

last name

first name

signature

1											18						
1 H 1.008	2										2 He 4.003						
3 Li 6.941	4 Be 9.012											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.31											13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.87	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.38	31 Ga 69.72	32 Ge 72.64	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.76	52 Te 127.60	53 I 126.90	54 Xe 131.29
55 Cs 132.91	56 Ba 137.33	57 La 138.91	72 Hf 178.49	73 Ta 180.95	74 W 183.84	75 Re 186.21	76 Os 190.23	77 Ir 192.22	78 Pt 195.08	79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.20	83 Bi 208.98	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	89 Ac (227)	104 Rf (267)	105 Db (268)	106 Sg (269)	107 Bh (270)	108 Hs (270)	109 Mt (278)	110 Ds (281)	111 Rg (282)	112 Cn (285)	113 Nh (286)	114 Fl (289)	115 Mc (290)	116 Lv (293)	117 Ts (294)	118 Og (294)

58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm (145)	62 Sm 150.36	63 Eu 151.96	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04	71 Lu 174.97
90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (266)

constants

$R = 0.08206 \text{ L atm/mol K}$

$R = 8.314 \text{ J/mol K}$

$N_A = 6.022 \times 10^{23} / \text{mol}$

$h = 6.626 \times 10^{-34} \text{ J}\cdot\text{s}$

$c = 3.00 \times 10^8 \text{ m/s}$

$g = 9.81 \text{ m/s}^2$

conversions

$1 \text{ atm} = 760 \text{ torr}$

$1 \text{ atm} = 101325 \text{ Pa}$

$1 \text{ atm} = 1.01325 \text{ bar}$

$1 \text{ bar} = 10^5 \text{ Pa}$

$^{\circ}\text{F} = ^{\circ}\text{C}(1.8) + 32$

$\text{K} = ^{\circ}\text{C} + 273.15$

conversions

$1 \text{ in} = 2.54 \text{ cm}$

$1 \text{ ft} = 12 \text{ in}$

$1 \text{ yd} = 3 \text{ ft}$

$1 \text{ mi} = 5280 \text{ ft}$

$1 \text{ lb} = 453.6 \text{ g}$

$1 \text{ ton} = 2000 \text{ lbs}$

$1 \text{ tonne} = 1000 \text{ kg}$

$1 \text{ gal} = 3.785 \text{ L}$

$1 \text{ gal} = 231 \text{ in}^3$

$1 \text{ gal} = 128 \text{ fl oz}$

$1 \text{ fl oz} = 29.57 \text{ mL}$

water data

$C_{s,\text{ice}} = 2.09 \text{ J/g } ^{\circ}\text{C}$

$C_{s,\text{water}} = 4.184 \text{ J/g } ^{\circ}\text{C}$

$C_{s,\text{steam}} = 2.03 \text{ J/g } ^{\circ}\text{C}$

$\rho_{\text{water}} = 1.00 \text{ g/mL}$

$\rho_{\text{ice}} = 0.9167 \text{ g/mL}$

$\rho_{\text{seawater}} = 1.024 \text{ g/mL}$

$\Delta H_{\text{fus}} = 334 \text{ J/g}$

$\Delta H_{\text{vap}} = 2260 \text{ J/g}$

$K_w = 1.0 \times 10^{-14}$

density of ethanol

$\rho = 0.789 \text{ g/mL}$

This exam should have exactly 20 questions. Each question is equally weighted at 5 points each. Bubble in your answer choices on the online bubbleseet provided. Your score is based on what you bubble on the bubblesheet and not what is circled on the exam.

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1. Why might single, high-dose oral B-vitamin supplements be less effective than smaller, frequent doses?

- a. The body cannot effectively store water soluble vitamins, so excess is simply digested for energy.
- b. Excess fat soluble vitamins like Vitamin B will quickly be excreted in urine.
- c. The body cannot effectively store water soluble vitamins, so excess is quickly excreted in urine.
- d. The body stores water soluble B vitamins very efficiently, making high doses potentially very dangerous.

**Explanation:** B vitamins are a family of water soluble vitamins, which are not easily stored in body tissues.

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2. What is the scientific (true) definition of the boiling point of a liquid?

- a. The temperature when bubbles first form in a liquid.
- b. The temperature at which the vapor pressure of the liquid equals the applied pressure.
- c. The temperature where water becomes less viscous.
- d. The temperature when a liquid first starts to evaporate.

**Explanation:** boiling occurs once the vapor pressure equals the applied pressure

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3. Which amino acid has a basic side chain?

- a. valine
- b. glutamine
- c. glutamate
- d. lysine
- e. leucine

**Explanation:** Lysine has a basic side chain.

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4. Which of the following was a common complaint to the FDA about products made with Olestra?

- a. gastrointestinal distress
- b. high fever
- c. sever head aches
- d. numbness in arms and legs
- e. hallucinations

**Explanation:** Although there were many colorful descriptions of the condition - gastrointestinal distress pretty much covers all them. None of the other symptoms listed were a complaint.

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5. Select the set of true statements.

