EEL4936/6936 – Power Plant Engineering
Midterm Exam
Monday, March 03, 2008
2 hours in length.

NAME: ___________________________

STUDENT #:_________________________

Section (Please select course number & section number that applies)

- ☐ Course 4936 – Section 797
- ☐ Course 4936 – Section 901
- ☐ Course 6936 – Section 798
- ☐ Course 6936 – Section 901

This exam is open book, open notes, open calculator, and open computer. All class materials provided on website are also allowed such as steam tables or steamtab software. Worked out homework problems **ARE** allow and encouraged. Copies of homework answer sheets from website **ARE** allowed and encouraged. Please show all work!

This exam is to be an individual effort. There is to be **NO** form of communication directly between students. There is to be **NO** passing of paper, pencil, calculator, text book, or any other materials directly between students. Student may ask any questions to moderator / instructor that pertain to clarity of exam questions.

As mentioned on the class syllabus, academic dishonesty of any kind will not be tolerated. If caught cheating, the guilty parties will be subject to **AT LEAST** failure of the course, up to and possibly including expulsion from the University. **DO NOT CHEAT**!!!

#1. A combined cycle power plant utilizes two thermal cycles to drive the prime mover(s). One Thermal Cycle is based on water/steam mixture where water is evaporated in the heat recovery steam generator. The other thermal cycle is based on air where the air is mixed with combustibles. What is the name of the thermal cycle that is based on air where the air is mixed with combustibles?

A. Carnot
B. Rankine
C. Brayton

Answer: c

#2. What are the 4 minimum steps to establish an electrically safe work condition?

A. ______________________________
B. ______________________________
C. ______________________________
D. ______________________________

Answer:

Isolate all sources of electrical energy
Apply Lockout / Tagout device
Verify absence of voltage
Ground phase conductors where possibility of induced voltage exists

#3. Given the following situation, determine the flash protection boundary in feet;

The activity is racking out a 3 phase, 13,800V line to line, power circuit breaker with doors open from an energized switchgear bus. The bolted fault level calculated on the switchgear bus is 12,000A and the clearing time of the next available upstream breaker is 6 cycles (0.1 seconds). Use the following equation for your calculation;

$$D_c = \left[2.65 \times MVA_{bf} \times t\right]^{1/2}$$

or

$$D_c = \left[53 \times MVA \times t\right]^{1/2}$$

where:

D_c = distance in feet from an arc source for a second-degree burn

MVA_{bf} = bolted fault capacity available at point involved (in mega volt-amps)

MVA = capacity rating of transformer (mega volt-amps). For transformers with MVA ratings below 0.75 MVA, multiply the transformer MVA rating by 1.25

t = time of arc exposure (in seconds)

A. 6.62 feet
B. 8.72 feet
C. 29.63 feet
D. 38.99 feet

Answer: B. 8.72 feet

MVAbf = 1.732 * 13,800V * 12,000A / 1,000,000

MVAbf = 286.8

D = [2.65 * 286.8 * 0.1] ^ 0.5

D = 8.72 feet

#4. Given that you will be performing voltage testing on a 480 vac breaker in a distribution panel with the panel cover removed exposing the breaker terminations, can you use the table 130.7(C)(9)(a) (listed below) to determine the hazard risk category? The calculated short circuit current available to the panel is 12,000 A, and the clearing time of the breaker upstream of the power panel is determined to be 15 cycles (0.25 seconds).

