**

**TENSILE TEST**

Specimen No.	Width	Thickness	Area	Ultimate Tensile Load, lb	Ultimate Unit Stress, psi	Character of Failure and Location
231-1	.75"	1.00"	.75"	52 500	70 000	Ductile
231-3	.75"	1.00"	.75"	52 275	69 700	Ductile

**GUIDED BEND TEST**

Specimen No.	Type of Bend	Result	Remarks
231-2	Side	Pass	
231-4	Side	Pass	Small (< 1/16") opening acceptable
231-6	Side	Pass	
231-5	Side	Pass	

**VISUAL INSPECTION**

Appearance acceptable  
 Undercut acceptable  
 Piping porosity none  
 Convexity none  
 Test date 12-3-2002  
 Witnessed by D. Davis

Radiographic-ultrasonic examination  
 RT report no.: D231 Result passed  
 UT report no.: \_\_\_\_\_ Result \_\_\_\_\_

**FILLET WELD TEST RESULTS**

Minimum size multiple pass Maximum size single pass  
 Macroetch Macroetch  
 1. \_\_\_\_\_ 3. \_\_\_\_\_ 1. \_\_\_\_\_ 3. \_\_\_\_\_  
 2. \_\_\_\_\_ 2. \_\_\_\_\_

**Other Tests**

All-weld-metal tension test  
 Tensile strength, psi 83,100  
 Yield point/strength, psi 72,600  
 Elongation in 2 in., % 28  
 Laboratory test no. PW 231

Welder's name W. T. Williams

Clock no. 261 Stamp no. \_\_\_\_\_

Tests conducted by RED Inc. & ABC Testing

Laboratory

Test number PQR 231

Per D. Miller

We, the undersigned, certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in conformance with the requirements of Section 4 of AWS D1.1/D1.1M, 2002 (year) Structural Welding Code—Steel.

Signed RED Inc.  
 Manufacturer or Contractor

By R. M. Boncrack

Title Q.C. Mgr.

Date 12-15-2002

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Figure 2 Example of a procedure qualification record (PQR).





## Test Coupons

When welding coupons are no longer needed or usable, they should be properly recycled, to save the company money and to keep salvageable items out of the landfills.

### 1.2.2 Welder Performance Qualification

Once a procedure has been qualified, the welder using it must be qualified to use that procedure by passing a welding performance qualification (WPQ) test. Because no single performance test

can qualify welders for all the different types of welding that must be done, a welder may be required to pass a number of performance qualification tests. Performance tests used to qualify welders are covered later in this module.

### 1.2.3 Welding Machine Operator Qualification

When automatic welding equipment is used, the operators of the equipment must demonstrate their ability to set up and monitor the equipment so that it will produce acceptable welds. The codes also contain qualification tests for these operators.

## Additional Resources

*2014 Technical Training Guide*. Current Edition. Cleveland, OH, USA: The Lincoln Electric Company.  
[www.lincolnelectric.com](http://www.lincolnelectric.com)

## 1.0.0 Section Review

1. Which of the following documents is often adopted into law?
  - a. Specifications
  - b. Codes
  - c. Standards
  - d. WPSs
2. A WPQ test is used to qualify a welder to perform a specific procedure.
  - a. True
  - b. False





2. What is the difference between a code and a specification?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_.

3. A \_\_\_\_\_ is a document that describes how a code is to be implemented.

4. Who specifies in the contract the codes, standards and specification that will be used on the project? \_\_\_\_\_

5. Codes and standards that apply to welding safety and quality have been developed and are published by a number of nationally recognized agencies. List the four agencies or societies and their abbreviations that have established widely used codes and standards used in the United States.

- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_
- d. \_\_\_\_\_

6. The American Society of Mechanical Institute publishes two codes the welders must be aware of:

- a. \_\_\_\_\_
- b. \_\_\_\_\_

THURSDAY

7. The ASME Boiler and Pressure Vessel Code (BPVC) contain eleven sections. List the three most commonly referenced by welders.

- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_

8. ASME B31, Code for Piping Pressure consist of eight sections. Each section gives the minimum requirements for the \_\_\_\_\_ of a particular type of piping system.

9. All sections Of ASME B31, Code for Pressure Piping, require \_\_\_\_\_

\_\_\_\_\_ and \_\_\_\_\_.

10. Among the many documents and standards published by the American Welding Society are document covering weld inspection. These include:

- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_
- d. \_\_\_\_\_

11. The American Petroleum Institute (API) publishes numerous documents related to \_\_\_\_\_.

FRIDAY

12. The \_\_\_\_\_ is a private organization that does not actually prepare standards, but instead adopts standards that it feels are of value to the public.

