Name: _____ Class: _____ Date: _____ ID: A

Common Challenges- Gas Exchange MYP

EDITED VERSION 2012

Multiple Choice
Identify the letter of the choice that best completes the statement or answers the question.

1. Suppose George Washington completely removed the bark from around the base of a cherry tree but was stopped by his father before cutting the tree down.
   a. The tree will live only the thin layer of bark was removed the majority of the bark is still present.
   b. The tree will live inside of a shoot transports oxygen through the plant.
   c. The tree will soon die for reasons unrelated to gas exchange.
   d. The tree will soon die because oxygen will no longer be able to sufficiently move up and down the tree.
   e. The tree will soon die although gas exchange occurs in the bark, gas is transported through the center of the shoot.
2. Which of the following statements is *correct about diffusion?*
   a. It is very rapid over long distances.
   b. It requires an expenditure of energy by the cell.
   c. It is a passive process in which molecules move from a region of higher concentration to a region of lower concentration.
   d. It is an active process in which molecules move from a region of lower concentration to one of higher concentration.
   e. It requires integral proteins in the cell membrane.
3. A student examining leaf cross sections under a microscope finds many loosely packed cells with relatively thin cell walls. The cells have numerous chloroplasts. What type of cells are these?
   a. parenchyma
   b. xylem
   c. endodermis
   d. guard cells
   e. stomata
4. An oil-water mixture is used as a spray against mosquitoes. How might this spray also affect gas exchange in other insects?
   a. The oil might coat their lungs.
   b. The oil might block the openings into the tracheal system.
   c. The oil might interfere with gas exchange across the capillaries.
   d. Only A and B are correct.
   e. A, B, and C are correct.
5. Tracheal systems for gas exchange are found in which organism?
   a. crustacean
   b. earthworm
   c. insect
   d. jellyfish
   e. vertebrate

6. Which of the following produces the most ATP when glucose ($C_6H_{12}O_6$) is completely broken down to carbon dioxide (CO_2) and water?
   a. glycolysis
   b. lactic acid fermentation
   c. alcohol fermentation
   d. photosynthesis
   e. aerobic respiration
7. Which of the following is an example of countercurrent exchange?
   a. the flow of water across the gills of a fish and that of blood within those gills
   b. the flow of blood in the dorsal vessel of an insect and that of air within its tracheae
   c. the flow of air within the primary bronchi of a human and that of blood within the pulmonary veins
   d. the flow of water across the skin of a frog and that of blood within the ventricle of its heart
   e. the flow of fluid out of the arterial end of a capillary and that of fluid back into the venous end of the same capillary
8. Which of the following is a characteristic of *both* hemoglobin and hemocyanin?
   a. found within blood cells
   b. red in color
   c. contains the element iron as an oxygen-binding component
   d. transports oxygen
   e. occurs in mammals
9. Which of the following is *false* concerning the hemoglobin molecule?
   a. It contains amino acids.
   b. It contains iron.
   c. It is composed of four polypeptide chains (proteins).
   d. It can bind four O_2 molecules.
   e. It is found in humans only.
10. *Use the data shown below to answer the following questions.*

    Blood entering a capillary bed of a vertebrate was measured for the pressures exerted by various factors.

	Arterial End of Capillary	**Verous End of Capillary**
Hydrostatic pressure	8 mm Hg	14 mm Hg
Osmotic pressure	26 mm Hg	26 mm Hg
Po_2	100 mm Hg	42 mm Hg
Pco_2	40 mm Hg	46 mm Hg

    The site of this capillary bed could be all of the following *except* the
    a. pancreas.
    b. muscle tissue.
    c. medulla (brain).
    d. alveoli.
    e. kidneys.

