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# QUESTION PAPER

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## ICATS SCIENCE CONTEST ADOLESCENTS (GRADE 9 & 10)

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TIME ALLOWED: 90 MINUTES

MAXIMUM MARKS: 90

TOTAL QUESTIONS: 30 MCQS

### INSTRUCTIONS

1. DON'T OPEN THIS BOOKLET UNTIL INSTRUCTED.
2. WRITE YOUR NAME, FATHER NAME, SCHOOL ETC AT THE BUBBLE SHEET ONLY.
3. RECORD ALL ANSWERS ON THE BUBBLE SHEET ONLY.
4. SELECT BEST ANSWER FROM THE FOUR GIVEN OPTIONS AND MARK ONLY ONE OPTION IN EACH QUESTION.
5. USE BLUE / BLACK INK TO FILL UP THE CIRCLES FOR YOUR ANSWERS ON THE BUBBLE SHEET.
6. USE OF ANY HELPING MATERIAL INCLUDING CELL PHONES AND ELECTRONIC DEVICES IS STRICTLY PROHIBITED.
7. EVERY CORRECT ANSWER EARNS THREE POINTS.
8. ONE POINT WOULD BE DEDUCTED FOR EVERY INCORRECT ANSWER.



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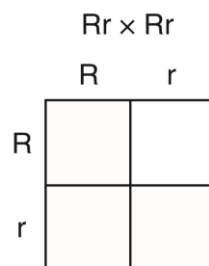
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**Q1. A prediction was made that the best conditions for earthworm growth occur when there are fewer than five earthworms per cubic meter of soil. This prediction is called a**

- A. law.
- B. theory.
- C. hypothesis.
- D. conclusion.

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**Q2. The diagram below represents a cross between two pea plants.**

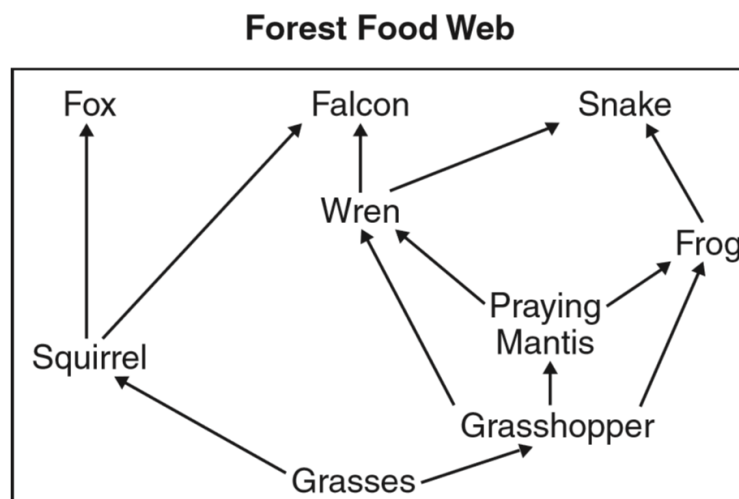


**In pea plants, the allele for round seeds (R) is dominant to the allele for oval seeds (r). In a cross between the two plants above, what percentage of the offspring will have round seeds?**

- A. 100%
- B. 75%
- C. 50%
- D. 25%

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**Q3. A forest-ecosystem food web is shown below.**



If additional wrens are introduced into this ecosystem, there will most likely be an immediate decrease in the

- A. frog population.
- B. snake population.
- C. falcon population.
- D. grasshopper population.

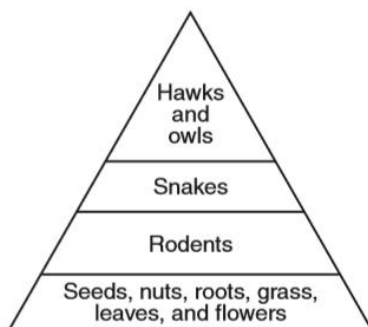
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**Q4. The table below contains information about animal diets.**

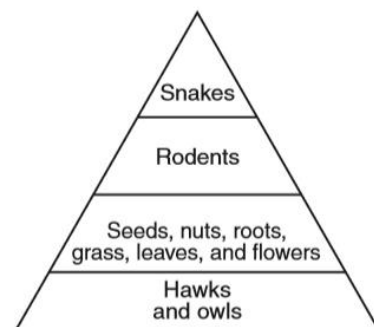
Animals	Diet
Snakes	Squirrels, chipmunks, gophers, and mice
Hawks and owls	Rodents and reptiles
Rodents	Seeds, nuts, roots, grass, leaves, and flowers

