

STUDENT NAME: _____

STUDENT ID NUMBER: _____

- This exam has 41 multiple choice questions worth 1 mark each.
- The exam period **will terminate at 12:50pm** at the latest.
- When you finish, **please give both your scantron sheet and question booklet to a TA.**

PLEASE READ the following instructions carefully:

1. Please use a pencil to fill out your answer sheet.
2. Enter your **name, student ID number, and E-mail address** on the Test-Scoring Answer Sheet.
3. **Please read each question carefully.** You must choose one of the given choices for each question. Record your answer on the Test-Scoring Answer Sheet.
4. All answers **MUST** be recorded on the computer card. Note that your computer card answer is the only answer that will be considered in the determination of your grade.

Good luck!

Table 8.3 Thermal Equivalent of O₂ and CO₂ for Nonprotein RQ

Nonprotein RQ	Caloric Value 1 L O ₂	Caloric Value 1 L CO ₂	Source of Calories	
			Carbohydrate (%)	Fat (%)
0.707	4.686	6.629	0	100
0.71	4.690	6.606	1.10	98.9
0.72	4.702	6.531	4.76	95.2
0.73	4.714	6.458	8.40	91.6
0.74	4.727	6.388	12.0	88.0
0.75	4.739	6.319	15.6	84.4
0.76	4.751	6.253	19.2	80.8
0.77	4.764	6.187	22.8	77.2
0.78	4.776	6.123	26.3	73.7
0.79	4.788	6.062	29.9	70.1
0.80	4.801	6.001	33.4	66.6
0.81	4.813	5.942	36.9	63.1
0.82	4.825	5.884	40.3	59.7
0.83	4.838	5.829	43.8	56.2
0.84	4.850	5.774	47.2	52.8
0.85	4.862	5.721	50.7	49.3
0.86	4.875	5.669	54.1	45.9
0.87	4.887	5.617	57.5	42.5
0.88	4.899	5.568	60.8	39.2
0.89	4.911	5.519	64.2	35.8
0.90	4.924	5.471	67.5	32.5
0.91	4.936	5.424	70.8	29.2
0.92	4.948	5.378	74.1	25.9
0.93	4.961	5.333	77.4	22.6
0.94	4.973	5.290	80.7	19.3
0.95	4.985	5.247	84.0	16.0
0.96	4.998	5.205	87.2	12.8
0.97	5.010	5.165	90.4	9.58
0.98	5.022	5.124	93.6	6.37
0.99	5.035	5.085	96.8	3.18
1.00	5.047	5.047	100	0

Source: Adapted from McArdle, W.D., Katch, F.I., Katch, V.L., *Exercise Physiology*, 2nd ed., p. 127 (Philadelphia: Lea & Febiger, 1986).

1. Which of the following statements is incorrect with regards to energy partitioning from foods?
 - a. Metabolizable energy is the total energy released from the complete oxidation of a food sample.
 - b. Determining digestible energy is especially important for ruminants.
 - c. The heat increment of feeding corresponds to the energy required for the digestion, absorption, and transport of nutrients.
 - d. Thermoregulation is a minimal component of energy expenditure.

2. Jane Doe goes to see her doctor complaining of dermatitis (flaky and itchy skin). The doctor performs a nutritional assessment and suspects that she is deficient in which of the following fatty acids:
 - a. Linoleic acid.
 - b. Butyric acid.
 - c. Alpha-linolenic acid.
 - d. Oleic acid.

3. Jamie is participating in a study in which her basal metabolic rate (BMR) is calculated each morning on three different days using a standardized protocol. On the first study visit, her BMR was determined to be about 1850 kcal/d. On the second study visit, her BMR was determined to be about 1850 kcal/d. On the third study visit, her BMR was determined to be about 1950 kcal/d. The researchers conducting the study suspected which of the following to be the most likely explanation for the increased BMR on day 3.
 - a. Jamie was lying down during the experiment.
 - b. Jamie was completely relaxed.
 - c. Jamie's BMR was measured in the morning on the 3rd visit.
 - d. Jamie had a large breakfast before her study visit.