11. After a heavy rain earthworms come to the surface. How would explain this behavior in terms of an earthworm's requirements for gas exchange?
    a. Earthworms always come the surface to exchange gases
    b. Earthworms breathe through their skin, if they stayed in waterlogged soil they would drown
    c. Gas exchange surfaces must remain moist they are seeking water which will increase gas exchange
    d. Their lungs will fill with water and gas exchange will be impossible
    e. Their heart can not circulate blood because the waterlogged soil has increased pressure on the earthworm
12. Air rushes into the lungs of humans during inhalation because
    a. the rib muscles and diaphragm contract, increasing the lung volume.
    b. pressure in the alveoli increases.
    c. gas flows from a region of lower pressure to a region of higher pressure.
    d. pulmonary muscles contract and pull on the outer surface of the lungs.
    e. a positive respiratory pressure is created when the diaphragm relaxes.
13. What would be expected if the amount of interstitial fluid *surrounding* the capillary beds of the lungs were to increase significantly?
    a. The amount of carbon dioxide entering the lungs from the blood would increase.
    b. The amount of oxygen entering the circulation from the lungs would increase.
    c. The amount of oxygen entering the circulation from the lungs would decrease.
    d. The pressure would cause the capillary beds to burst.
    e. Both C and D would be expected.
14. Some large redwood trees have been cut in a way that allows cars to drive through them.
    a. The tree will live only the thin layer of bark is alive, the majority of the shoot is dead cells involved only in structural support.
    b. The tree will live only leaf tissues require gas exchange.
    c. The tree will soon die for reasons unrelated to gas exchange.
    d. The tree will soon die because oxygen will no longer be able to sufficiently move up and down the tree.
    e. The tree will soon die although gas exchange occurs in the bark, gas is transported through the center of the shoot.
15. Organisms in which a circulating body fluid is distinct from the fluid that directly surrounds the body's cells are likely to have
    a. an open circulatory system.
    b. a closed circulatory system.
    c. a gastrovascular cavity.
    d. branched tracheae.
    e. hemolymph.
16. Through how many capillary beds must a human red blood cell travel if it takes the shortest possible route from the right ventricle to the right atrium?
    a. one
    b. two
    c. three
    d. four
    e. five

17. Gas exchange, necessary for photosynthesis, can occur most easily in which leaf tissue?
    a. epidermis
    b. palisade mesophyll
    c. spongy mesophyll
    d. vascular tissue
    e. bundle sheath
18. Which of the following features do all gas exchange systems have in common?
    a. The exchange surfaces are moist.
    b. They are enclosed within ribs.
    c. They are maintained at a constant temperature.
    d. They are exposed to air.
    e. They are found only in animals.
19. In the absence of oxygen, yeast cells can obtain energy by fermentation, resulting in the production of
    a. ATP, $CO_2$and ethanol (ethyl alcohol).
    b. ATP, CO_2, and lactate.
    c. ATP, NADH, and pyruvate.
    d. ATP, pyruvate, and oxygen.
    e. ATP, pyruvate, and acetyl CoA.
20. Which of the following occurs with the exhalation of air from human lungs?
    a. The volume of the thoracic cavity decreases.
    b. The volume of the lungs decreases.
    c. The diaphragm contracts.
    d. The epiglottis closes.
    e. The rib cage expands.
21. Pores on the leaf surface that function in gas exchange are called
    a. hairs.
    b. xylem cells.
    c. phloem cells.
    d. stomata.
    e. parenchyma.
22. Gas exchange takes place in all cells. Choose the *incorrect* statement regarding gas exchange.
    a. Both photosynthesis and cell respiration use and release gases
    b. Autotrophs use oxygen to release chemical energy from organic compounds and produce ATP
    c. Cell Respiration produces carbon dioxide that must be eliminated by most cells
    d. Autotrophs use oxygen to build organic compounds (glucose)
    e. Plants produce carbon dioxide through cell respiration
23. If a molecule of CO_2 released into the blood in your left toe travels out of your nose, it must pass through all of the following structures *except* the
    a. right atrium.
    b. pulmonary vein.
    c. alveolus.
    d. trachea.
    e. right ventricle.