13. The \_\_\_\_\_ website list the guides and specifications associated with Marine welds.

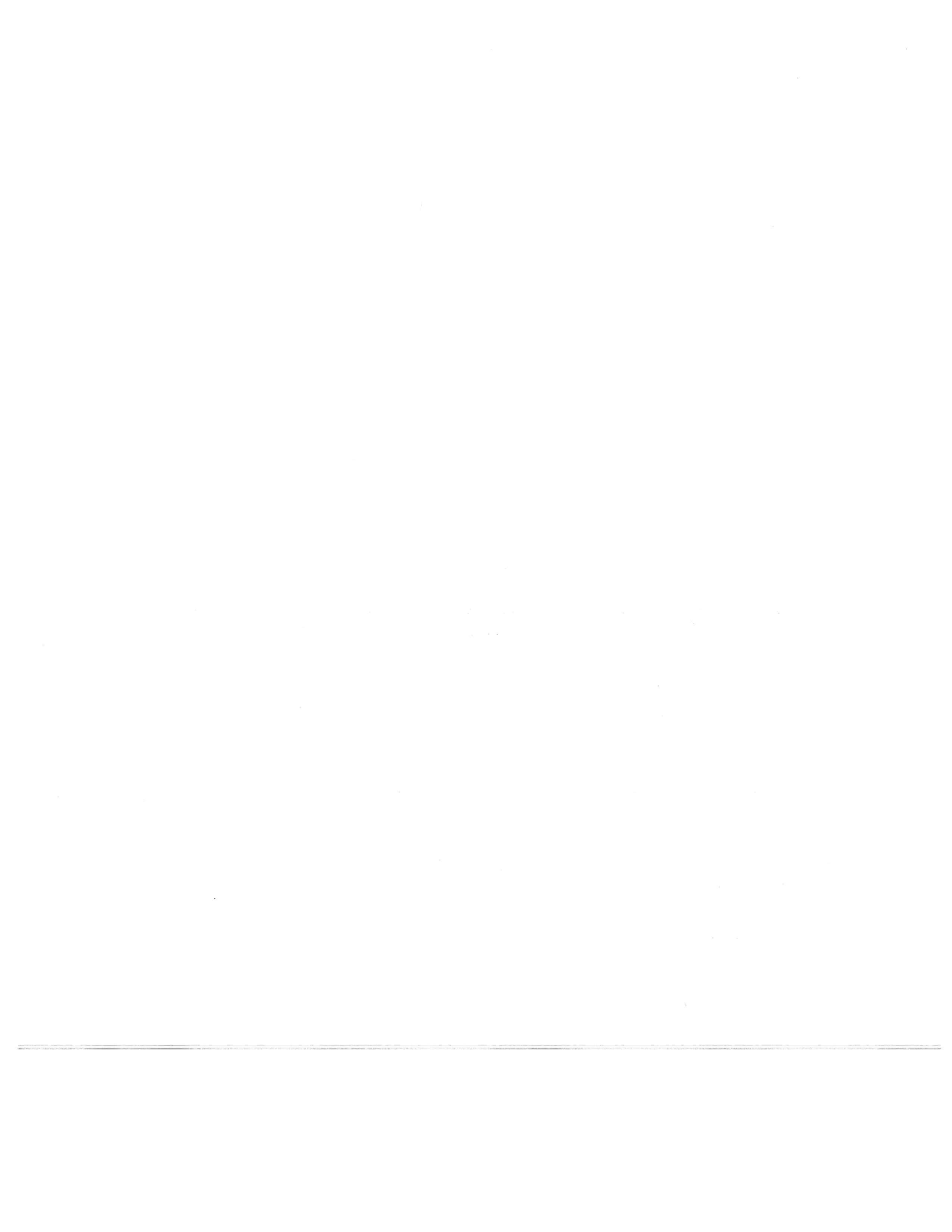
14. What is the main purpose for codes and standards discussed in this module (section 1.1.7) ?  
\_\_\_\_\_

15. A written document that contains materials, methods, processes, electrode type, techniques and all other necessary and relevant information about the weldment is the  
\_\_\_\_\_.

16. The Welding Procedure Qualification (WPS) list the following information in detail:

- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_
- d. \_\_\_\_\_

17. \_\_\_\_\_ are items that cannot be changed without requalifying the welding procedure, while \_\_\_\_\_ are items that can be changed within a range identified by the code, but does not affect the qualification process.



## SECTION ONE

### 1.0.0 GTAW

#### Objective

Identify GTAW-related safety practices and describe the electrical characteristics that affect GTAW.

- Identify GTAW-related safety practices.
- Describe the electrical characteristics that affect GTAW.

#### Trade Terms

**Lift-arc technology:** A type of GTAW technology in which the tungsten electrode may be touched to the work, but the arc will not strike until the tip is lifted away to an appropriate distance.

**Truncated:** Having the pointed top (vertex) of a conical shape cut off, leaving only a plane section parallel to the base of the cone.

**Tungsten:** A nonstandard common name for the tungsten electrode used in GTAW; also, the principal metal from which the electrodes are constructed.