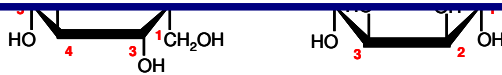
4. Eicosanoids act as important signalling molecules. Which of the following statements is the most correct?
 - a. Phospholipase A2 cleaves 20-carbon fatty acids from the sn-2 position of the phospholipid backbone.
 - b. The lipoxygenase pathway is also known as the linear pathway.
 - c. Eicosanoids are produced by most cells in the body and are considered to be "hormone-like".
 - d. Only A and B are correct.
 - e. A, B, and C are all correct.

5. The Krebs's cycle is an important pathway for the production of cellular energy. Which of the following statements is the most correct?
 - a. Amino acids derived from the breakdown of protein can be transformed into pyruvate and used to generate energy during times of starvation.
 - b. When the cell has sufficient energy, acetyl-CoA is converted back into pyruvate in order to regenerate glucose and create glycogen stores.
 - c. High levels of oxaloacetate can feedback and inhibit pyruvate carboxylase.
 - d. A and C are correct.
 - e. A, B, and C are all correct.

6. Which of the following Haworth structures corresponds to the beta isoform of this monosaccharide (note that hydrogen atoms are not shown in order to improve figure clarity)?



NO CORRECT ANSWER!
EVERYONE GOT A MARK HERE.



Use the following Table to answer questions 7 and 8:

FRACTION	DIET 1		DIET 2	
	INTAKE	EXCRETION	INTAKE	EXCRETION
Protein	20%	7%	30%	15%
Fat	25%	19%	0%	3%
CHO	50%	30%	65%	35%
Fibre	4%	39%	4%	39%
Silica	1%	5%	1%	8%

7. The nitrogen-free extract obtained from the proximate analysis corresponds to which fraction in the above table?
- Fat
 - CHO
 - Fibre
 - Silica
8. Farmer Jane is interested to know the digestibility of the fat in Diet 1. Calculate the apparent digestibility of fat in this diet.
- 86.3%
 - 84.8%
 - 83.3%
 - 87.8%
9. Which of the following nutrients is inorganic?
- Stearic acid
 - Protein
 - Vitamin D
 - Water
 - Cellulose

10. The various regions of the digestive tract have specific roles during the digestion of foods. Which of the following is correct?
- The amylase enzyme is secreted in the mouth and begins to digest triglycerides.
 - Bacteria, which are equally distributed along the human digestive tract, play important roles in the fermentation of dietary fibre.
 - Water is predominantly absorbed in the small intestine.
 - The acidity of gastric juice is neutralized in the antrum of the stomach before moving into the small intestine.
 - None of the above are correct.
11. A nutritious diet has several important characteristics. Which of the following is not one of these characteristics?
- A diet must have pleasurable taste characteristics.
 - A diet should provide enough Calories and essential nutrients to keep you healthy.
 - A diet should minimize the amount of “nutrient-poor” foods.
 - A diet must be varied in order to get all necessary nutrients.
 - A diet should be moderate and avoid the consumption of excessive Calories.
12. The following article was published by Mohiti-Asli *et al* in Poultry Science in December 2012. Based on the title of this manuscript, which analytical approaches do you suspect were used to determine fibre and crude protein content in this animal feed?

Effects of feeding regimen, fiber inclusion, and crude protein content of the diet on performance and egg quality and hatchability of eggs of broiler breeder hens

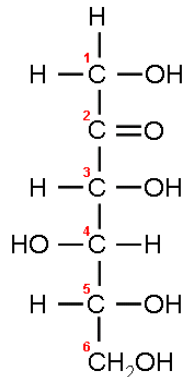
- Southgate analysis and Kjeldahl analysis.
 - Van Soest analysis and Kjeldahl analysis.
 - Van Soest analysis and Gas chromatography analysis.
 - Gas chromatography analysis and Kjeldahl analysis.
13. Several parameters are used in order to calculate an individual’s basal metabolic rate with the Harris-Benedict equation. Which of the following parameters is never used?
- Physical activity.
 - Weight.
 - Gender.
 - Body temperature.
 - Age.
14. When using calorimetry to determine the energy potential of a particular food sample, which of the following is not produced during the process?
- Carbon dioxide
 - Oxygen
 - Water
 - Heat