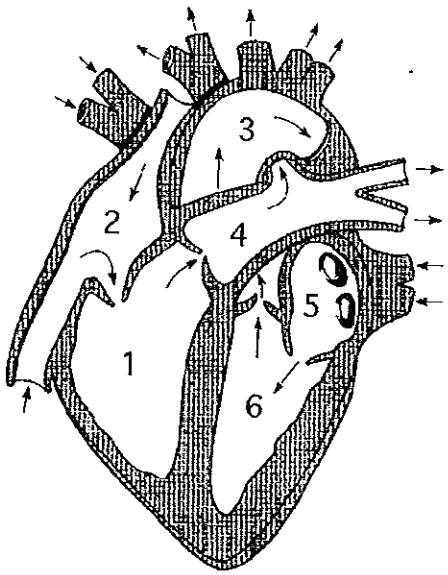
24. Gas exchange in organisms relies on diffusion, a relatively slow process. Choose the adaptation(s) that would increase the rate of diffusion.
    a. large surface area to volume ratio
    b. steep concentration gradients maintained across membranes
    c. a long diffusional distance
    d. Both A and B
    e. A, B and C
25. All of the following respiratory surfaces are associated with capillary beds *except* the
    a. gills of fishes.
    b. alveoli of lungs.
    c. tracheae of insects.
    d. skin of earthworms.
    e. skin of frogs.
26. At an atmospheric pressure of 870 mm Hg, what is the contribution of oxygen?
    a. 100 mm Hg
    b. 127 mm Hg
    c. 151 mm Hg
    d. 182 mm Hg
    e. 219 mm Hg
27. Which organism(s) is/are multicellular and yet lack both circulatory and respiratory systems?
    a. Apple Tree
    b. Black bread mold (fungi)
    c. Grasshoppers
    d. A and B only
    e. A, B and C
28. At the summit of a high mountain, the atmospheric pressure is 380 mm Hg. If the atmosphere is still composed of 21% oxygen, what is the partial pressure of oxygen at this altitude?
    a. 0 mm Hg
    b. 80 mm Hg
    c. 160 mm Hg
    d. 380 mm Hg
    e. 760 mm Hg
29. Which one of the following statements about gills operating in water is *false*?
    a. Water can support the delicate gill features.
    b. Most fish actively pump water over their gills.
    c. Keeping membranes moist is no problem.
    d. Water carries more oxygen than air, and therefore gills need to be more efficient than lungs.
    e. Gills have evolved many times in aquatic animals.
30. Where do air-breathing insects carry out gas exchange?
    a. in specialized external gills
    b. in specialized internal gills
    c. in the alveoli of their lungs
    d. across the membranes of cells
    e. across the thin cuticular exoskeleton

31. Which of the following are the only vertebrates in which blood flows directly from respiratory organs to body tissues without first returning to the heart?
    a. amphibians
    b. birds
    c. fishes
    d. mammals
    e. reptiles
32. What kinds of molecules pass through a cell membrane most easily?
    a. large and hydrophobic
    b. small and hydrophobic
    c. large polar
    d. ionic
    e. monosaccharides such as glucose
33. In order for an insect to grow as large as an elephant, what changes or modifications would need to be made in the circulatory systems of insects?
    a. The circulating body fluid would need to be contained in closed vessels.
    b. The heart would need to generate higher pressures.
    c. The heart would need to have multiple ostia.
    d. Only A and B are correct.
    e. A, B, and C are correct.
34. Calculate the approximate surface area to volume ratio for a rectangle with the following dimensions: Length= 100mm, width= 50mm, height= 1mm
    a. 4:1
    b. 1:1
    c. 2:1
    d. 1:1000
    e. 420:510
35. Air flows in only one direction through the lungs of which animals?
    a. frogs
    b. birds
    c. mammals
    d. crocodiles
    e. flying insects
36. What is the term used for the metabolic pathway in which glucose ($C_6H_{12}O_6$) is degraded to carbon dioxide (CO_2) and water?
    a. cellular respiration
    b. glycolysis
    c. fermentation
    d. photosynthesis
    e. none of the above
37. Countercurrent exchange in the fish gill helps to maximize
    a. endocytosis.
    b. blood pressure.
    c. diffusion.
    d. active transport.
    e. osmosis.