**G**as tungsten arc welding (GTAW) is an arc welding process that uses a welding power source to produce an electric arc between a tungsten electrode and the base metal. The arc melts and fuses the base metal to form the weld. A filler metal is typically added. In processes where a filler metal is not added, it is referred to as autogenous welding. In manual welding (Figure 1), the filler metal is usually a handheld metal rod or wire that is fed into the leading edge of the weld metal pool. An inert gas or gas mixture is used to shield the electrode and molten weld metals to prevent oxidation and contamination from the atmosphere. The finished weld has no slag because no flux is used. Also, since no filler metal is transported within the arc, the process produces little or no spatter.

GTAW is used to weld a variety of metals. The process is slower than gas metal arc welding (GMAW); however, it produces high-quality welds. GTAW has been commonly used for root pass welds on pipe where the subsequent fill and cover passes are performed with SMAW, GMAW,

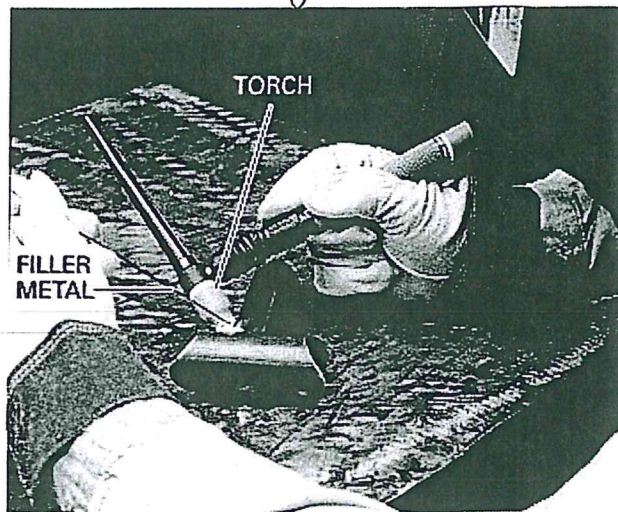


Figure 1 Performing manual GTAW.

or FCAW. In the past, GTAW was called tungsten inert gas (TIG) welding. Today, the nonstandard term TIG is still used, including in the control nomenclature marked on some welding machines.

#### 1.1.0 Safety Summary

The following is a summary of safety procedures and practices that welders must observe when cutting or welding. Keep in mind that this is only a summary. Complete safety coverage is provided in the Welding Level One module, *Welding Safety*. That module should be completed before continuing with this one. Above all, be sure to wear appropriate protective clothing and equipment when welding or cutting.

##### 1.1.1 Protective Clothing and Equipment

Welding activities can cause injuries unless you wear all of the protective clothing and equipment that is designed specifically for the welding industry. The following information includes important safety guidelines about protective clothing and equipment:

- Wear a face shield over snug-fitting cutting goggles or safety glasses for gas welding or cutting. Either the face shield or the lenses of the welding goggles must be an approved shade for the application. A welding hood equipped with a properly tinted lens is best for all forms of welding.
- Wear proper protective leather and/or flame-retardant clothing along with welding gloves that protect the welder from flying sparks, molten metal, and heat.



- Wear high-top safety shoes or boots. Make sure that the tongue and lace area of the footwear will be covered by a pant leg. If the tongue and lace area is exposed or the footwear must be protected from burn marks, wear leather spats under the pants or chaps over the front and top of the footwear.
- Wear a 100-percent cotton cap with no mesh material included in its construction. The bill of the cap points to the rear. If a hard hat is required for the environment, use one that allows the attachment of rear deflector material and a face shield. A hard hat with a rear deflector is generally preferred when working overhead, and may be required by some employers and job sites.
- Wear earmuffs or at least earplugs to protect your ear canals from sparks.

**WARNING!**

Using proper personal protective equipment (PPE) for the hands and eyes is particularly important. The most common injuries that welders experience during GTAW operations are injuries to the fingers and eyes. Welders who fail to use proper gloves, safety glasses, and face shields when they are holding and grinding the tungsten electrode by hand can cut or burn their fingers, have splintered tungsten electrode lodge in their hands or fingers, or get small slivers of the electrode stuck in their eyes.

### 1.1.2 Fire/Explosion Prevention

Welding activities usually involve the use of fire or extreme heat to melt metal. Whenever fire is used, it must be controlled and contained. Welding or cutting activities are often performed on vessels that may once have contained flammable or explosive materials. Residues from those materials can catch fire or explode when a welder begins work on such a vessel. The following are fire and explosion prevention guidelines associated with welding:

- Never carry matches or gas-filled lighters in your pockets. Sparks can cause the matches to ignite or the lighter to explode, causing serious injury.
- Never use oxygen to blow dust or dirt from clothing. The oxygen can remain trapped in the fabric for a time. If a spark hits clothing during this time, the clothing can burn rapidly and violently out of control.

