

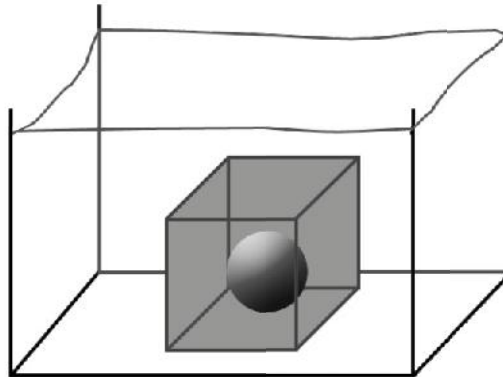
All questions worth 4 points.

1. Cuckoo is a bird which deposits an egg in another bird's nest. Cuckoo's egg hatches before the host's do and the cuckoo chick throws the other eggs out of the nest. So it is the only chick fed by the host bird. The relationship between cuckoo and the host bird is a relationship of:



- A) neutralism B) symbiosis C) prey-predator
 D) parasitism E) competition

2. An iron ball, trapped inside an ice cube, is sitting on the bottom of a vessel full of water.



After ice melting:

- A) a water volume, equal to the ice cube volume, flows out of the vessel
 B) the level of water remains the same, whatever the ice cube volume is
 C) a water volume, equal to the one of the iron ball, flows out of the vessel
 D) the level of water decreases or increases depending on the ratio V_{ice}/V_{ball}
 E) the level of water decreases because $\rho_{ice} < \rho_{water}$

3. In a terrestrial food chain, the leaves of creeping buttercup (*Ranunculus repens*) are consumed by plant lice, the lice are eaten by ladybug, which is consumed by chaffinch, the last one becoming food for owls. The organism that can use the solar energy to produce organic substances is:



- A) creeping buttercup B) plant louse C) ladybug
 D) chaffinch E) owl

4. What do you do if you spill a concentrated solution of caustic soda on your hand?

- A) Pour a diluted solution of sodium bicarbonate
- B) Wash your hands with water
- C) Put cooking oil on your hands
- D) Rinse hand with diluted acetic acid (vinegar) and then use the ointment recommended by the teacher
- E) Pour a concentrated solution of hydrochloric acid to neutralize the effect of caustic soda.

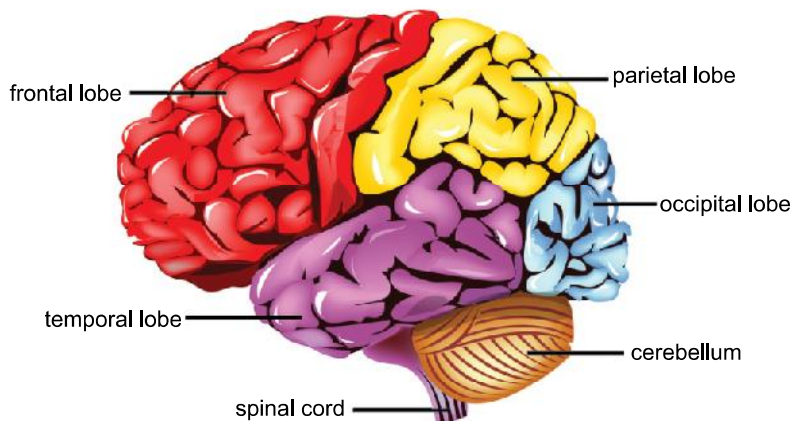


5. A generator has electro-motor voltage E and internal resistance r . At the terminals of the generator, n identical resistors are connected in parallel. Which of the following measurements will decrease by disconnecting a resistor?

- A) voltage at the terminals of the source
- B) amperage
- C) equivalent resistance of the external circuit
- D) battery efficiency
- E) all of the above

6. The cerebral cortex is the superior coordination center of the human body's activities. A cerebral hemorrhage in the left frontal lobe causes:

Parts of the Human Brain



- A) paralysis of the left half of the body
- B) loss of thermal sensitivity in the right side of the body
- C) loss of visual sensitivity
- D) loss of thermal sensitivity in the left side of the body
- E) paralysis of the right half of the body

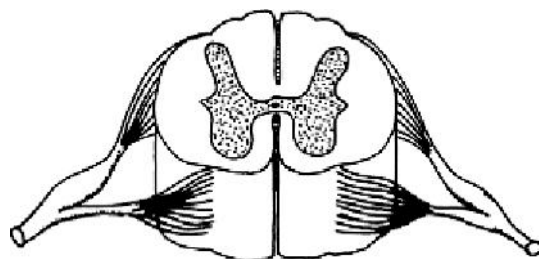
7. Kitchen salt, slaked lime, quicklime (or burnt lime), copper sulfate, caustic soda, sodium hydro carbonate are just some substances with practical use in various fields. Which of the following sequences contain only chemical substances?