Table 130.7(C)(9)(a) ***Continued***

Task (Assumes Equipment Is Energized, and Work Is Done Within the Flash Protection Boundary)	Hazard/ Risk Category	V-rated Gloves	V-rated Tools
600 V Class Switchgear (with power circuit breakers or fused switches) — Notes 5 and 6			
CB or fused switch operation with enclosure doors closed	0	N	N
Reading a panel meter while operating a meter switch	0	N	N
CB or fused switch operation with enclosure doors open	1	N	N
Work on energized parts, including voltage testing	2*	Y	Y
Work on control circuits with energized parts 120 V or below, exposed	0	Y	Y
Work on control circuits with energized parts >120 V, exposed	2*	Y	Y
Insertion or removal (racking) of CBs from cubicles, doors open	3	N	N
Insertion or removal (racking) of CBs from cubicles, doors closed	2	N	N
Application of safety grounds, after voltage test	2*	Y	N
Removal of bolted covers (to expose bare, energized parts)	3	N	N
Opening hinged covers (to expose bare, energized parts)	2	N	N

General Notes (applicable to the entire table: **[ROP 360]**
(a) *Rubber Iinsulating Gloves* are gloves rated and tested for the maximum line-to-line voltage upon which work will be done. **[ROP 309, 331, 360]**
(b) *Insulated and Insulating Hand Tools* are tools rated and tested for the maximum line-to-line voltage upon which work will be done. **[ROP 331, 360]**
Insulated and Iinsulating Hhand Ttools are tools that are manufactured and tested in accordance with the ASTM F 1505 standard. **[ROP 358]**
(c) 2* designation — means that a arc flash suit hood, or alternatively a face shield used in combination with a balaclava (sock hood) is required for thi
task in addition to the other Hazard/Risk Category 2 requirements of Table 130.7(C)(10). These components shall have a minimum arc rating of 8 cal/c
[ROP 356, 360]
[ROP-406]
(d) Y = yes (required), N = no (not required) **[ROP 360]**
((e)) For systems rated less than 1000 volts, the fault currents and upstream protective device clearing times are based on an 18-inch working distance. **[ROP 360]**
((f)) For systems rated 1 kV and greater, the Hazard/Risk Ccategories are based on a 36-inch working distance. **[ROP 360]**
(g) For equipment protected by upstream current limiting fuses with arcing fault current in their current limiting range (1/2 cycle fault clearing time or less), the hazard/risk category required may be reduced by one number. **[ROP 322]**
Specific Notes (as referenced in the table): **[ROP 360]**
1. Maximum of 25 kA short circuit current available, and maximum of 0.03 second (2 cycle) fault clearing time. **[ROP 322]**
2. Maximum of 65 kA short circuit current available, and maximum of 0.03 second (2 cycle) fault clearing time. **[ROP 322]**
3. **[ROP 349]**
4. Maximum of 42 kA short circuit current available, and maximum of 0.33 second (20 cycle) fault clearing time. **[ROP 348]**
5. Maximum of 35 kA short circuit current available, and maximum of up to 0.5 second (30 cycle) fault clearing time. **[ROP 348]**
6. **[ROP 349]**

A. Yes
B. No

Answer: A. Yes. Reason is that bolted fault current level is 12KA and note 5 limits max bolted fault current for use of table at 35KA, with clearing time < 30 cycles (actual clear time is 15 cycles).

#5. Given the situation in problem 4 above, assuming you can use table 130.7(C)(9)(a) (listed below problem 4) to determine the hazard risk category, what is the hazard risk category assigned for the task described in problem 4?

A. Hazard Risk Category 0
B. Hazard Risk Category 1
C. Hazard Risk Category 2
D. Hazard Risk Category 3

Answer C. Hazard Risk Category 2

#6. Given the activity in problem #4 above (where panel voltage is 480Vac phase to phase), using table 130.2(C) (shown below), what is the limited approach boundary (assuming exposed FIXED circuit part)?

Table 130.2(C) Approach Boundaries to Live Parts for Shock Protection. (All dimensions are distance from live part to employee.)