- I. *trans*-fats are the good kind of fat in your diet
  - II. Starch is the main form of glucose storage for humans
  - III. Cellulose does not contribute significant calories to our diet
  - IV. Micro-minerals are typically taken in 10-100 mg doses
- a. II only
  - b. I, III, and IV
  - c. I and III
  - d. II and IV
  - e. III and IV

**Explanation:** III and IV are true statements.

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6. Last unit we studied polymers. Nylon is a common plastic/material that is a polyamide. Which one of the following compounds from our current unit (food and nutrition) is also a polyamide?

- a. proteins
- b. Olestra
- c. starch
- d. triglycerides
- e. cellulose

**Explanation:** Proteins are long chain polyamides - although we call them polypeptides.

7. Triglycerides are to glycerol as Olestra is to \_\_\_\_\_ .

- a. lysine
- b. sucrose
- c. glycerine
- d. lactose
- e. phenol

**Explanation:** Olestra is made by joining fatty acids to sucrose, the same way that triglycerides are made by joining fatty acids to glycerol.

8. Carl loves simplicity and decides that all his dietary needs can be had by taking a single multivitamin every day (and that is all he takes). If Carl continues this on this dietary path, he will no doubt end up \_\_\_\_\_ .

- a. undernourished
- b. healthier and stronger
- c. malnourished

**Explanation:** A vitamin provides NO macronutrients which you must have in order to have proper nutrition. One who is undernourished lacks the correct number of calories.

9. How many Calories are in 11 grams of protein powder?

- a.  $4.4 \times 10^4$  Cal
- b.  $9.9 \times 10^4$  Cal
- c. 44 Cal
- d. 77 Cal
- e. 99 Cal

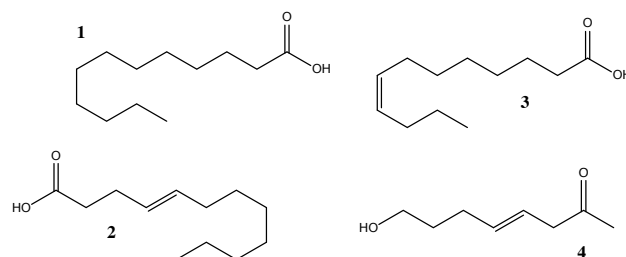
**Explanation:** Each gram of protein contributes 4 Cal, or 4 kcal of energy.  $11 \times 4 = 44$  Calories.

10. Which of the following amino acids will have a net negative charge in the body?

- a. leucine
- b. lysine
- c. glutamine
- d. valine
- e. glutamate

**Explanation:** Glutamate is our example of an acidic amino acid, which means it will have a net negative charge.

11. Identify the cis fatty acid.



- a. 2
- b. 3
- c. 4
- d. 1

**Explanation:** Molecule 2 is a trans fatty acid. Molecule 1 is a fully saturated fatty acid. Molecule 3 is a cis fatty acid. Molecule 4 has a trans functionality but is not a fatty acid.

12. Susan is staying on a new diet and aiming for 1820 calories a day. She looked at the breakdown of her macronutrients by mass (grams) and determined that her percentages are 50% carbs, 30% fat and 20% protein. Where are the majority of Susan's calories coming from?

- a. carbohydrates
- b. proteins
- c. fats

**Explanation:** For every 100 grams, Susan is eating 200 Calories carbs, 270 Calories of fat, and 80 Calories protein. Her calorie intake is 49% fat calories.

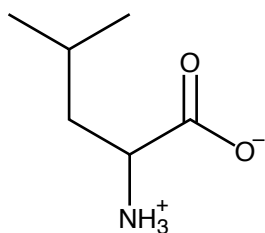
13. When an oil is hydrogenated, it results in \_\_\_\_\_ carbon-carbon double bonds and the melting point \_\_\_\_\_.

- a. more ; lowers
- b. more ; increases
- c. less ; lowers
- d. less ; increases

**Explanation:** The hydrogen ADDS across the double bonds thus making them single bonds and saturated with H, therefore LESS double bonds. This also means the melting point is higher and the compound is closer to becoming a fat instead of an oil.

14. Which amino acid is pictured below?

- a. alanine
- b. glutamate
- c. valine
- d. leucine
- e. lysine



**Explanation:** This amino acid is leucine.

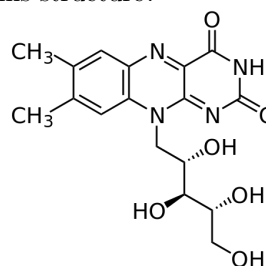
15. Charlie loves Doritos and has decided to only eat Doritos for his diet. A party size bag is 14.5 oz and will supply just over 2000 calories. So yeah, Charlie will eat a whole bag everyday for all his nutritional needs. What is the ultimate outcome of Charlie's choice of diet here?

- a. This diet will lead to him being dehydrated.
- b. He is going to become very malnourished in time.
- c. He is definitely undernourished on this diet.
- d. He will have found the perfect diet for himself.

**Explanation:** There are too many micronutrients (vitamins and minerals) that Charlie will not have which means he'll be malnourished. There are plenty of calories there, so he will not be undernourished.