- Make sure that any flammable material in the work area is moved or shielded by a fire-resistant covering. Approved fire extinguishers must be available before attempting any heating, welding, or cutting operations. If a hot-work permit and a fire watch are required, be sure those items are in place before beginning and ensure that all site requirements have been observed.
- Never release a large amount of oxygen or use oxygen as compressed air. The presence of oxygen around flammable materials or sparks can cause rapid and uncontrolled combustion. Keep oxygen away from oil, grease, and other petroleum products.
- Never release a large amount of fuel gas, especially acetylene. Propane tends to concentrate in and along low areas and can ignite at a considerable distance from the release point. Acetylene is lighter than air, but is even more dangerous than propane. When mixed with air or oxygen, acetylene will explode at much lower concentrations than any other fuel.
- To prevent fires, maintain a neat and clean work area, and make sure that any metal scrap or slag is cold before disposing of it.
- Before cutting containers such as tanks or barrels, check to see if they have contained any explosive, hazardous, or flammable materials, including petroleum products, citrus products, or chemicals that decompose into toxic fumes when heated. As a standard practice, always clean and then fill any tanks or barrels with water, or purge them with a flow of inert gas such as nitrogen to displace any oxygen. Containers must be cleaned by steam cleaning, flushing with water, or washing with detergent until all traces of the material have been removed.

**WARNING!**

Welding or cutting must never be performed on drums, barrels, tanks, vessels, or other containers until they have been emptied and cleaned thoroughly, eliminating all flammable materials and all substances (such as detergents, solvents, greases, tars, or acids) that might produce flammable, toxic, or explosive vapors when heated. Clean containers only in well-ventilated areas. Vapors can accumulate during cleaning, causing explosions or injury.

Proper procedures for cutting or welding hazardous containers are described in the *American Welding Society (AWS) F4.1, Safe Practices for the Preparation of Containers and Piping for Welding and Cutting*.





### 1.1.3 Work Area Ventilation

Vapors and fumes tend to rise in the air from their sources. Welders often have to work above the welding area where the fumes are being created. Welding fumes can cause personal injuries. Good work area ventilation helps to remove the vapors and to protect the welder. The following is a list of work area ventilation guidelines to consider before and during welding activities:

- Follow confined space procedures before conducting any welding or cutting in a confined space.
- Never use oxygen for ventilation in confined spaces.
- Always perform cutting or welding operations in a well-ventilated area. Cutting or welding operations involving zinc or cadmium materials or coatings result in toxic fumes. For long-term cutting or welding of such materials, always wear an approved full-face, supplied-air respirator that uses breathing air supplied from outside of the work area. For occasional, very short-term exposure, a HEPA-rated or metal-fume filter may be used on a standard respirator.
- Make sure confined spaces are properly ventilated for cutting or welding purposes. Use powered extraction systems when available.

### 1.1.4 GTAW-Specific Safety

GTAW, also referred to as heliarc or TIG welding, is a process that is different from the processes used in shielded metal arc welding (SMAW), GMAW, and flux-cored arc welding (FCAW). In other forms of welding, the electrode or wire is consumed in the welding process. In GTAW, the electrode itself is not consumed, but a separate rod of filler metal is consumed.

Vapors from the melted base metal, the filler metal, and from the shielding gases used in the GTAW process can create respiratory issues. As always, welders performing any kind of work must be aware of the vapors generated from the welding processes. Argon gas is often used for shielding in the GTAW process. A combination of the arc and the gas generates substantial levels of ultraviolet (UV) light, which reacts with the oxygen in the area of the weld. UV radiation can ionize oxygen in the atmosphere near the weld, which can lead to a rise in ozone and nitrogen dioxide levels. As long as the work is being performed in well-ventilated areas, the risks are minimal. If work must be performed in confined spaces, consider using additional ventilation or respirators. Follow your employer's policies in this matter.

Because GTAW work is often performed on delicate welds, the welder is frequently positioned very close to the work. The risk of UV radiation being emitted from the electrical arc is higher because the shielding gas used with GTAW is more transparent than gases used with other forms of welding. This transparency is due to the minimal smoke produced from the weld. Because of the brightness of the GTAW process, safety representatives recommend that the welder wear darker clothing to minimize UV reflections under the welding helmet. They also recommend that the walls of the work area be painted with a paint that reduces reflections from the UV light generated by the GTAW process. Because aluminum and stainless steel reflect more light than common carbon steels, welders need to take extra precautions to protect their vision when performing GTAW work on these metals.

The GTAW process requires the base metal and the filler metal to be extremely clean. Cleaning solvents are used to prepare the metals. Welders must read all Safety Data Sheet (SDS) information about any cleaning agent before using it. Some cleaning agents are flammable, while others are nonflammable. Make sure that you know which kind you are using. Pay special attention to any storage requirements for such cleaning agents.

**WARNING!**

Chlorinated cleaning solvents can produce toxic gases. For this reason, they should never be used for cleaning metals in a welding setting.

The tungsten electrodes used for GTAW become contaminated over time and with use. When electrodes lose their original shapes, welders must grind the tungsten tips to reshape them and make them suitable for continued use. The tungsten dust and flying particles from these grinding activities can damage the welder's vision and present a respiratory hazard. Read and understand the SDS that comes with each batch of electrodes.

### 1.2.0 Welding Current

The welding arc required for GTAW is produced by electrical current from a constant-current (CC) welding machine. Electrical current is the flow of electrons along a conductor. The current flows through two welding cables, one connected to the workpiece and the other connected to the torch, which holds a tungsten electrode.