(1)	(2) Limited Approach Boundary[1]	(3)	(4)	(5)
Nominal System Voltage Range, Phase to Phase	Exposed Movable Conductor	Exposed Fixed Circuit Part	Restricted Approach Boundary[1]; Includes Inadvertent Movement Adder	Prohibited Approach Boundary[1]
Less than 50	Not specified	Not specified	Not specified	Not specified
50 to 300	3.05 m (10 ft 0 in.)	1.07 m (3 ft 6 in.)	Avoid contact	Avoid contact
301 to 750	3.05 m (10 ft 0 in.)	1.07 m (3 ft 6 in.)	304.8 mm (1 ft 0 in.)	25.4 mm (0 ft 1 in.)
751 to 15 kV	3.05 m (10 ft 0 in.)	1.53 m (5 ft 0 in.)	660.4 mm (2 ft 2 in.)	177.8 mm (0 ft 7 in.)
15.1 kV to 36 kV	3.05 m (10 ft 0 in.)	1.83 m (6 ft 0 in.)	787.4 mm (2 ft 7 in.)	254 mm (0 ft 10 in.)
36.1 kV to 46 kV	3.05 m (10 ft 0 in.)	2.44 m (8 ft 0 in.)	838.2 mm (2 ft 9 in.)	431.8 mm (1 ft 5 in.)
46.1 kV to 72.5 kV	3.05 m (10 ft 0 in.)	2.44 m (8 ft 0 in.)	965.2 mm (3 ft 2 in.)	635 mm (2 ft 1 in.)
72.6 kV to 121 kV	3.25 m (10 ft 8 in.)	2.44 m (8 ft 0 in.)	991 mm (3 ft 3 in.)	812.8 mm (2 ft 8 in.)
138 kV to 145 kV	3.36 m (11 ft 0 in.)	3.05 m (10 ft 0 in.)	1.093 m (3 ft 7 in.)	939.8 mm (3 ft 1 in.)
161 kV to 169 kV	3.56 m (11 ft 8 in.)	3.56 m (11 ft 8 in.)	1.22 m (4 ft 0 in.)	1.07 m (3 ft 6 in.)
230 kV to 242 kV	3.97 m (13 ft 0 in.)	3.97 m (13 ft 0 in.)	1.6 m (5 ft 3 in.)	1.45 m (4 ft 9 in.)
345 kV to 362 kV	4.68 m (15 ft 4 in.)	4.68 m (15 ft 4 in.)	2.59 m (8 ft 6 in.)	2.44 m (8 ft 0 in.)
500 kV to 550 kV	5.8 m (19 ft 0 in.)	5.8 m (19 ft 0 in.)	3.43 m (11 ft 3 in.)	3.28 m (10 ft 9 in.)
765 kV to 800 kV	7.24 m (23 ft 9 in.)	7.24 m (23 ft 9 in.)	4.55 m (14 ft 11 in.)	4.4 m (14 ft 5 in.)

Note: For Flash Protection Boundary, see 130.3(A).
[1]See definition in Article 100 and text in 130.2(D)(2) and Annex C for elaboration.

Limited Approach Boundary___________________________

Answer:
Limited Approach Boundary = 3 Ft, 6 in.

#7. An area where combustible dusts can exist in atmosphere in an explosive mixture under normal operating conditions is an example of;

A. Class I, Division 1 location
B. Class I, Division 2 location
C. Class II, Division 1 location
D. Class II, Division 2 location
E. Class III, Division 1 location
F. Class III, Division 2 location

ANSWER: C

#8. Using the table below, for a situation where there is a 480V MCC assembly across from another 480V MCC assembly, where the doors to both MCC assemblies can be opened at the same time exposing live parts on both sides of the working space, what is the minimum working space required between the two MCC assemblies?

Table 400.15(A)(1) Working Spaces

Nominal Voltage to Ground	Minimum Clear Distance					
	Condition 1		Condition 2		Condition 3	
0–150	900 mm	(3 ft)	900 mm	(3 ft)	900 mm	(3 ft)
151–600	900 mm	(3 ft)	1 m	(3½ ft)	1.2 m	(4 ft)

Note: Where the conditions are as follows:

Condition 1 — Exposed live parts on one side and no live or grounded parts on the other side of the working space, or exposed live parts on both sides effectively guarded by suitable wood or other insulating materials. Insulated wire or insulated busbars operating at not over 300 volts to ground shall not be considered live parts.