15. Which of the following events is not correct when talking about the regulation of glycogen stores in the liver?
- Hexokinase is responsible for converting blood glucose into glucose-6-phosphate in order to create a concentration gradient that favours glucose uptake by hepatocytes.
 - Following the consumption of a meal, insulin levels rise in the blood and increase the activity of the glycogen synthase enzyme.
 - Glycogenin serves as a scaffolding protein enabling glucose monomers to be strung together.
 - In times when energy is required, glucose molecules are removed from glycogen and converted into glucose-6-phosphate where they can either be released from hepatocytes as free glucose or enter glycolysis to generate energy.
16. Which of the following statements regarding the human digestive system is correct?
- Bacteria in the small intestine produce short-chain fatty acids.
 - Gastric glands in the stomach secrete bile acids.
 - Kerckring folds help increase the absorptive surface area of the small intestine.
 - The large intestine is the primary region for nutrient digestion and absorption.
17. Which of the following nutrients is not produced by gut bacteria during fermentation?
- Lactate
 - Short chain fatty acids
 - Vitamins
 - Long chain fatty acids
18. Which of the following tissues has the greatest impact on a person's BMR if they were training to be a weight lifter?
- Adipose tissue.
 - Muscle.
 - Liver.
 - Brain.
19. Which of the following statements is incorrect?
- The initial breakdown of glucose in the cytosol generates ATP only through substrate-level phosphorylation.
 - High levels of cellular ATP inhibit the activity of glucokinase.
 - During high-intensity exercise, the muscle produces lactic acid.
 - None, because all of the statements above are correct.
20. When palmitic acid (C16:0) is completely oxidized, it generates the equivalent of:
- 131 ATP
 - 119 ATP
 - 96 ATP
 - 35 ATP

Use the following information to answer Questions 21 and 22. Bob is the proud new owner of a horse; however, he's worried that the food he has purchased will not fulfill his horse's nutritional requirements. He decides to take a small sample of the horse's food and analyze it. The weight of the initial food sample is 600 grams. The subsequent proximate analysis revealed that the food sample consists of 50% water, 6% crude fat, 15% crude protein, 4% ash, and 20% crude fibre.

21. What is the weight, in grams, of the digestible carbohydrate in the initial food sample?
- 30
 - 24
 - 36
 - 5
22. Bob is quite a smart guy and knows that his food sample actually contains 17.5% nitrogen. What is the approximate weight (in grams) of nitrogen in this sample? Assume that crude protein in his food sample weighs 90g.
- ~16
 - ~12
 - ~18
 - Can not be calculated
23. The brush border enzyme _____ is responsible for breaking sucrose into one molecule of glucose and one molecule of fructose?
- Maltase.
 - Isomaltase.
 - Invertase.
 - Lactase.
24. When considering the digestion of lipids, which of the following statements is incorrect?
- Gastric lipase is secreted in the stomach and hydrolyzes the sn-3 position of a triglyceride.
 - Bile acids act as an important emulsifier to solubilise dietary lipids in the small intestine.
 - Pancreatic lipase hydrolyzes triglycerides, resulting in the production of 2 fatty acids and a monoacylglycerol.
 - Short-chain fatty acids are transported into the intestinal enterocytes by a specific membrane transporter.
25. Which of the following dietary fibres is not considered "insoluble"?
- Lignin
 - Hemicellulose
 - Mucilage
 - Cellulose
26. Which of the following is functionally most similar to the human stomach?
- The rumen of the cow.
 - The crop of a turkey.
 - The abomasum of a goat.
 - The cecum of the horse.

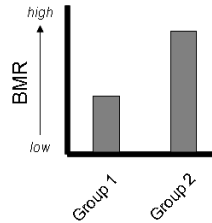
27. Which of the following statements is correct?
- Sucrose is a non-reducing disaccharide.
 - Glycogen and amylopectin are heteropolysaccharides in which glucose residues are linked together via α -(1,4)-glycosidic bonds into linear chains.
 - Maltose consists of two glucose molecules connected through an β -(1,2)-glycosidic bond.
 - Glycogen is one of the two major forms of plant starch.
28. The pig, cat, and dog are all examples of which digestive system?
- Simple system
 - Simple system with functional caecum
 - Ruminant system
 - Avian system
29. When the body metabolizes nutrients for energy, fats yield about _____ times the energy as carbohydrates or proteins.
- 1/2
 - 2
 - 4
 - 6
30. Use the Fischer structure to answer this question. Of the statements below, which is incorrect?