An arc is established in the gap between the end of the tungsten electrode and the work. The gap has a high electrical resistance. When the electrical current meets resistance, heat is generated. When the arc is struck across the gap, the resistance generates intense heat of 6,000°F to 10,000°F ( $\approx 3,300^{\circ}\text{C}$  to  $5,500^{\circ}\text{C}$ ), melting the base metal and forming a weld. The area surrounding the arc is flooded with a shielding gas to prevent oxidation of the tungsten electrode, filler rod, and base metal surface during the welding process. Figure 2 shows the GTAW welding process.

### 1.2.1 Characteristics of Welding Current

The current produced by a welding machine to perform welding has different characteristics than the current flowing through utility power lines. Welding current has low voltage and high amperage, while the power-line current has high voltage and low amperage.

Voltage is the measure of the electromotive force or pressure that causes current to flow in a circuit. There are two voltage levels associated with welding current: open-circuit voltage and operating voltage. Open-circuit voltage is the voltage that is present when the machine is on but no welding is taking place. For GTAW, there are usually ranges of open-circuit voltages that can be selected, up to about 80V. Operating voltage, or arc voltage, is the voltage after the arc has been struck. With GTAW, arc voltage is generally much lower than the open-circuit voltage. The arc voltage drops rapidly with increasing current flow.

Amperage is the electrical current flow in a circuit. The unit of measurement for amperage is the ampere, or amp. The number of amps produced by the welding machine determines the intensity of the arc and the amount of heat generated. The

higher the amperage, the hotter the arc. Usually, welders use a finger control or a foot pedal to control the GTAW welding machine current.

### 1.2.2 DC Welding Current

Direct current (DC) is electrical current that flows in one direction only. The direction in which the current is flowing is called the polarity.

The direction in which the current flows in a circuit determines polarity. Direct current electrode negative (DCEN), also referred to by the nonstandard term *straight polarity*, is almost always used for performing GTAW on ferrous and nonferrous metals.

When the welding circuit is set up as DCEN, the tungsten electrode of the GTAW torch is connected to the negative terminal of the welding machine and the workpiece lead is connected to the positive terminal. DCEN produces the greatest amount of heat in the base metal, compared to other types of welding current. About two-thirds of the arc heat goes to the base metal and one-third goes to the tungsten electrode. Welders usually use a tungsten electrode with a pointed end that is slightly truncated, or blunted, for DCEN. The weld bead produced is narrow but with deep penetration. DCEN is used to weld steels, stainless steels, nickel, and titanium. Because DCEN provides limited cleaning action, the base metal surfaces must first be thoroughly cleaned of any contaminants such as rust, mill scale, or oxides.

Direct current electrode positive (DCEP), also referred to by the nonstandard term *reverse polarity*, produces the least amount of heat in the base metal. About one-third of the arc heat goes to the base metal and two-thirds goes to the tungsten electrode. Because of this, DCEP usually requires a large tungsten electrode with a rounded end. Unlike DCEN, the weld bead produced is wide but with shallow penetration. This current type also has a strong cleaning action on the surface of oxidized base metals. DCEP is only used for special applications in which shallow penetration is required. Figure 3 shows typical DCEN and DCEP welding circuits.

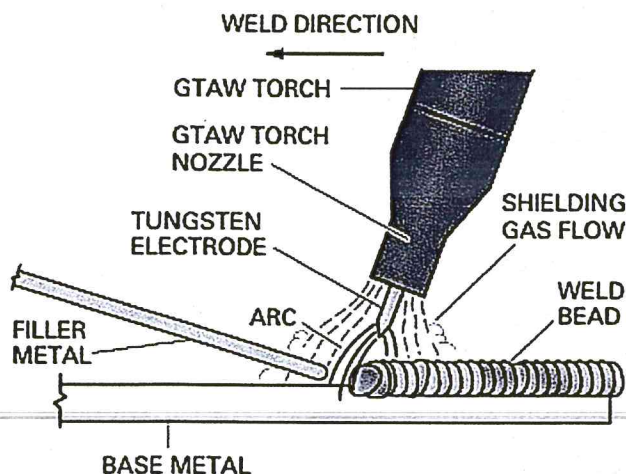


Figure 2 Diagram of the GTAW welding process.

## Polarity Switches

Many welding machines have a polarity switch. Instead of physically having to disconnect the welding leads and reconnect them to change polarity, the welder changes polarity by turning a switch.