- A) nitrogen, glass, gold, copper sulfate, caustic soda
- B) carbon dioxide, oxygen, nitrogen, mercury, silver
- C) iron, zinc, copper, brass, cast iron, bronze
- D) washing soda, steel, hydrogen, calcium
- E) bronze, carbon, oxygen, gold, sulfur

8. Consider two identical bodies *A* and *B*, which move one towards the other. As a result of their interaction, the kinetic energy of body *B*:

- A) always increases
- B) always decreases
- C) remains constant
- D) always becomes 0
- E) can't remain constant

9. Spinal nerves connect the spinal cord to the peripheral body parts. The consequences of spinal nerve damage are the following:



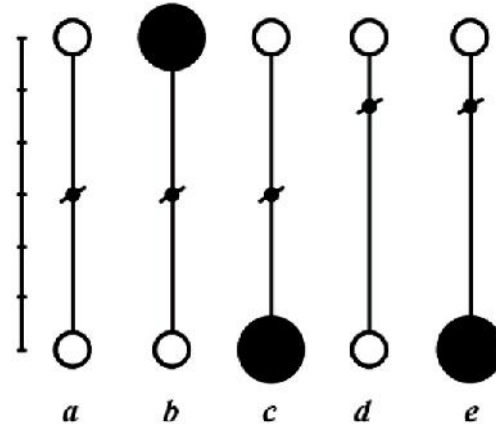
- A) loss of olfactory sensitivity
- B) loss of taste sensitivity
- C) loss of thermal sensitivity
- D) loss of auditory sensitivity
- E) loss of visual sensitivity

10. Acid rains damaged marble monuments and statues; one of the reactions involved is:

- A) $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2 \uparrow$
- B) $\text{CaCO}_3 + 2\text{HNO}_3 \rightarrow \text{Ca}(\text{NO}_3)_2 + \text{H}_2\text{O} + \text{CO}_2 \uparrow$
- C) $\text{Ca}(\text{OH})_2 + \text{CO}_2 \rightarrow \text{CaCO}_3 + \text{H}_2\text{O}$
- D) $\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca}(\text{OH})_2$
- E) $\text{Ca}(\text{OH})_2 + 2\text{HCl} \rightarrow \text{CaCl}_2 + 2\text{H}_2\text{O}$

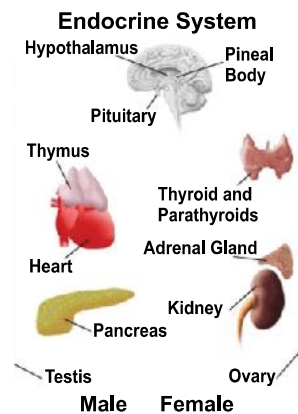
11. Knowing that the balls from the figure are made of the same material, identify the unstable equilibrium state in the following situations.

- A) a B) b C) c
D) d E) e



12. An adult person whose endocrine pituitary gland secretes a reduced amount of hormones will have the following symptoms:

- A) reduced physical development, but normal intellectual functioning
B) reduced physical and mental development
C) exaggerated increase in height
D) normal physical development
E) exaggerated growth of extremities



13. Your classmate gets an electric shock, his hand being in contact with a non isolated conductor. What should you do?

- A) Throw a bucket of water to cool him down
B) Use a fire extinguisher not to catch fire
C) Hit his hand with a dry wood
D) Call an electrician to isolate the conductor
E) Run not to get hurt

14. *Cuscuta epithymum* is a parasitic plant that twirls on the stems of some plants like lucerne, clover or grapevines. It has the following features:

- A) well developed vegetative organs
B) feeding through photosynthesis
C) well developed propagating organs
D) green color
E) organs for retrieval of raw sap from the host