16. Wow. That is a pretty big micronutrient. Which of the choices given below is the only possible (logical) choice that fits this structure?

- a. vitamin B<sub>2</sub>
- b. protein
- c. calcium
- d. vitamin A
- e. vitamin K



**Explanation:** There are numerous polar sights on the molecule - especially hydroxyl groups. This means it is very polar and therefore water-soluble. The only micronutrient listed that is water soluble is vitamin B<sub>2</sub> (aka: riboflavin), one of the many B-vitamins.

17. Which characteristic is fundamental to all triglycerides?

- a. a primary amine
- b. a carboxylic acid
- c. a *cis*-double bond
- d. ester bonds
- e. a *trans*-double bond

**Explanation:** Triglycerides have three ester bonds.

18. Based on your understanding of macronutrients, why does it make sense why fat is so difficult for people to lose?

- a. Fat produces the fewest Calories, so the body prefers to burn other fuel sources first
- b. Fats store glucose, so the body prioritizes burning other fuel sources first
- c. Fats are the most energy dense form of nutrition, so the body prioritizes burning other fuel sources first
- d. Fats are essential to building proteins

**Explanation:** Fats are the most energy dense form of nutrition, so the body prioritizes burning other fuel sources first

19. The following nutritional information is given for one serving of a tasty snack treat. The bag says that it contains 3 servings. Larry decides to eat the entire bag instead of one serving. How many calories is Larry getting from this indulgence?

One Serving	60 g
Carbohydrate	36 g
Fat	18 g
Protein	6 g

- a. 990
- b. 1060
- c. 330
- d. 440
- e. 875

**Explanation:**  $(36 \times 4) + (18 \times 9) + (6 \times 4)$   
 $= 330 \text{ Cal/serving.}$

Three servings (bag) =  $(330 \times 3) = 990 \text{ Cal}$

20. If you do multiple distillations of an ethanol/water mixture, what is the highest percentage of ethanol that you can achieve?

- a. 95%
- b. 100
- c. 98%
- d. 75
- e. 40%

**Explanation:** ethanol and water form an azeotrope at 95

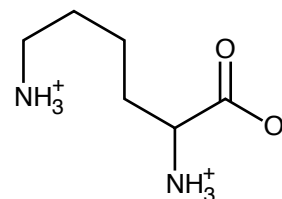
21. Hannah bought some cask strength Maker's Mark whisky. It is labeled as having 54.9% ABV. She pours herself a rather generous 2.5 oz. How many grams of ethanol are in Hannah's generous pour? (front page has needed conversions)

- a. 19.6 g
- b. 40.6 g
- c. 28.4 g
- d. 32.0 g
- e. 14.0 g

**Explanation:**  $2.5 \text{ oz} \left( \frac{54.9}{100} \right) \left( \frac{29.57 \text{ mL/oz}}{0.789 \text{ g/mL}} \right) = 32.0 \text{ g of ethanol}$

22. Which amino acid is pictured below?

- a. valine
- b. leucine
- c. glutamate
- d. alanine
- e. lysine



**Explanation:** This amino acid is lysine.

23. Which of the following best describes why a *cis*-unsaturated fatty acid appears less viscous than a *trans*-unsaturated fatty acid?

- a. A *cis*-unsaturated fatty acid has permanent kinks in its structure, resulting in higher overall dispersion forces
- b. A *cis*-unsaturated fatty acid has permanent kinks in its structure, resulting in lower overall dispersion forces
- c. A *cis*-unsaturated fatty acid has a more linear structure, resulting in lower overall dispersion forces
- d. A *cis*-unsaturated fatty acid has a more linear structure, resulting in higher overall dispersion forces

**Explanation:** A *cis*-unsaturated fatty acid has permanent kinks in its structure, resulting in lower overall dispersion forces. The more linear the structure, the higher the overall dispersion forces are. This resulting in a thicker (more viscous) substance that is more likely to be unhealthy.

24. Which one of the following is a monosaccharide?

- a. sucrose
- b. starch
- c. cellulose
- d. fructose
- e. glycogen
- f. lactose

**Explanation:** Fructose is the only monosaccharide listed.

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25. Liquid P and Liquid Q are mixed in equal molar amounts which is 50/50 as they say. The mixture is then distilled. We know that the vapor pressure of Liquid Q is considerable higher than the vapor pressure of Liquid P. So which statement best describes the collected distillate (what is being collected)?

- a. The distillate will have a lot more Q in it than P.
- b. The distillate will have the same amounts of P and Q.
- c. The distillate will be close to 100% P.
- d. The distillate will have a lot more P in it than Q.

**Explanation:** According to Raoult's Law, the vapor phase will have much more Q than P due to the fact that the vapor pressure is much higher.

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After you are finished and have all your answers circled, go to the front of the room and then use the QR code show below to pull up the virtual answer page for your exam. Enter the appropriate info plus all your answers - click the SUBMIT button. Double check your choices on the next page. Once your are sure, click the submit button on that page to enter your answers. Make sure you get the confirmation screen (different background color!) and show it to the TA or proctor. After that, turn in your exam and scratch paper. You're free to leave after that.



<https://mccord.cm.utexas.edu/zinc>