Review Questions for Glucose topic

Review questions will not be collected and are not worth any points. Doing them will, however, help you prepare for the midterms and quizzes in this course. Furthermore, some of these review questions will appear on the final exam (although the numbers within the questions may be changed).

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1) A certain monosaccharide molecule consists of 7 carbon atoms. How many hydrogen atoms and oxygen atoms does it contain?

A) 7 hydrogen atoms and 4 oxygen atoms
B) 2 hydrogen atoms and 1 oxygen atoms
C) 14 hydrogen atoms and 7 oxygen atoms
D) None. It is an organic molecule.

2) Which of the following is a polysaccharide?

A) starch
B) sucrose
C) glucose
D) galactose

3) In animals, the primary form of carbohydrate storage is

A) starch.
B) glycogen.
C) cellulose.
D) keratin.

4) The major monosaccharide in the blood

A) Amino acids
B) Oxygen
C) Glucose
D) Water

5) The major source of glucose for the body is _____ in our diet.

A) Sweets
B) Glycogen
C) Proteins
D) Starch

6) When glucose levels in the blood are high (such as after a carbohydrate-rich meal) the _____ (an organ) stores the glucose.

A) Adipose
B) Liver
C) Pancreas
D) Small intestine

7) The liver stores carbohydrate as a polymer of glucose called

A) Starch
B) Glucagon
C) Insulin
D) Glycogen

8) The term meaning high blood sugar is

A) Diabetes
B) Hypertonic
C) Hyperglycemia
D) Hypotonic

9) Glucose levels in the blood are controlled by hormones released from the _____ (an organ)

A) Pancreas
B) Liver
C) Small intestine
D) Pituitary gland

10) The cells within the pancreas that release insulin are called

A) Alpha cells
B) Acinar cells
C) Diabetes cells
D) Beta cells

11) The action of the hormone insulin is to

A) Cause drowsiness after a meal
B) Increase cellular uptake of glucose
C) Increase movement of chyme through the GI tract
D) Decrease blood oxygen

12) The effect of insulin on glucose in the blood

A) Increases blood glucose
B) Decreases blood glucose
C) Transforms glucose into other carbohydrates
D) Transforms glucose into polymers in the blood

13) The action of the hormone glucagon is to

A) Increase blood flow to the digestive organs
B) Increase heart rate and breathing rate
C) Increase appetite, especially for carbohydrate-rich foods
D) Cause the liver to release glucose

14) The effect of glucagon on glucose in the blood

A) Increases blood glucose
B) Decreases blood glucose
C) Transforms glucose into other carbohydrates
D) Transforms glucose into polymers in the blood

15) Diabetes is caused by

A) Poor blood circulation
B) Abnormally low dietary consumption of carbohydrates
C) The insulin system not working
D) Plaques (fatty deposits) in the arteries

16) The major symptom of uncontrolled diabetes that we discussed in class was…

A) Weakness, especially in the lower limbs
B) Weakened heart with poor circulation
C) Drowsiness or complete coma
D) Increased blood sugar

17) The two other major symptoms of uncontrolled diabetes that we discussed in class were…(more than one correct answer)

A) Increased urination
B) Glucose in the urine
C) Loss of vision
D) Weight gain
E) Increased cravings for sweets

18) In diabetes, glucose level in the blood is _____ and glucose use by the cells is _____

A) Increased, Increased
B) Decreased, Increased
C) Increased, Decreased
D) Decreased, Decreased

19) Which statement about uncontrolled diabetes is false?

A) The disease causes hypoglycemia.
B) It can result from inadequate insulin release from the pancreas
C) Cellular uptake of glucose is decreased
D) Glucose usually appears in the urine.

20) Since cells can't use glucose without the insulin hormone system working correctly, the cells of people with diabetes use _____ for energy (more than one answer possible).

A) insulin
B) sucrose
C) fatty acids
D) amino acids

21) How many major types of macromolecules are there in living things? _____

22) The biological macromolecules are all_____, which means that they are chains of smaller molecules known as _____.