**Which energy pyramid best represents the data in the table?**

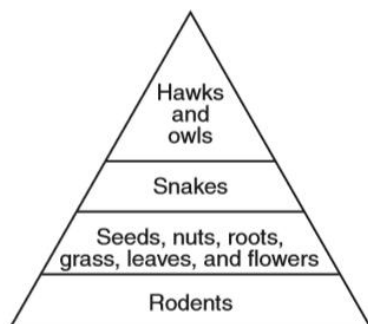
**A**



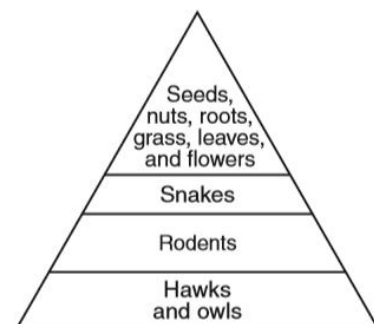
**C**



**B**



**D**



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**Q5. The diet of white-tailed deer consists primarily of shrubs. Sika are another species of deer that eat both grasses and shrubs. After an extended drought period, why might the sika population be favored over the white-tailed deer population?**

- A. Sika require less food than do the white-tailed deer.
- B. Sika require more water than do the white-tailed deer.
- C. Sika have more food sources than do the white-tailed deer.
- D. Sika have fewer food sources than do the white-tailed deer.

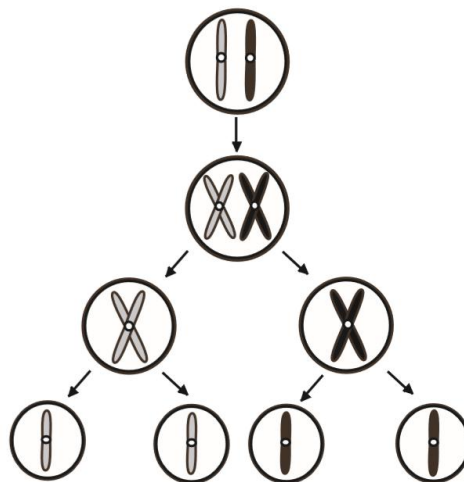
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**Q6. How do nutrients, absorbed by the small intestine, travel to the individual cells of the human body?**

- A. The nutrients are absorbed from the small intestine into the blood and move through the circulatory system to the body cells.
- B. The nutrients move from the small intestine directly to the liver and then move through the lymphatic system to the body cells.
- C. The small intestine forces the nutrients into the kidneys, where the nutrients are then dissolved in fluids used by the body cells.
- D. The body cells send nerve impulses indicating a lack of nutrients to the small intestine, and the small intestine sends the nutrients back to the cells.

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**Q7. The diagram below shows a cellular process that occurs in organisms.**



**This process is known as**

- A. meiosis.
- B. mitosis.
- C. endocytosis.
- D. phagocytosis

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**Q8. The table below lists the typical diploid number of chromosomes of several different organisms. Which of the following is the best explanation for why the chromosome number is an even number in each of these organisms?**