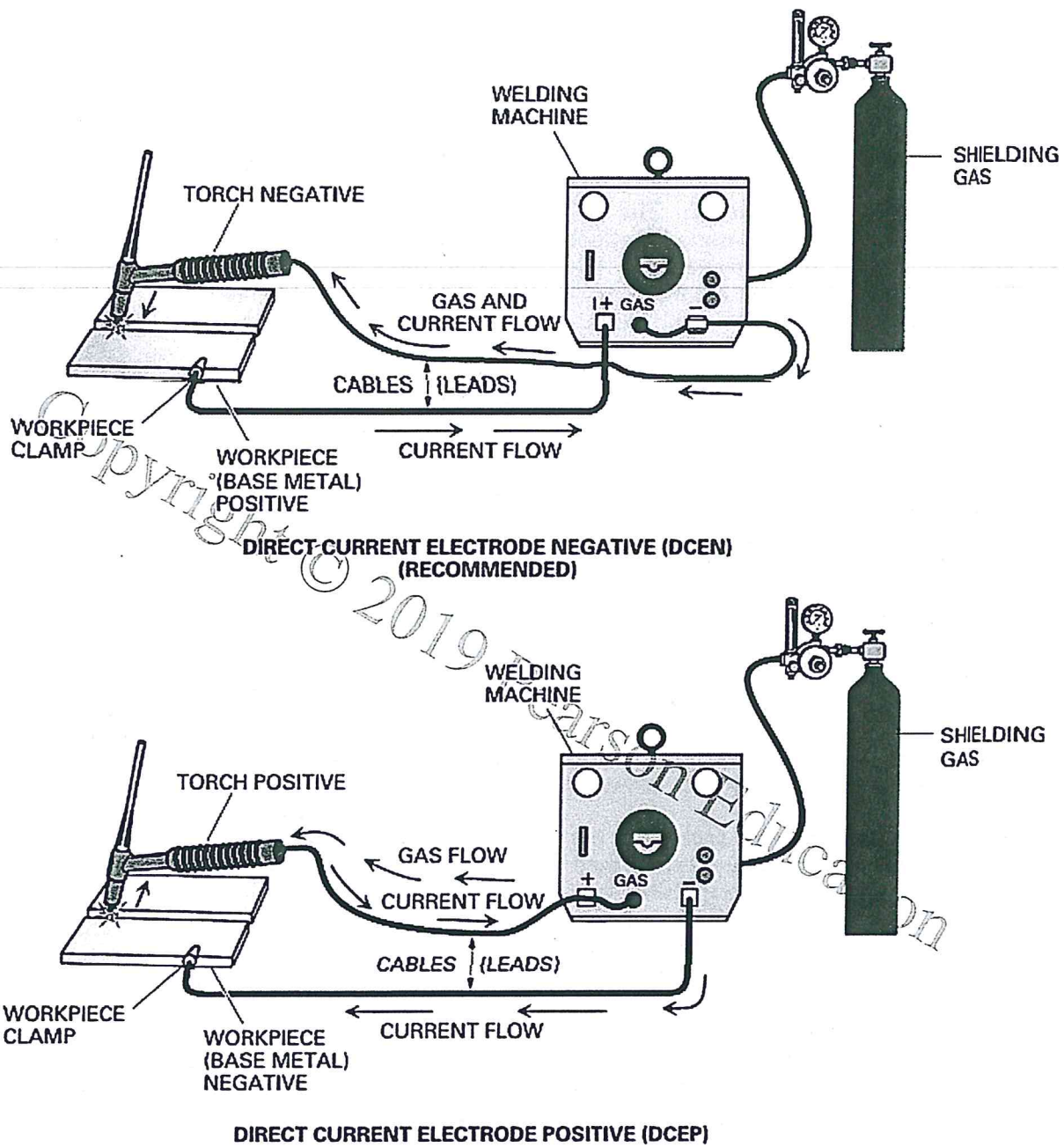


Figure 3 Representative DCEN and DCEP welding circuits.

### 1.2.3 AC Welding Current

Alternating current (AC) is electrical current that alternates between positive and negative values. In the positive half of the cycle, the current flows in one direction; during the negative half, the current reverses itself. The number of cycles completed in one second is called the frequency. In the United States, AC is almost always 60 cycles per second, or 60 Hertz (Hz). In other countries, the frequency is often 50 Hz. Figure 4 shows one cycle of AC.

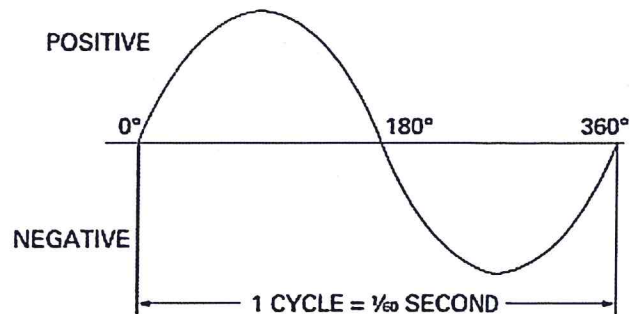


Figure 4 AC cycle.



AC is DCEN for half the time and DCEP for the remainder of the time. For this reason, AC characteristics fall in between those of DCEN and DCEP. About half of the heat goes to the base metal and the other half to the tungsten electrode. The weld bead size and penetration are midway between the beads produced by DCEN and DCEP. Some cleaning action does occur with AC. The AC tungsten electrode has a small, rounded (balled) tip. Newer welding machines with variable AC-frequency controls do not require a balled tungsten tip. AC is used with GTAW to weld aluminum, magnesium, and their alloys.