15. The organisms of people living at high altitudes have the following adaptations:

- A) an increased number of white blood cells
- B) a decreased number of white blood cells
- C) an increased number of red blood cells
- D) a decreased number of red blood cells
- E) an increased number of platelets

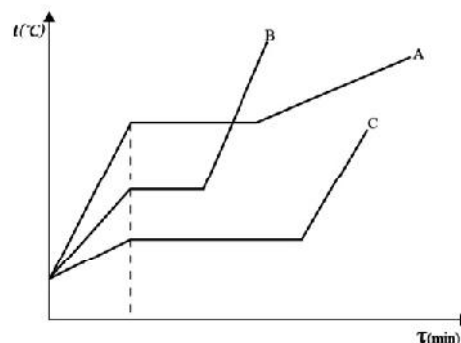
16. Anna introduces a piece of sodium in a bowl with water. Which of the following statements is true?

- A) The obtained solution colors the phenolphthalein in blue.
- B) The obtained solution colors the phenolphthalein in red.
- C) The reaction does not take place.
- D) The obtained solution colors the litmus in red.
- E) The solution is cloudy.



17. Using a spirit lamp we heat three equal amounts of different fluids *A*, *B*, *C*. The variation of the temperature *t* as a function of the heating time τ is represented in the next figure.

What answer best expresses the relationship between the boiling temperatures (t_A , t_B , t_C) of the liquids and their latent heats of vaporization (λ_A , λ_B , λ_C)?

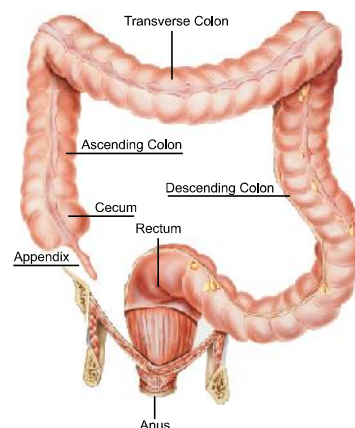


- A) $t_A < t_B < t_C$ $\lambda_A > \lambda_B > \lambda_C$
- C) $t_A = t_B = t_C$ $\lambda_C = \lambda_B \geq \lambda_A$
- E) $t_A > t_B > t_C$ $\lambda_B < \lambda_A < \lambda_C$

- B) $t_A < t_C < t_B$ $\lambda_C > \lambda_B > \lambda_A$
- D) $t_A > t_B > t_C$ $\lambda_B > \lambda_A > \lambda_C$

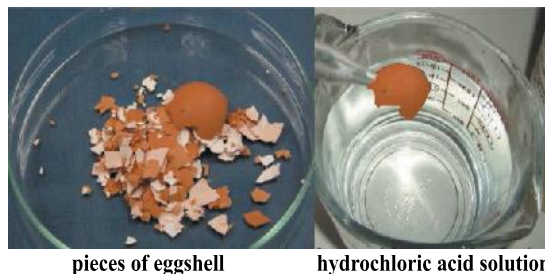
18. The inflammation of the large intestine (colon) leads to:

- A) malabsorption of carbohydrates
- B) malabsorption of lipids
- C) malabsorption of minerals
- D) malabsorption of proteins
- E) malabsorption of fats

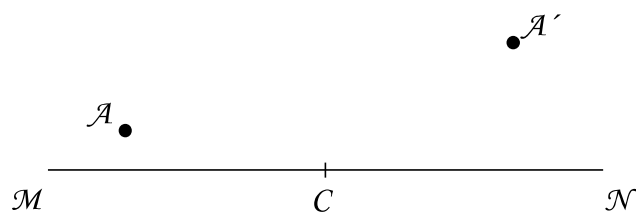


19. Roger puts a few pieces of eggshell in a glass with hydrochloric acid solution. What does he observe?

- A) an effervescence is produced
- B) a blue precipitate is formed
- C) a green precipitate is formed
- D) a dark "smoke" is produced
- E) no change occurs



20. What optical instrument can be placed in point C , perpendicularly on the optical axis MN , such that A' is the image of the object A created by that optical instrument.