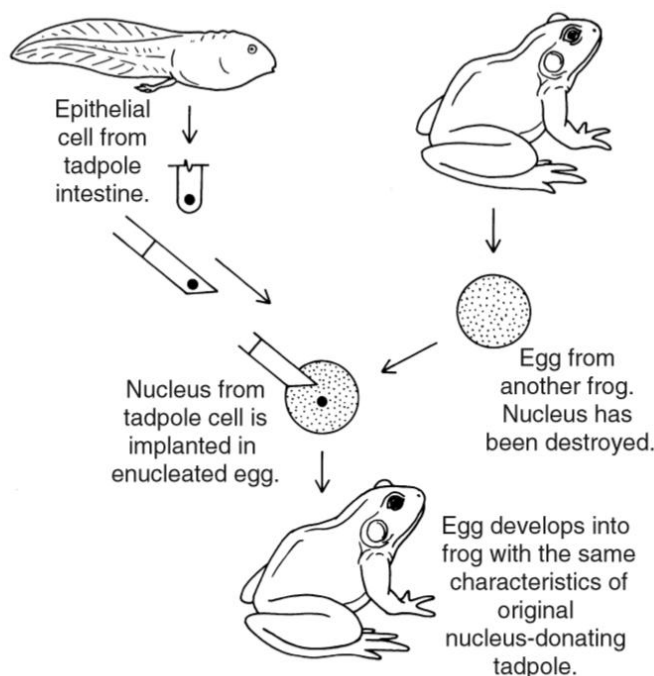
**Diploid Chromosome  
Number**

Goldfish	94
Potato	48
Human	46
Pea	14
Fruit fly	8

- A. It is only a coincidence; many other organisms have an odd number of chromosomes.
- B. The diploid chromosome number is always even so that when mitosis occurs each new cell gets the same number of chromosomes.
- C. The diploid chromosome number represents pairs of chromosomes, one from each parent, so it is always an even number.
- D. Chromosomes double every time the cell divides, so after the first division, the number is always even.

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**Q9. Which of these is best demonstrated by the experiment below?**



- A. Differentiated cells contain a complete set of genes.
- B. All frogs are genetically identical.
- C. Embryonic development is controlled by the cytoplasm.
- D. The nucleus of a tadpole cell is unspecialized.

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**Q10. There are many different enzymes located in the cytoplasm of a single cell. How is a specific enzyme able to catalyze a specific reaction?**

- A. Different enzymes are synthesized in specific areas of the cytoplasm.
- B. Most enzymes can catalyze many different reactions.
- C. An enzyme binds to a specific substrate (reactant) for the reaction catalyzed.
- D. Enzymes are transported to specific substrates (reactants) by ribosomes.

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**Q11. In a pond, the primary producer is a green alga, *Spirogyra*; the primary consumer is the crustacean, *Daphnia*; the secondary consumer is a small fish, the bluegill; and the tertiary consumer is a larger fish, the smallmouth bass. What changes can be expected in the pond if the *Daphnia* are killed with pesticides?**

- A. The *Spirogyra* population will probably die.
- B. The bluegill population will probably increase.
- C. The *Daphnia* population will eat something else.
- D. The smallmouth bass population will die.

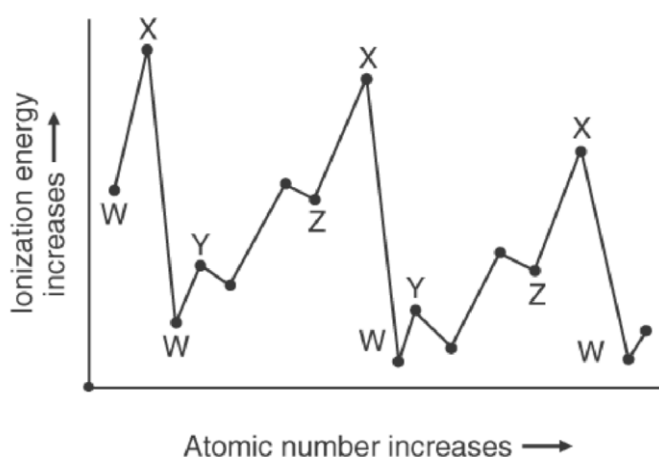
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**Q12. A population of termites initially consists of darkly colored and brightly colored members. After several generations, the termite population consists almost entirely of darkly colored members because the brightly colored termites are easier for a predatory species of insectivores to locate. This situation is an example of**

- A. the evolution of a new species.
- B. natural selection.
- C. artificial selection.
- D. adaptive radiation

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**13. The chart below shows the relationship between the first ionization energy and the increase in atomic number. The letter on the chart for the alkali family of elements is**



- A. W.
- B. X.
- C. Y.
- D. Z.