### 1.2.4 High Frequency

High frequency is an electrical current with a very high voltage (3,000V to 5,000V) and very low amperage. It is called high frequency because it cycles at millions of times per second compared to standard current, which has a frequency of 60 Hz. This high-voltage, high-frequency current creates a very stable arc that is able to jump a gap of about ½ inch (≈13 mm). Because high-frequency current has such low amperage, it creates very little heat.

High frequency has two purposes: to stabilize AC and to allow a DC arc to be started without touching the tungsten electrode to the work. The high voltage allows it to jump the gap between the two.

When AC is used with GTAW, each time the arc cycles, it goes out and must be reestablished in the opposite direction. Even though this happens very fast (60 times per second), it can cause the arc to extinguish on the reverse polarity part of the AC cycle when the electron flow is weakest. If this happens, oxides are absorbed into the weld, causing porosity, which weakens the weld. To prevent the AC arc from extinguishing, a high-frequency current is added to the

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## Starting DC GTAW without High Frequency

DC GTAW is often performed without a high-frequency start for noncritical welds. The arc is touch-started in the weld zone or on a piece of copper. Copper is less likely to contaminate the tungsten. Some machines have a built-in selectable no high-frequency start mode.

alternating welding current. The high-frequency current, with its high voltage and low amperage, establishes a path on which the alternating welding current can travel, preventing the arc from extinguishing as it cycles. When non-squarewave AC is being used, the high frequency must be on continuously.

When using DC for GTAW without high frequency, welders must physically touch the tungsten to the work to establish the arc. Except for newer GTAW machines with lift-arc technology, this may not be desirable since it can cause contamination of the electrode and defects in the weld. To prevent this, high-frequency current can be added to the direct welding current. When the tungsten electrode is brought close to the work, the high-voltage, high-frequency arc jumps the gap, establishing a path for the direct welding current to travel without touching the tungsten to the work. Typically, a timer will automatically shut off the high frequency about two to three seconds after the welding arc has been established. Since DC flows in only one direction, it is very stable. The high voltage and frequency is only needed for starting the arc.

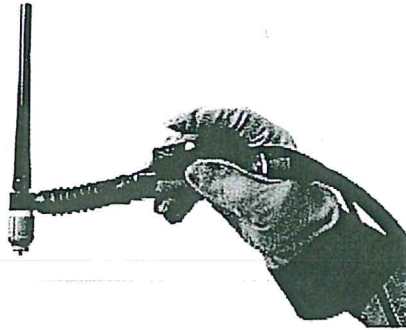
Welding power sources specifically designed for GTAW have a high-frequency generator built into them. If conventional power sources are used for GTAW, a separate auxiliary high-frequency generator can be attached if required. The generators require 120VAC to operate. Some auxiliary high-frequency generators only have high-frequency controls; others may have a combination of high-frequency controls and gas and cooling-water controls. Most will have a torch switch that plugs into the console. The switch attaches to the torch and can be used to turn the power, shielding gas, and cooling water (if used) on or off. The auxiliary high-frequency generator is connected to the power source by the electrode cable. The GTAW torch is connected to the auxiliary high-frequency generator (Figure 5).

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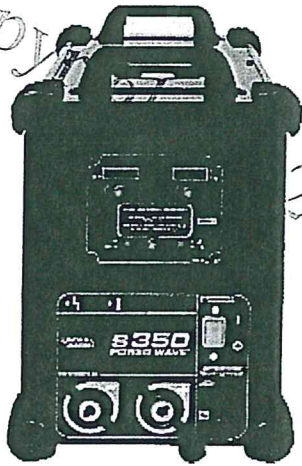
## High-Frequency Operation Precaution

When operating most transformer and transformer-rectifier machines in SMAW mode, welders must turn off the high-frequency generators.

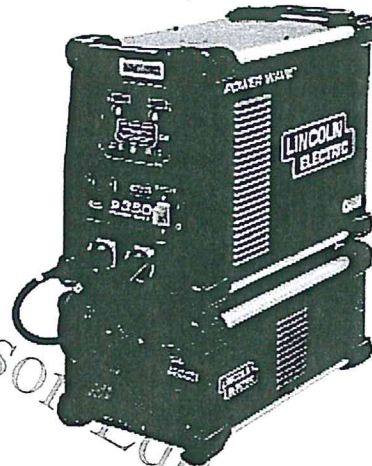




**REMOTE CONTROLLED ARC START  
SWITCH ON GTAW TORCH**



**GTAW WELDING  
MACHINE**



**GTAW MACHINE ON TOP OF  
HIGH-FREQUENCY GENERATOR**

*Figure 5* Auxiliary high-frequency generator with a GTAW torch.



## Additional Resources

*AWS B1.10, Guide for the Nondestructive Examination of Welds.* Miami, FL: American Welding Society.

*AWS B1.11, Guide for the Visual Examination of Welds.* Miami, FL: American Welding Society.

*AWS D3.5, Guide for Steel Hull Welding.* Miami, FL: American Welding Society.