23) Write the names of the four macromolecule types. Following the name of each one, also write the name of its monomer(s) in parenthesis.

24) List all the atoms that carbohydrate molecules are made out of: _____

25) The main function of carbohydrates in the body is _____

26) Monosaccharides and polysaccharides are members of which macromolecule group? _____

27) Which carbohydrate is our blood sugar? Be as specific as possible and write its name and its molecular formula. _____

28) A certain monosaccharide molecule has 9 carbons. Write its entire molecular formula: _____

31) Plants store glucose as a polysaccharide called _____. A very similar polysaccharide, called _____, is the form that glucose is stored as in animal livers and muscles.

32) Name 3 foods, listed in class, that are rich in starch:

_____
_____
_____

33) Large carbohydrates (such as starch) are called polysaccharides. They are polymers of the monosaccharide _____.

34) One of the major reasons we eat is to provide "fuel" molecules (such as glucose) for our cells. Our cells usually use a process called cellular aerobic respiration to convert the energy in fuel molecules into cellular energy. Write the complete chemical reaction of cellular aerobic respiration of one molecule of glucose. Include all reactant and product molecules in the chemical reaction.

35) Cellular aerobic respiration is used to recharge the cell's supply of an energy-rich molecule inside the cell. Name that energy-rich molecule: _____ (hints: It is not glucose. The molecule this question is asking about is the direct energy source that powers the cell's proteins).

36) The liver stores glucose in the form of a glucose polymer called _____.

37) What is the normal range of blood glucose? _____. (Your answer must include the number range and the correct units).

38) The pancreas contain two kinds of hormone-secreting cells: Some cells secrete the hormone _____ and other cells secrete the hormone _____.

39) The pancreas secretes the hormone _____ when there is _____, a term that means high blood sugar levels. The pancreas secretes the hormone _____ when there is _____, a term that means low blood sugar levels.

40) Insulin causes cells to do what? _____.

41) Most cells respond to insulin by taking in blood glucose for energy, but the cells of one major organ respond to insulin by storing the blood glucose as glycogen. This organ is the _____.

42) The hormone _____ is a pancreatic hormone that raises the plasma glucose concentrations, such as during periods of fasting between meals or when starving.

43) Glucagon is secreted in response to low/high (circle one) glucose in the blood, and its major target is the _____ (an organ).

44) In response to glucagon, the liver _____, which increases the glucose concentration in the blood.

45) Fill in the blanks in the following paragraphs. Be as specific as possible in your answers.

> If you ate a meal consisting of pasta and potatoes, the major polysaccharide you are consuming is _____. This nutrient will be broken down in the digestive system into the monosaccharide _____.
>
> The monosaccharide will travel in the blood to the _____ (an organ), which will store it in the form of a polysaccharide known as _____. When blood sugar levels are low (such as between meals) the liver breaks down the polysaccharide into the monomer _____ to keep your blood sugar levels from declining.

46) Blood glucose levels stay more or less constant (at around 70-100 mg/100 ml). This steady level of glucose is maintained mainly by two hormones with opposing effects. For the hormone that is secreted **just after** a carbohydrate-rich meal is eaten, answer the following questions:

a) Hormone name: _____

b) Which organ secretes this hormone? _____

c) Name the cell type within this organ that secretes the hormone: ____

d) The hormone raises/lowers (circle one) blood sugar.

e) What is the target organ/tissue of the hormone? _____

f) What is the response of the target organ/tissue to the hormone?

_____

47) Blood glucose levels stay more or less constant (at around 70-100 mg/100 ml). This steady level of glucose is maintained mainly by two hormones with opposing effects. For the hormone that is secreted between meals (**many hours after** the last meal is eaten) answer the following questions:

a) Hormone name: _____

b) Which organ secretes this hormone? _____

c) Name the cell type within this organ that secretes the hormone: ____

d) This hormone raises/lowers (circle one) blood sugar.

e) What is the target organ/tissue of the hormone? _____

f) What is the response of the target organ/tissue to the hormone?