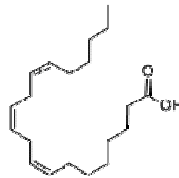
- This monosaccharide is an aldose.
 - Carbon 2 is the anomeric carbon.
 - This sugar is in the D conformation.
 - The number of possible stereoisomers that exist for this sugar is 8.
31. A 90 kg individual is trying to rapidly estimate their BMR. What is their approximate BMR?
- Over 2500 kcal/d
 - Between 2000-2100 kcal/d
 - Between 2400-2500 kcal/d
 - Less than 2000 kcal/d

32. Numerous proteins play an important role in the digestion and absorption of carbohydrates. Which of the following statements is correct?
- The digestion of lactose begins in the mouth through α -amylase.
 - Isomaltase plays an important role by breaking α -1,4-glycoside bonds.
 - Over time, people lose the ability to breakdown maltose.
 - Glucose and fructose enter the bloodstream from intestinal absorptive cells via the Glut2 transporter.
33. When considering the proximate analysis, which of the following statements is incorrect with regards to sources of error?
- Dry matter is slightly underestimated because oven drying evaporates not only water, but also other volatile components like short-chain fatty acids.
 - Various plant products like amylopectin and amylase can be extracted by ether.
 - Using high temperatures to determine the mineral content of foods may result in the lost of certain volatile minerals.
 - The Kjeldahl analysis assumes that all protein has 16% nitrogen; however, certain foods deviate with regards to this assumed % content of nitrogen.
34. If Alex Baldwin rides a stationary bike for 2 hours and consumes 80.0 L of oxygen and expires 64.0 L of carbon dioxide, what is the percentage of non-protein energy provided by fat? Feel free to use the table on the first page.
- 33.4
 - 66.6
 - 71.6
 - None of the above are correct
35. Who is considered to be the founding father of metabolic studies?
- Anaxogoras
 - Santorio Sanctorius
 - Ancel Keys
 - Johan Kjeldahl
36. Bile acids circulate between the liver and the intestine in a process referred to as:
- The Cori Cycle.
 - Enterohepatic Circulation.
 - Reverse Cholesterol Transport.
 - None of the above.
37. Which of the following statements is correct when considering carbohydrate digestion?
- Pancreatic α -amylase is able to digest α -(1,6)-glycosidic bonds.
 - Cellulose and lactose are resistant to α -amylase digestion.
 - Most disaccharides are digested by enzymes located in the brush border membrane of the large intestine.
 - Fructose is absorbed by small intestinal enterocytes by SGLT1-mediated active transport.

38. The following figure is from a recent study performed by researchers at the University of Guelph. The researchers looked at two groups of people and measured the average basal metabolic rate (BMR) in each group (represented by the bars). Which of the following interpretations of the data is incorrect?



- Group 2 has a higher average basal metabolic rate than Group 1.
 - Group 1 could be comprised of lean individuals and Group 2 of obese individuals.
 - Group 2 could be comprised of only men and Group 1 of only women.
 - Group 1 could be a young population and Group 2 an elderly population.
39. Which of the following names is incorrect for the fatty acid illustrated below?



- 20:3 n-6
 - 20:3 $\Delta^{8,11,14}$
 - 20:3 $\Delta^{6,9,12}$
 - 20:3 ω -6
40. During the lecture on proximate analysis, you may have asked yourself why do I have to learn about food composition analyses? Does anyone really use this? How will this impact my life? Of the following statements, which is the most correct?
- Knowing the composition of a particular food product helps to confirm food authenticity and prevent economic fraud.
 - Governments demand this information from the food industry in order to maintain the quality and safety of foods.
 - To ensure that the composition of a food has not changed during the manufacturing process.
 - All of the above.
41. BONUS QUESTION. This is **VERSION #1** of the midterm exam. This question provides me with a back-up should problems arise with the scantron. Please indicate which version of the midterm you have:
- Version #1
 - Version #2