



Answer sheet

Part one: MCQ questions (answer all of them)

Q1) Choose the most appropriate answer:

(30 marks)

1. One of the following is not a part of an X-ray unit:
 - a) Cathode.
 - b) Vacuum tube.
 - c) Low voltage source.
 - d) Anode.

2. When electrons strike an atom:
 - a) The electrons interact with either the orbital electrons or nucleus of the target atom.
 - b) More than 99% of the kinetic energy of the projectile electron is converted to thermal energy.
 - c) Photons may be produced.
 - d) All of the above.

3. Regarding the interaction of X-rays with matter: when the X-ray photon has energy slightly greater than binding energy (the energy required to remove an electron from its atom), it will eject an electron from its atom (called photoelectron). Another electron in the atom then drops into the vacancy with emission of characteristic photons. This is called:
 - a) Classical or Coherent Scattering.
 - b) Compton Effect.
 - c) Photoelectric Effect.
 - d) Pair production.

4. When we say that this part of the body has a positive pressure, we mean that its pressure is:
 - a) Above atmospheric pressure.
 - b) Below atmospheric pressure.
 - c) Equal to atmospheric pressure.
 - d) None of the above.

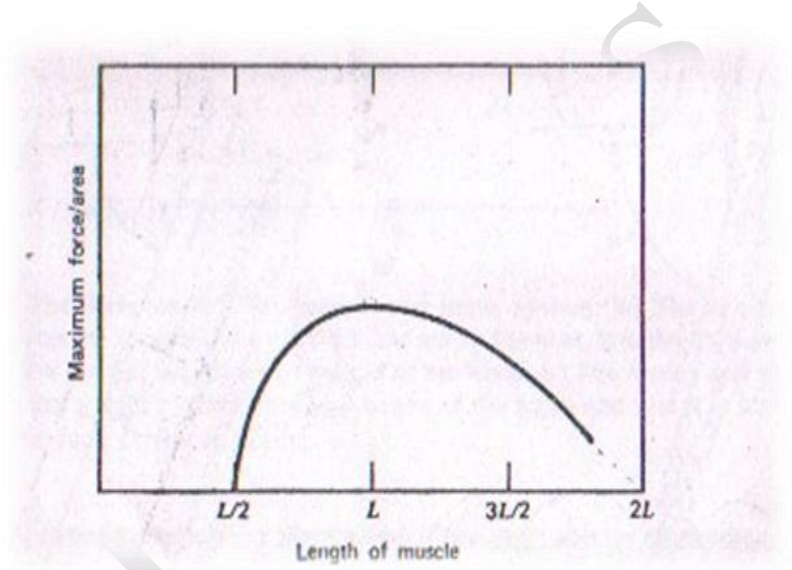
5. At a fixed temperature, gas volume is inversely related to its pressure. This is called:
- a) Henry's law.
 - b) Boyle's law.**
 - c) Dalton's law.
 - d) Charles' law.
6. You asked the nurse to measure the body temperature of your patient in the emergency room. She told you that it was 104 °F. This is equal to:
- a) 38 °C.
 - b) 39 °C.
 - c) 40 °C.**
 - d) 41 °C.
7. An increase of temperature of any material means:
- a) An increase in the energy of molecules of that material.**
 - b) A decrease in the energy of molecules of that material.
 - c) No change in the energy of molecules of that material.
 - d) None of the above.
8. The amount of energy (per Kcal) that is released after combustion of 30 gm of fat and 70 gm of carbohydrate is: (Consider that each 1 g of fat releases 9 Kcal and each 1 g of carbohydrate releases 4 Kcal.)
- a) 330 Kcal
 - b) 420 Kcal
 - c) 550 Kcal**
 - d) 640 Kcal
9. Suppose you wish to lose 4 Kg. How long would you have to work at an activity of 12 Kcal / min to lose 4 Kg of fat?
- a) 30 hours
 - b) 40 hours
 - c) 50 hours**
 - d) 60 hours
10. During action membrane potential of neurons, there is a large momentary change in the resting membrane potential (the inside of the cell becomes more positive than outside) because:
- a) The potassium leaves the cell.
 - b) The potassium enters the cell.
 - c) The sodium leaves the cell.
 - d) The sodium enters the cell.**

11. If you become weightless in an orbiting satellite, your bone minerals will:
- a) Increase.
 - b) **Decrease.**
 - c) Not change.
 - d) None.
12. The friction inside knee joint is small because:
- a) The applied body weight on knee joint is small.
 - b) **The synovial fluid inside the joint reduces the coefficient of friction effectively.**
 - c) The surface area of the joint is large.
 - d) The space inside the joint is small.
13. The oxygen diffuses from the alveolus to the pulmonary capillary because
- a) Oxygen diffuses faster than carbon dioxide.
 - b) Alveolar PO_2 is greater than capillary PCO_2 .
 - c) **Alveolar PO_2 is greater than capillary PO_2 .**
 - d) Alveolar PO_2 is lower than capillary PCO_2 .
14. Consider a closed liter container of dry air at atmospheric pressure (760 mm Hg) that contains 78% N_2 , 20% O_2 , 1% CO_2 and 1% of other gases. The partial pressure of N_2 is equal to:
- a) 520 mm Hg.
 - b) 580 mm Hg.
 - c) **610 mm Hg.**
 - d) 630 mm Hg.
15. The hundreds of millions of alveoli within human lungs vary from 75 to 300 μ in diameter. They are in communication with each other. In a case of absence of surfactant:
- a) **The smaller alveoli will collapse and further expanding the larger alveoli.**
 - b) The larger alveoli will collapse and further expanding the smaller alveoli.
 - c) There is no movement between small and large alveoli.
 - d) None of the above.

Part two: problems (answer all of them)

Q2) A muscle is capable of supplying a maximum force per unit area of $3.1 \times 10^7 \text{ N/m}^2$ (see Fig. below).

- If the cross-sectional area of the muscle is 20 cm^2 , what is the maximum force that can be supplied at the muscle's normal length?
- Estimate the force that can be supplied by this muscle at $3L/2$.



Q3) An artery with a 3 mm radius is partially blocked with plaque; in the constricted region the effective radius is 2mm and the average blood velocity is 50 cm/sec. What is the average velocity of the blood in the unconstricted region?

Q4) The atmospheric pressure is due to the weight of the air above us. The density of air is $1.3 \times 10^{-3} \text{ g/cm}^3$. What is the weight in dynes of 1 cm^3 of air?

Part three: short assay questions (answer three of them)

Q5) List four factors affecting basal metabolic rate (BMR) of body.

Q6) Define Reynolds number, write the formula and explain its parameters.

Q7) In x-ray generation there are many types x-ray of radiation resulting from electron-anode interaction, list two of them with brief explanation for each one.

Q8) There are two types of fluid flow. List them with explanation.