_____

48) Hyperglycemia is a characteristic of the disease _____.

49) Hyperglycemia may be caused by a deficiency of the hormone _____.

50) The major three symptoms of uncontrolled diabetes that were listed in class are _____, _____, and _____.

51) Diabetes mellitus results from the inadequate secretion or action of the hormone _____.

52) Explain how the liver helps maintain a constant blood glucose concentration:

53) Explain, at a cellular and molecular level, why diabetes leads to increased urine volume.

54) Beer's law states that the _____ of a solution is proportional to its _____.

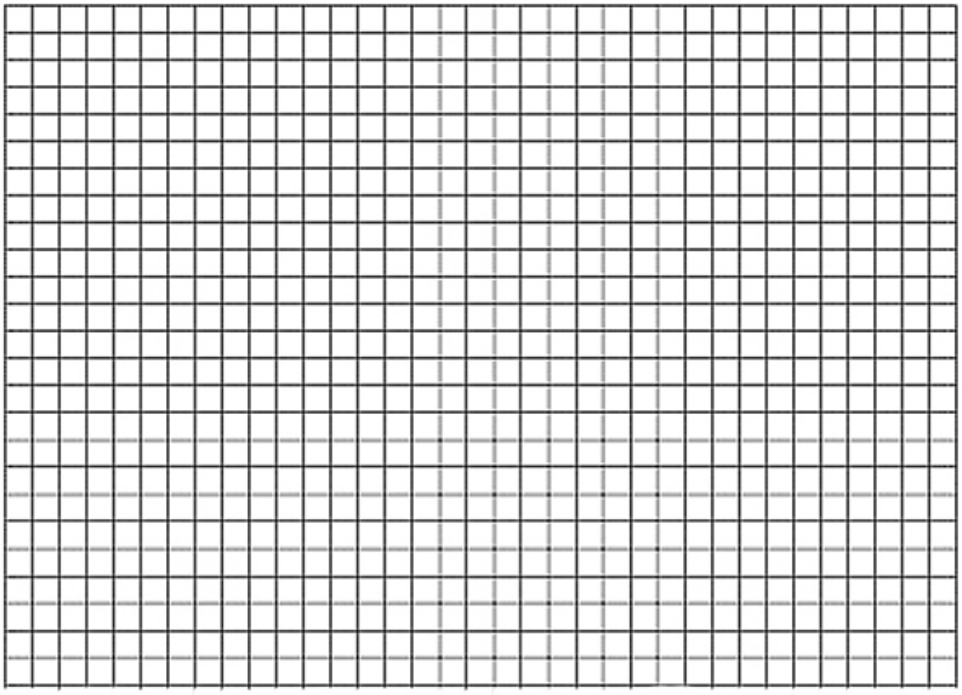
55) What does the blank tube contain, and what is its function when using the spectrophotometer?

56) Why do you draw a linear (straight line) graph of absorbance versus solute concentration even though your experimental values deviated slightly from a straight line? Why must your line intersect the origin of the graph (zero concentration equals zero absorbance)?

57) A student performed a glucose determination experiment just like the one your performed in laboratory. The following are her data:

Tube number:	Glucose concentration (g/L):	Absorbance:
1	0	0
2	0.25	0.13
3	0.50	0.23
4	0.75	0.40
5	1.0	0.48
6	1.25	0.62
7	Unknown	0.33

Determine the blood glucose concentration of the unknown. Use the same approach you used in class: Graph the standards, make a best-fit straight line, then use the best-fit line to determine the unknown's glucose concentration from its absorbance. Be sure to label and number your graph axis correctly, to show all your unit conversion factors for plotting the standards, and to state the glucose concentration of the unknown in mg/100 mL concentration units. Plot the absorbance on the y-axis, with the high number 0.7 at line 21. Plot the glucose concentration on the x-axis, with the high number 2.0 at line 32.