Condition 2 — Exposed live parts on one side and grounded parts on the other side. Concrete, brick, or tile walls shall be considered as grounded surfaces.

Condition 3 — Exposed live parts on both sides of the work space (not guarded as provided in Condition 1) with the operator between.

A. 3 feet
B. 3 ½ feet
C. 4 feet

ANSWER: C

#9. The theoretical maximum efficiency of a steam cycle is given by the equation:
$Eff_{thmax} = (1 - T_{out}/T_{in}) * 100\%$,
where T_{out} is the **absolute temperature** for heat rejection and T_{in} is the **absolute temperature** for heat addition. (Fahrenheit temperature is converted to absolute temperature by adding 460 ^{o}F)
A power plant is operating with a stable HP inlet steam pressure of 680 psia and steam temperature of 500 ^{o}F. The condenser pressure is 1 psia and condensate temperature is 100 ^{o}F.

What is the approximate theoretical maximum steam cycle efficiency this plant can achieve?

A. 35%
B. 42%
C. 57%
D. 80%

ANSWER: B.

$Eff_{thmax} = (1 – [100 + 460]/[500 + 460]) * 100\%$

$Eff_{thmax} = 41.7\%$

#10. A liquid is in a saturated condition with 50% quality. Assuming pressure remains constant, the addition of a small amount of heat will...
A. raise the liquid temperature above the saturation (boiling) point.
B. result in a subcooled liquid.
C. result in vaporization of some of the liquid and increase in steam quality of mixture.
D. result in superheated steam.

ANSWER: C.

Temp Fahr t	Abs Press. Lb per Sq In. p	Specific Volume Sat. Liquid v_f	Evap v_{fg}	Sat. Vapor v_g	Enthalpy Sat. Liquid h_f	Evap h_{fg}	Sat. Vapor h_g
460.0	466.87	0.01961	0.97463	0.99424	441.5	763.2	1204.8
464.0	485.56	0.01969	0.93588	0.95557	446.1	758.6	1204.7
468.0	504.83	0.01976	0.89885	0.91862	450.7	754.0	1204.6
472.0	524.67	0.01984	0.86345	0.88329	455.2	749.3	1204.5
476.0	545.11	0.01992	0.82958	0.84950	459.9	744.5	1204.3
480.0	566.15	0.02000	0.79716	0.81717	464.5	739.6	1204.1
484.0	587.81	0.02009	0.76613	0.78622	469.1	734.7	1203.8
488.0	610.10	0.02017	0.73641	0.75658	473.8	729.7	1203.5
492.0	633.03	0.02026	0.70794	0.72820	478.5	724.6	1203.1
496.0	656.61	0.02034	0.68065	0.70100	483.2	719.5	1202.7

#11. Given the steam table data above, what is the enthalpy of a steam / water mixture that is 50% steam quality, given that the steam-water mixture is at 480 ^oF?

A. 464.5 BTU/lbm
B. 739.6 BTU/lbm
C. 834.3 BTU/lbm
D. 1204.1 BTU/lbm

ANSWER: C.

H = Hf + Hfg * (%quality) = 464.5 + 739.6 * 0.5

H = 834.3 BTU/lbm

Abs Press. Lb/Sq In. (Sat. Temp)		Sat. Water	Sat. Steam	Temperature — Degrees Fahrenheit 550	600	650	700	750	800
	Sh			11.61	61.61	111.61	161.61	211.61	261.61
950	v	0.02141	0.4721	0.4883	0.5485	0.5993	0.6449	0.6871	0.7272
(538.39)	h	534.74	1194.7	1207.6	1255.1	1294.4	1329.3	1361.5	1392.0
	s	0.7358	1.3970	1.4098	1.4557	1.4921	1.5228	1.5500	1.5748
	Sh			5.42	55.42	105.42	155.42	205.42	255.42
1000	v	0.02159	0.4460	0.4535	0.5137	0.5636	0.6080	0.6489	0.6875
(544.58)	h	542.55	1192.9	1199.3	1249.3	1290.1	1325.9	1358.7	1389.6
	s	0.7434	1.3910	1.3973	1.4457	1.4833	1.5149	1.5426	1.5677

#12. Given the superheat steam table data above, if steam pressure is 950 psia and temperature of the superheat is 800 ^{o}F, what is the approximate amount of **superheat**?

