

last name

first name

signature

1 1 H 1.008																	18 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	3	4	5	6	7	8	9	10	11	12	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 bubble sheet provided. Your score is based on what you bubble on the bubble sheet and not what is circled on the exam.

1. Which amino acid has a basic side chain?

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

Explanation: Lysine has a basic side chain.

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

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

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

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

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

Explanation: ethanol and water form an azeotrope at 95

4. 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. 440
- b. 875
- c. 990
- d. 1060
- e. 330

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

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

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

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

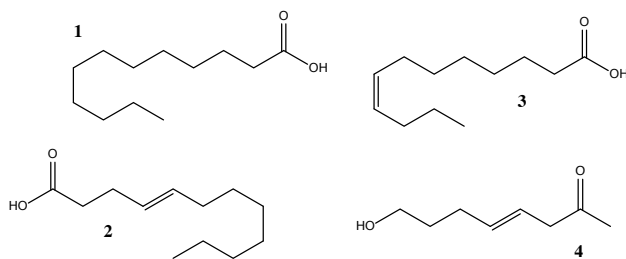
Explanation: Each gram of protein contributes 4 Cal, or 4 kcal of energy. $11 \times 4 = 44$ Calories.

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

7. 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.

8. Which one of the following is a monosaccharide?

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

Explanation: Fructose is the only monosaccharide listed.

9. 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. 14.0 g
- b. 40.6 g
- c. 19.6 g
- d. 28.4 g
- e. 32.0 g

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

10. 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.

11. 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. healthier and stronger
- b. undernourished
- 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.

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

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

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.

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

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

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

14. 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.

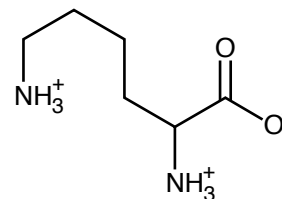
15. Liquid P and Liquid Q are mixed in equal molar amounts which is 50/50 as they say. The mixture is then distilled. We know that the vapor pressure of Liquid Q is considerable higher than the vapor pressure of Liquid P. So which statement best describes the collected distillate (what is being collected)?

- a. The distillate will have a lot more P in it than Q.
- 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 Q in it than P.

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.

16. Which amino acid is pictured below?

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



Explanation: This amino acid is lysine.

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

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

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

18. Which characteristic is fundamental to all triglycerides?

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

Explanation: Triglycerides have three ester bonds.

19. 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 will have found the perfect diet for himself.
- c. He is going to become very malnourished in time.
- d. He is definitely undernourished on this diet.

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.

20. Select the set of true statements.

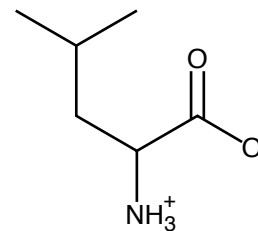
- I. *trans*-fats are the good kind of fat in your diet
- II. Starch is the main form of glucose storage for humans
- III. Cellulose does not contribute significant calories to our diet
- IV. Micro-minerals are typically taken in 10-100 mg doses

- a. I, III, and IV
- b. I and III
- c. III and IV
- d. II only
- e. II and IV

Explanation: III and IV are true statements.

21. Which amino acid is pictured below?

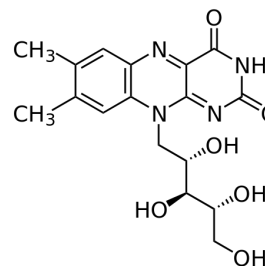
- a. lysine
- b. leucine
- c. glutamate
- d. alanine
- e. valine



Explanation: This amino acid is leucine.

22. 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 B₂
- b. vitamin K
- c. protein
- d. vitamin A
- e. calcium



Explanation: There are numerous polar sites 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 B₂ (aka: riboflavin), one of the many B-vitamins.

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

- a. Fats are essential to building proteins
- b. Fat produces the fewest Calories, so the body prefers to burn 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 store glucose, so the body prioritizes burning other fuel sources first

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

24. Triglycerides are to glycerol
as Olestra is to _____ .

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

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

25. When an oil is hydrogenated, it results in _____ carbon-carbon double bonds and the melting point _____ .

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

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 you 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.



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