Answers for Review Questions for Glucose Review topic:

1) C
2) A
3) B
4) C
5) D
6) B
7) D
8) C
9) A
10) D
11) B
12) B
13) D
14) A
15) C
16) D
17) A and B
18) C
19) A
20) C and D
21) Four
22) Polymers
    Monomers
23) Carbohydrates (monosaccharides)
    Proteins (Amino acids)
    Lipids (Fatty acids and Glycerol)
    Nucleic acids (Nucleotides)
24) Carbon, Hydrogen, and Oxygen atoms
25) To provide energy for cells
26) Carbohydrates
27) Glucose
    $C_6H_{12}O_6$
28) $C_9H_{18}O_9$
31) Starch
    Glycogen
32) Wheat products (pasta, bread cereal), potatoes, rice.
33) Glucose
34) $C_6H_{12}O_6 + 6O_2 \rightarrow 6H_2O + 6CO_2$

35) ATP
36) Glycogen
37) 70 – 100 mg glucose/100 mL blood
38) Insulin
Glucagon
39) Insulin
Hyperglycemia
Glucagon
Hypoglycemia
40) Take in glucose from the plasma
41) Liver
42) Glucagon
43) Low
Liver
44) Breaks down glycogen
45) Starch
Glucose
Liver
Glycogen
Glucose
46) a) Insulin
b) Pancreas
c) Beta cell
d) Lowers
e) All cells of all organs
f) Take in glucose from the blood

47) a) Glucagon
b) Pancreas
c) Alpha cell
d) Raises
e) The liver
f) Release glucose into the blood
48) Diabetes mellitus
49) Insulin

50) High blood sugar
Glucose in the urine
Large volumes of urine

51) Insulin

52) When blood glucose levels are high (such as after a carbohydrate-rich meal) the liver takes in glucose from the blood and stores it. When blood glucose levels are low (such as between meals) the liver releases its stored glucose into the blood.

53) High blood sugar levels lead to glucose in the urine (because the urine is formed from substances in the blood). Glucose in the urine leads to large volumes of urine because the large glucose concentration in the urine draws water into the urine by osmosis.

54) Absorbance
Solute concentration

55) The blank tube contains only the solvent (with none of the glucose). Its purpose is to calibrate the spectrophotometer for zero absorbance.

56) The graph of absorbance versus solute concentration is supposed to be an perfect straight line because, according to Beer's law, absorbance is proportional to solute concentration, and proportional things should always graph to a perfect straight line. On the real graph, however, your data points do not form an perfect straight line due to small errors in pipetting the solutions and small errors in reading the absorbance of the solutions. To account for these errors, you draw a best-fit straight line through the points. This best fit line "averages out" the small errors in the individual graph points.

The best fit line always goes through zero zero because Beers law states that absorbance is proportional to solute concentration. If solute concentration is zero the absorbance must be zero also.

57) To answer this review question it may be helpful to first review the rules for proper graphing that were outlined in the Math Review web handout.

These are the unit conversion factors for plotting the standards:

Point 1:

0 abs	x	(21 lines/0.7 abs) = 0 lines
0 g/L	x	(32 lines/2.0 (g/L)) = 0 lines

Point 2:

0.13 abs	x	(21 lines/0.7 abs) = 3.9 lines
0.25 g/L	x	(32 lines/2.0 (g/L)) = 4 lines

Point 3:

0.23 abs	x	(21 lines/0.7 abs) = 6.9 lines
0.5 g/L	x	(32 lines/2.0 (g/L)) = 8 lines

Point 4:

0.40 abs	x	(21 lines/0.7 abs) = 12 lines
0.75 g/L	x	(32 lines/2.0 (g/L)) = 12 lines