A. 261. ^{o}F
B. 538.4 ^{o}F
C. 800 ^{o}F
D. 900^{o}F

ANSWER: A.

Temp Fahr t	Abs Press. Lb per Sq In. p	Specific Volume Sat. Liquid v_f	Evap v_{fg}	Sat. Vapor v_g	Enthalpy Sat. Liquid h_f	Evap h_{fg}	Sat. Vapor h_g
460.0	466.87	0.01961	0.97463	0.99424	441.5	763.2	1204.8
464.0	485.56	0.01969	0.93588	0.95557	446.1	758.6	1204.7
468.0	504.83	0.01976	0.89885	0.91862	450.7	754.0	1204.6
472.0	524.67	0.01984	0.86345	0.88329	455.2	749.3	1204.5
476.0	545.11	0.01992	0.82958	0.84950	459.9	744.5	1204.3
480.0	566.15	0.02000	0.79716	0.81717	464.5	739.6	1204.1
484.0	587.81	0.02009	0.76613	0.78622	469.1	734.7	1203.8
488.0	610.10	0.02017	0.73641	0.75658	473.8	729.7	1203.5
492.0	633.03	0.02026	0.70794	0.72820	478.5	724.6	1203.1
496.0	656.61	0.02034	0.68065	0.70100	483.2	719.5	1202.7

#13. Using the steam table shown above, which one of the following is the approximate amount of heat required to convert 100 lbm of water at 480 ^{o}F and 566.15 psia to a saturated vapor at 566.15 psia?

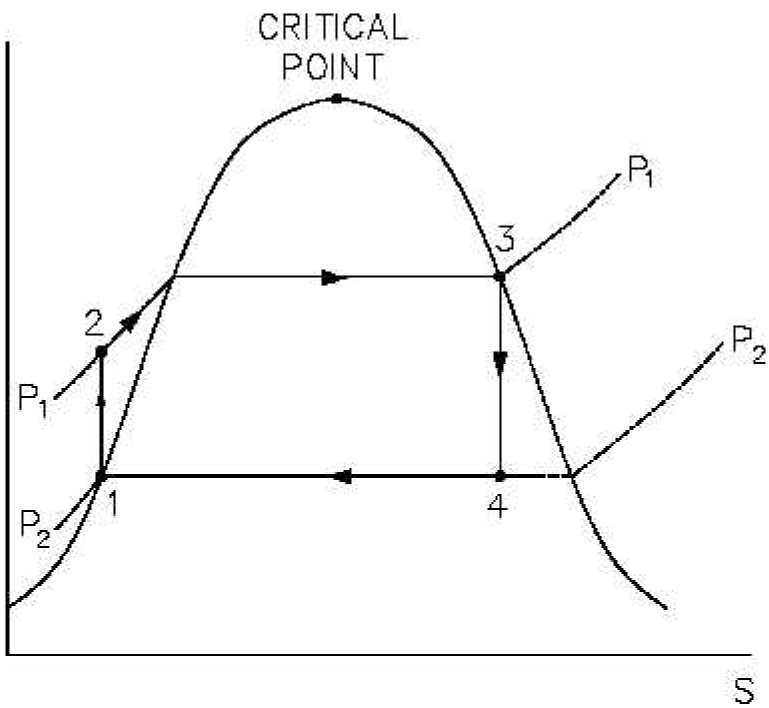
A. 739.6 Btu
B. 7,396 Btu
C. 73,960 Btu
D. 739,600 Btu

ANSWER: C.