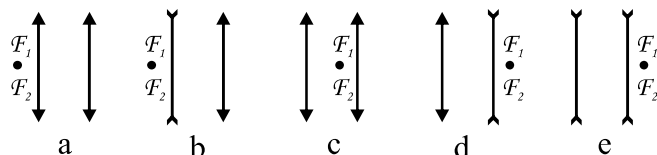


- A) a convergent lens
 - B) a concave lens
 - C) a flat lens
 - D) a divergent lens
 - E) a convex mirror
21. Bats are animals active at night. They have the following adaptation to the nocturnal life:
- A) Give birth to live pups and feed them with milk
 - B) Emit ultrasonic waves for orientation
 - C) Eat insects
 - D) Have a tail membrane to catch the pups
 - E) Have a four chamber heart

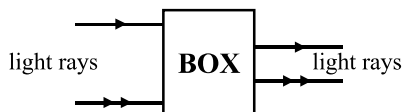


22. Which of the following represents a physical property?
- A) Iron rusts in moist air
 - B) Paper burns
 - C) Oxygen is a colorless gas
 - D) Copper oxidizes in moist air
 - E) Leaves rot

23. Which of the optical systems



can be placed in the following box, for parallel light rays to be transformed into parallel light rays.



- A) a B) b C) c
D) d E) e

24. The stomata are small pores which make water and gas exchange between the plant and the external environment. Lily is an aquatic plant for which stomata:

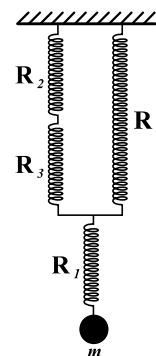


- A) are in smaller size on the upper side of leaf
B) are missing on the underside of leaf
C) are more numerous on the undersides of leaf
D) are missing on the upper side of leaf
E) are in smaller size on the underside of the leaf

25. What pair contains only natural materials?

- A) cement and beeswax B) wood and marble C) methane and glass
D) cork and plastic E) brick and concrete

26. The system from the figure consists of four resorts (R_1, R_2, R_3, R_4) having equal elasticity constants. We suspend a ball of mass m . What is the proper relationship between the springs' elongations $\Delta l_1, \Delta l_2, \Delta l_3$ and Δl_4 ?



- A) $\Delta l_1 < \Delta l_2 < \Delta l_3 < \Delta l_4$ B) $\Delta l_1 > \Delta l_2 > \Delta l_3 > \Delta l_4$
C) $\Delta l_1 > \Delta l_2 = \Delta l_3 > \Delta l_4$ D) $\Delta l_1 > \Delta l_4 > \Delta l_3 = \Delta l_2$
E) $\Delta l_1 < \Delta l_2 = \Delta l_3 + \Delta l_4$

27. Dolphin and shark are hydrophilic animals, adapted to the aquatic environment.

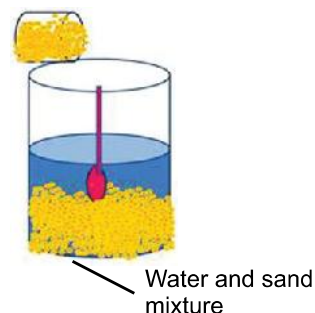
Their common character is:



- A) the presence of lacrimal glands
- B) feeding of pups with milk
- C) a constant temperature of the body
- D) breathing gills
- E) hydrodynamic body shape

28. Joana mixes 2g of fine sand and 8g of water. It is true that:

- A) the solution is 20% (w/w)
- B) the mass of the solution is 10g
- C) the dissolved mass is 2g
- D) the solution is 10% (w/w)
- E) sand does not form a solution in water



29. Consider P_1 and P_2 , two pieces of different masses, $m_1 > m_2$, made of the same material. The pieces are heated such that the volume expansions ΔV_1 and ΔV_2 are equal. Let Δt_1 , Δt_2 denote the resulting variation of temperature of P_1 and P_2 , respectively. Did the two pieces receive, during heating, the same amount of heat Q ?

- A) No, $Q_1 > Q_2$, because the first piece heats more
- B) No, $Q_1 < Q_2$, because the volume of the first piece is bigger
- C) Yes, $Q_1 = Q_2$ even if $\Delta t_1 > \Delta t_2$
- D) We can't specify because we don't know the specific heats of the pieces
- E) Yes, $Q_1 = Q_2$ because $\Delta t_1 = \Delta t_2$

30. Tenia is a flatworm parasite in the human small intestine. The parasite lifestyle caused these adaptations:

- A) well developed nervous system
- B) well developed sense organs
- C) well developed circulatory system
- D) well developed respiratory system
- E) well developed reproductive system