38. Stomatal density on fossilized leaves have been used to make predictions about the earth's temperature thousands or even millions of years ago. The fossilized leaves from the *Cretaceous* period have very high stomatal densities. What would you predict about the carbon dioxide levels and temperatures in that period?
    a. high carbon dioxide levels, high temperatures
    b. low carbon dioxide levels, high temperatures
    c. high carbon dioxide levels, low temperatures
    d. low carbon dioxide levels, low temperatures
    e. carbon dioxide and temeperatures are highly variable and not measureable
39. Which of the following would likely move through the lipid bilayer of a plasma membrane most rapidly?
    a. Na^+
    b. hemoglobin
    c. Cl^-
    d. O_2
    e. $C_6H_{12}O_6$
40. The opening of stomata is thought to involve
    a. an increased turgor pressure in guard cells.
    b. a decrease in the osmotic concentration of the stoma.
    c. active transport of water out of the guard cells.
    d. decreased turgor pressure in guard cells.
    e. movement of K^+ from guard cells.
41. A container holds a mixture of gases whose total pressure equals 2100 mm/Hg. Nitrogen's partial pressure is 1400 mm/Hg. What percent of the container is nitrogen gas?
    a. 66%
    b. 0.66%
    c. 1.5%
    d. 34%
    e. 0.34%
42. Why is the position of lung tissues *within* the body an advantage or maybe necessity for terrestrial organisms?
    a. Blood vessels can not be close to the body surface
    b. Air could not pass over external respiratory surfaces
    c. Gas exchange surfaces must be moist, internal tissues are less likely to dry out.
    d. The weight of the atmosphere would cause the tissues to collapse
    e. All of the above
43. In addition to ATP, what are the end products of glycolysis?
    a. CO_2 and H_2O
    b. CO_2 and pyruvate
    c. NADH and pyruvate
    d. CO_2 and NADH
    e. H_2O, $FADH_2$, and citrate

44. Why is the respiratory system of a bird more efficient than the human respiratory system?
    a. The bird respiratory system does not mix exhaled air with inhaled air.
    b. A bird lung contains multiple alveoli, which increases the amount of surface area available for gas exchange.
    c. The human respiratory system ends in small parabronchi, which reduce the amount of surface area available for gas exchange.
    d. Only B and C are correct.
    e. A, B, and C are correct.
45. Based upon your knowledge of gases and the metabolism of cells what prediction would you make in regards to the D.O. (dissolved oxygen) concentration in a body water with an extensive community of producers?
    a. The D.O. would remain constant throughout a 24 hour period.
    b. The D.O. would be lower at midnight and higher at 4pm.
    c. The D.O. would be higher at midnight and lower at 4pm.
    d. The D.O. would fluctuate with temperature.
    e. The D.O. would be highest at the bottom and lowest at the surface.
46. Which one of these statements about lungs is *false*?
    a. Gas exchange takes place across moist membranes.
    b. The gases move across the exchange membranes by diffusion.
    c. The total exchange surface area is relatively large.
    d. The lining of the alveoli is only one cell thick.
    e. The concentration of CO_2 is higher in the air than in the alveolar capillaries.
47. Select the true statement regarding oxygen in the atmosphere and the oxygen dissolved in the lake behind the building.
    a. Partial pressure and the concentration of oxygen are equal in the atmosphere and the lake.
    b. Partial pressures are equal, but the concentration of oxygen is much less in the lake.
    c. Partial pressures are equal, but concentration of oxygen is much more in the lake.
    d. Partial pressure is greater in the lake and concentrations of oxygen are equal in the atmosphere and the lake.
    e. Partial pressures is less in the lake and concentrations of oxygen are equal in the atmosphere and the lake.
48. Which is a correct statement concerning the insect circulatory system?
    a. The circulating fluid bathes tissues directly.
    b. Blood is always contained in a system of tubes called tracheae.
    c. Blood transports oxygen and nutrients to all the tissues.
    d. There is no heart, or pump.
    e. There is no blood, or circulating fluid.

Refer to the diagram of the human heart in the figure below to answer the following questions.