Energy = Hvf * mass = 739.6 BTU/lbm * 100 lbm

Energy = 73,960 Btu

#14. In the basic steam thermal heat cycle there are 4 processes, compression, expansion, evaporation, and condensation. Referring to the diagram shown below, which line presents the evaporation process of the basic steam cycle?



A. Line 1 -2.
B. Line 2 -3.
C. Line 3 -4.
D. Line 4 -1.

ANSWER: B.

#15. The law that states that energy is neither created nor destroyed, only altered in form is;

A. The first law of thermodynamics
B. The second law of thermodynamics

Answer: A.

#16. Using the following equation;

Air HP = [V * H] / 6356

given that the needed volume of a fan application is 50,000 CFM and the pressure difference across the fan is 25 inches of water, the **air HP** of the fan is (note this equation assumes compressibility factor of 1.0 and 100 efficiency);

A. 123 Air HP
B. 197 Air HP
C. 215 Air HP
D. 247 Air HP

Answer B.

Air HP = [V * H] / 6356

Air HP = [50,000 CFM * 25 " H_2O] / 6356

Air HP = 196.7 HP

#17. To achieve maximum overall nuclear power plant thermal efficiency, feed water should enter the steam generator (S/G) _____________ and the pressure difference between the S/G and the condenser should be as _____________ as possible.
A. as subcooled as practical; great
B. as subcooled as practical; small
C. close to saturation; great
D. close to saturation; small

ANSWER: C.

#18. Establishing natural circulation requires that a heat sink be ____________ in elevation than a heat source and that a ____________ difference exist between the heat sink and heat source.
A. lower; pressure
B. lower; temperature
C. higher; pressure
D. higher; temperature

Answer: D

#19. For a reactor operating in a “sub critical” state, the reactivity (p) is ______________ and the neutron multiplication factor (k) is _____________

A. p > 1 , k > 0
B. p < 0 , k < 1
C. p = 0 , k = 1
D. p = 1 , k = 0

Answer: B

#20. In a nuclear reactor, the primary purpose of the “Coolant” is;

A. Primary heat extraction
B. Pressure regulation
C. Slow neutrons produced by fission
D. Shielding

Answer: A

#21. What is the annual maximum permissible occupational radiation exposure for a worker in rem;

A. 1 rem
B. 5 rem
C. 10 rem
D. 15 rem

Answer B

Typical annual exposure levels in millirem:
5 statutory limit on radiation from operating a nuclear power plant
25 internal exposure from radioactive material ingested into the body
45 cosmic rays
75 diagnostic medical exposure (x-rays)
60 external radiation from radioactive ores, etc
120 natural radiation sources (combined)
200 average total exposure in the U.S.
500 average occupational dose for radiologists
1250 natural exposure in mountainous regions of Brazil
5000 maximum permissible occupational exposure (5 rem)
Consequences of radiation exposure in rem (not millirem!)

rem	Effect
0-25	No observable effect
25-100	Slight blood changes
100-200	Significant temporary reduction in blood platelets and white blood cells
200-500	Severe blood damage, nausea, hair loss, hemorrhage, death in many cases
>600	Death in less than two months for over 80% of people

#22. Given the formula for Hydroturbine power below, What is the power developed (in HP) by a hydroturbine if the net head of water is 100 feet, turbine discharge flow is 500 ft3/s, and turbine efficiency is 0.75?

P = (H * Q * n) / 8.81

Where Turbine output (HP)
H = net head (ft)
Q = turbine discharge (ft3/s)
N = turbine efficiency

A. 4,257 HP
B. 5,675 HP
C. 37,500 HP
D. 50,000 HP

ANSWER: A

P = (H * Q * n) / 8.81

= (100 ft) * (500 ft3/s) * (0.75) / 8.81

= 4257 HP

23. Using the table shown below; If the power developed by a turbine with a head of 100 feet is 10,000 HP and the head is increased to 125 feet, what is the new HP developed by the hydroturbine?