*AWS D3.7, Guide for Aluminum Hull Welding.* Miami, FL: American Welding Society.

Lincoln Electric website: <http://www.lincolnelectric.com>

*Modern Welding Technology.* 6th Edition. Howard B. Cary. Englewood Cliffs, NJ: Prentice Hall, Inc.

*OSHA 1910.269, Appendix C, Protection from Step and Touch Potentials.* Current Edition. Washington, DC: Occupational Safety and Health Administration (OSHA).

*OSHA 19260.351, Arc Welding and Cutting.* Current Edition. Washington, DC: Occupational Safety and Health Administration (OSHA).

*Welding Handbook, Vol. 1, Welding Science & Technology.* 9th Edition. Miami, FL: American Welding Society, 2001.

*Welding Handbook, Vol. 2, Part 1: Welding Processes.* Miami, FL: American Welding Society, 2004.

### 1.0.0 Section Review

1. When performing long-term cutting or welding of zinc or cadmium materials or coatings, always \_\_\_\_\_.
  - a. ventilate the area with a continuous oxygen supply
  - b. connect the welding nozzle to a nitrogen purge
  - c. wear an approved full-face, supplied-air respirator
  - d. use a water-cooled, multi-flame (rosebud) torch
2. Direct current electrode negative (DCEN) produces the greatest amount of heat in the \_\_\_\_\_.
  - a. base metal
  - b. filler metal
  - c. electrode
  - d. torch



**WELDING 2    Module 8 29207-15 GTAW Equipment and Filler Metals    Section 1**

Name \_\_\_\_\_ Date \_\_\_\_\_

**TUESDAY March 24, 2020**

*Read Section 1, page 1 and answer the following questions.*

1. Define the following Terms:

a. GTAW

\_\_\_\_\_

b. Lift-arc technology

\_\_\_\_\_

\_\_\_\_\_

c. Truncated

\_\_\_\_\_

\_\_\_\_\_

d. Tungsten

\_\_\_\_\_

\_\_\_\_\_

2. In manual GTAW the \_\_\_\_\_ is usually a handheld rod or wire that is fed into the leading edge of the weld pool.

3. GTAW is slower than GMAW but it produces \_\_\_\_\_ welds.

**WEDNESDAY March 25, 2020**

*Read Sections 1.1.0-1.1.3 Safety pages 1,2, and 3, and answer the following questions.*

1. Welding activities can cause injuries unless you wear all the necessary

\_\_\_\_\_.

2. From Section 1.1.1 briefly list five Safety Guidelines about protective clothing and equipment.

1) \_\_\_\_\_

2) \_\_\_\_\_

3) \_\_\_\_\_

4) \_\_\_\_\_

5) \_\_\_\_\_

3. The most common injuries that welders experience during GTAW operations is injuries to \_\_\_\_\_.
4. Welding or cutting must never be performed on drums, barrels, tanks, vessels or other containers until they have been \_\_\_\_\_.
5. Good work area \_\_\_\_\_ helps remove fumes and protect welders.

**THURSDAY March 26, 2020**

*Read Sections 1.1.4-1.2.4 and answer the following questions.*

1. How is GTAW different from other welding processes? \_\_\_\_\_  
\_\_\_\_\_
2. \_\_\_\_\_ gas is most often used for GTAW processes.
3. GTAW requires the base metal and filler metal to be \_\_\_\_\_.
4. The welding arc required for GTAW is produced by electrical current from a \_\_\_\_\_ welding machine.
5. Usually welders use a finger controls or foot pedal to control the GTAW welding machine \_\_\_\_\_.
6. The direction in which direct current flows in a circuit determines polarity. Direct Current Electrode Negative (DCEN) is referred to as \_\_\_\_\_ polarity while Direct Current Electrode Positive is referred to as \_\_\_\_\_ polarity.
7. High frequency is an electrical current with a very high voltage (3,000 – 5,000) and very low amperage. High frequency has two purpose, 1) \_\_\_\_\_ and 2) \_\_\_\_\_.

**FRIDAY March 27, 2020 Section 1 Review Test**

*Read Section 1 and answer the following questions.*

1. Answer Section review questions 1 and 2 page 8.      1) \_\_\_\_\_      2) \_\_\_\_\_
2. \_\_\_\_\_ is a nonstandard common name for the tungsten electrode used in GTAW processes.
3. When making GTAW welds always wear safety glasses and a welding hood with the \_\_\_\_\_.
4. In other forms of welding the electrode or wire is consumed in the welding process but in the GTAW the electrode is not consumed but a \_\_\_\_\_.
5. When tungsten electrodes lose their original shape, welders must \_\_\_\_\_ and make them suitable for continued use.



6. Welders usually use a tungsten electrode with a pointed end that is slightly \_\_\_\_\_ or blunted.

7. \_\_\_\_\_ is the direction in which current flows in a circuit.

8. DCEN is referred to as \_\_\_\_\_ polarity.

9. DCEP is referred to as \_\_\_\_\_ polarity