49. Which sequence of blood flow can be observed in either a reptile or a mammal?
    a. left ventricle → aorta (artery) → lungs → systemic circulation
    b. right ventricle → pulmonary vein → pulmocutaneous circulation
    c. pulmonary vein → left atrium → ventricle → pulmonary circuit
    d. vena cava (vein) → right atrium → ventricle → pulmonary circuit
    e. right atrium → pulmonary artery → left atrium → ventricle
50. Why is gas exchange more difficult for aquatic animals with gills than for terrestrial animals with lungs?
    a. Water is denser than air.
    b. Water contains much less O_2 than air per unit volume.
    c. Gills have less surface area than lungs.
    d. Only A and B are correct.
    e. A, B, and C are correct.

Common Challenges- Gas Exchange MYP
Answer Section

MULTIPLE CHOICE

1.	ANS: C	PTS: 1	TOP: Concept 35.4
2.	ANS: C	PTS: 1	TOP: Concept 7.2
3.	ANS: A	PTS: 1	TOP: Concept 35.1
4.	ANS: B	PTS: 1	TOP: Concept 42.5
5.	ANS: C	PTS: 1	TOP: Concept 42.5
6.	ANS: E	PTS: 1	TOP: Concept 9.4
7.	ANS: A	PTS: 1	TOP: Concept 42.5
8.	ANS: D	PTS: 1	TOP: Concept 42.7
9.	ANS: E	PTS: 1	TOP: Concept 42.7
10.	ANS: D	PTS: 1	TOP: Concept 42.6
11.	ANS: B	PTS: 1	
12.	ANS: A	PTS: 1	TOP: Concept 42.6
13.	ANS: C	PTS: 1	TOP: Concept 42.1
14.	ANS: A	PTS: 1	TOP: Concept 35.4
15.	ANS: B	PTS: 1	TOP: Concept 42.1
16.	ANS: B	PTS: 1	TOP: Concept 42.2
17.	ANS: C	PTS: 1	TOP: Concept 35.3
18.	ANS: A	PTS: 1	TOP: Concept 42.1 | Concept 42.5
19.	ANS: A	PTS: 1	TOP: Concept 9.5
20.	ANS: A	PTS: 1	TOP: Concept 42.6
21.	ANS: D	PTS: 1	TOP: Concept 35.3
22.	ANS: D	PTS: 1	
23.	ANS: B	PTS: 1	TOP: Concept 42.2 | Concept 42.6
24.	ANS: D	PTS: 1	
25.	ANS: C	PTS: 1	TOP: Concept 42.1 | Concept 42.5
26.	ANS: D	PTS: 1	TOP: Concept 42.6
27.	ANS: D	PTS: 1	
28.	ANS: B	PTS: 1	TOP: Concept 42.6
29.	ANS: D	PTS: 1	TOP: Concept 42.5
30.	ANS: D	PTS: 1	TOP: Concept 42.5
31.	ANS: C	PTS: 1	TOP: Concept 42.1 | Concept 42.2
32.	ANS: B	PTS: 1	TOP: Concept 7.2
33.	ANS: D	PTS: 1	TOP: Concept 42.1 | Concept 42.2
34.	ANS: C	PTS: 1	
35.	ANS: B	PTS: 1	TOP: Concept 42.6
36.	ANS: A	PTS: 1	TOP: Concept 9.1
37.	ANS: C	PTS: 1	TOP: Concept 42.5
38.	ANS: A	PTS: 1	
39.	ANS: D	PTS: 1	TOP: Concept 7.2

40. ANS: A PTS: 1 TOP: Concept 36.4
41. ANS: A PTS: 1
42. ANS: C PTS: 1
43. ANS: C PTS: 1 TOP: Concept 9.2
44. ANS: A PTS: 1 TOP: Concept 42.6
45. ANS: B PTS: 1
46. ANS: E PTS: 1 TOP: Concept 42.6
47. ANS: B PTS: 1
48. ANS: A PTS: 1 TOP: Concept 42.1
49. ANS: D PTS: 1 TOP: Concept 42.1 | Concept 42.2
50. ANS: D PTS: 1 TOP: Concept 42.5