TABLE 3.5.1 Proportionality Laws*

Constant head	Constant runner and diameter	Variable runner, diameter, and head
$P \propto D^2$	$P \propto H^{3/2}$	$P \propto D^2 H^{3/2}$
$n \propto \frac{1}{D}$	$n \propto H^{1/2}$	$n \propto \frac{H^{1/2}}{D}$
$Q \propto D^2$	$Q \propto H^{1/2}$	$Q \propto D^2 H^{1/2}$

*P = turbine output, hp (kW)
D = runner discharge diameter, ft (m)
n = turbine rotating speed, rpm
Q = turbine discharge, ft³/s (m³/s)
H = net head, ft (m)

A. 4,400 HP
B. 7,155 HP
C. 13,975 HP
D. 20,000 HP

ANSWER C:

(P1/P2) = (H1/H2) 3/2 Solving for P2

P2 = P1 * (H1/H2) -3/2

P2 = P1 * (H2/H1) 3/2

P2 = 10,000 HP * (125ft/100ft) 3/2

= 13,975 HP

#24. What is the speed of a synchronous 8 pole generator operating at 60 Hz?

A. 3600 RPM
B. 1800 RPM
C. 1200 RPM
D. 900 RPM

ANSWER D.

f = n * p / 120
or
n = f * 120 / p

n = 60 * 120 / 8

n = 900

#25. For a synchronous generator, real power delivered into the transmission system is controlled by the _____________ between generator voltage and transmission system voltage, and reactive power is controlled by the _____________ between generator voltage and transmission system voltage.

A. phase angle, voltage magnitude
B. voltage magnitude, phase angle

Answer: A

BONUS QUESTION:

Suppose you are given four radioactive cookies -- one an alpha emitter cookie, one a beta emitter cookie, one a gamma emitter cookie, and one neutron emitter cookie. You must eat one, hold one in your hand, put one in your pocket, and give the last one you throw away.

Which cookie do you eat, which cookie do you hold in your hand, which cookie do you put in your pocket and which cookie do you throw away to minimize your radiation exposure?

Eat the _______________ Cookie

Hold the ________________ Cookie in your hand
Put the ________________ Cookie in your pocket
Throw away the ________________ Cookie

ANSWER: eat the gamma; hold the alpha in your hand; put the beta in your pocket; throw away the neutron cookie.

REASONING:
For a given total energy of ionizing radiation, alpha radiation is more damaging than beta radiation which is more damaging than gamma rays. However, alpha radiation has a shorter wavelength than beta and beta radiation has a shorter wavelength than gamma.

If Radiation Were Cookies...
...which one would you eat?

So if you had four cookies, and you could eat one, put one in your pocket, hold one in your hand, and throw the other away, what would you do?

This problem is used to help people understand the effects of different kinds of radiation. This has largely to do with each type of radiation's **dose factor**.

Gamma cookie: You would eat this one, because it doesn't cause much somatic damage.

Beta cookie: Your pocket is the choice for this one, as it will be shielded by one layer of clothing.

Alpha cookie: Hold this one in your hand, because it will be blocked by your first layer of skin.

Neutron cookie: Throw this sucker away.

The dose factor has to do with the size of the particle (photons have no mass, at least while at rest), its state of charge (an alpha particle is +2), and its penetration distance.

http://www.everything2.com/index.pl?node_id=45824

1 - C
2 - Isolate all sources of electrical energy
Apply Lockout / Tagout device
Verify absence of voltage
Ground phase conductors where possibility of induced voltage exists
3 – B
4 – A
5 – C
6 - Limited Approach Boundary = 3 Ft, 6 in.
7 - C
8 - C
9 – B
10 – C
11 – C
12 – A
13 – C
14 - B
15 - A
16 - B
17 – C
18 - D
19 - B
20 - A
21 – B
22 - A
23 - C
24 - D
25 - A
BONUS
ANSWER:
eat the gamma;
hold the alpha in your hand;
put the beta in your pocket;
throw away the neutron cookie.