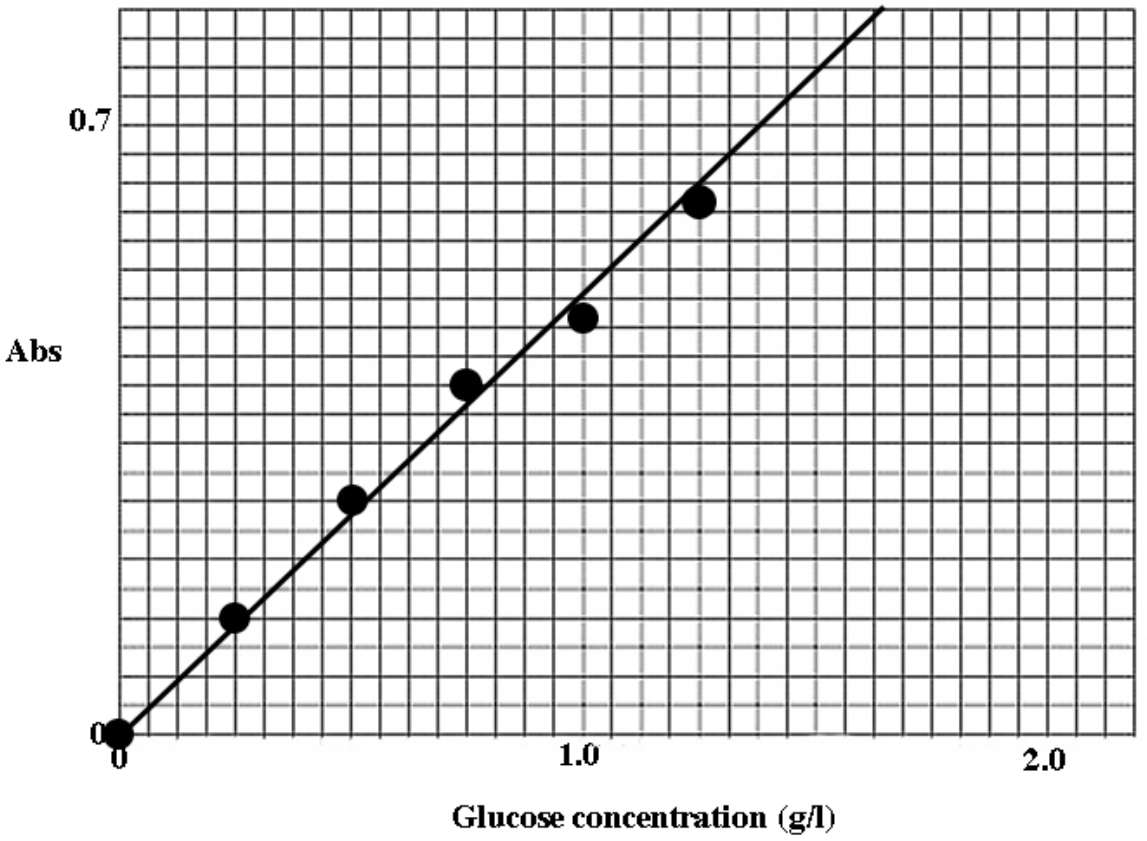
Point 5:

0.48 abs	x	(21 lines/0.7 abs) = 14.4 lines
1.0 g/L	x	(32 lines/2.0 (g/L)) = 16 lines

Point 6:

0.62 abs	x	(21 lines/0.7 abs) = 18.6 lines
1.25 g/L	x	(32 lines/2.0 (g/L)) = 20 lines

The graph (including the axis labels and the best-fit straight line) is shown below.



e) The unknown has an absorbance 0.33. To find the line on the Y-axis that corresponds to 0.33 abs, we do the following calculation using the unit conversion factor for the Y-axis:

0.33 abs x (21 lines/0.7 abs) = 9.9 lines.

f) Starting at 9.9 lines on the Y-axis, we move to the right until we touch the best-fit straight line. Then we go straight downward until we touch the X-axis. This turns out to be 10 lines on the X-axis. We then calculate what glucose concentration this is using the unit conversion factor for the X-axis:

10 lines x (2.0 (g/L)/32 lines)= 0.625 g/L.

g) The last step is to convert this answer into mg/100 ml concentration units. The math is easier if we recall that 100 mL = 1 dL.

$$0.625 \text{ g/L} \times (1000 \text{ mg/g}) \times (1 \text{ L}/10 \text{ dL}) = 62.5 \text{ mg}/100 \text{ ml}$$