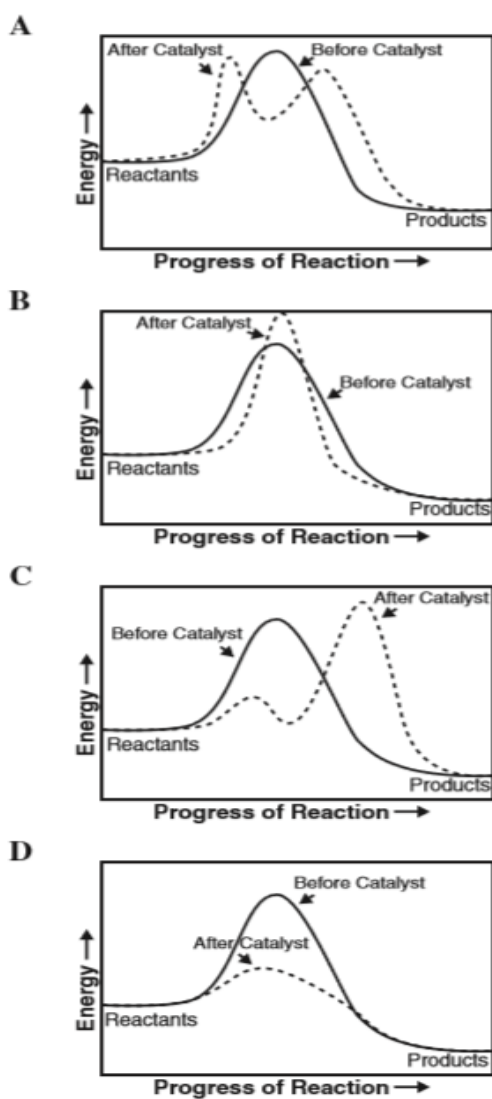
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**Q14.** If the solubility of NaCl at 25 °C is 36.2 g/100 g H<sub>2</sub>O, what mass of NaCl can be dissolved in 50.0 g of H<sub>2</sub>O?

- A. 18.1 g
- B. 36.2 g
- C. 72.4 g
- D. 86.2 g

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**Q15.** Which reaction diagram shows the effect of using the appropriate catalyst in a chemical reaction?

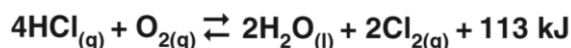


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**Q16. When a reaction is at equilibrium and more reactant is added, which of the following changes is the immediate result?**

- A. The reverse reaction rate remains the same.
  - B. The forward reaction rate increases.
  - C. The reverse reaction rate decreases.
  - D. The forward reaction rate remains the same.
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**Q17. Which action will drive the reaction to the right?**

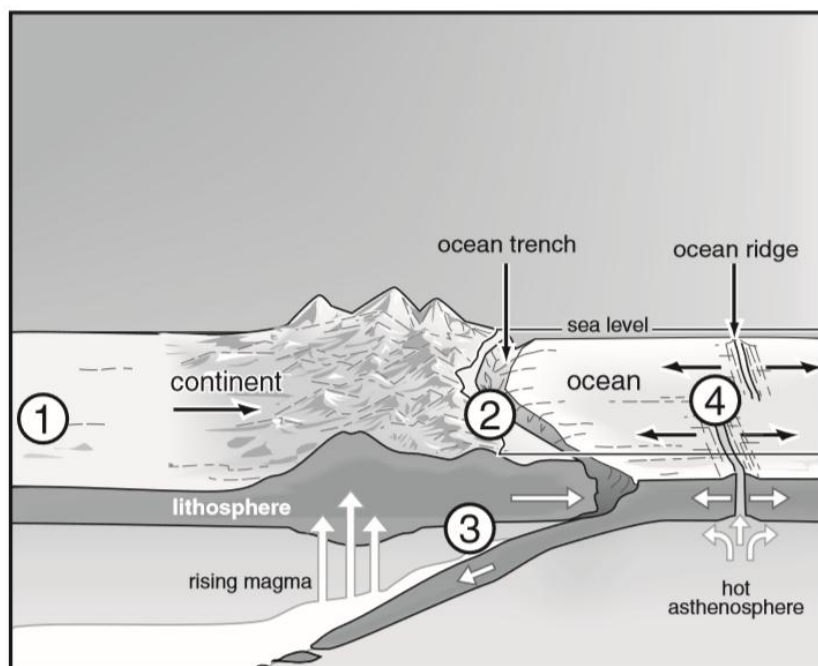


- A. heating the equilibrium mixture
  - B. adding water to the system
  - C. decreasing the oxygen concentration
  - D. increasing the system's pressure
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**Q18. The boiling point of liquid nitrogen is 77 kelvin. It is observed that ice forms at the opening of a container of liquid nitrogen. The best explanation for this observation is**

- A. water at zero degrees Celsius is colder than liquid nitrogen and freezes.
  - B. the nitrogen boils and then cools to form a solid at the opening of the container.
  - C. water trapped in the liquid nitrogen escapes and freezes.
  - D. the water vapor in the air over the opening of the liquid nitrogen freezes out.
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**Q19.**





At which location would earthquakes be least likely to occur?

- A. 1
- B. 2
- C. 3
- D. 4

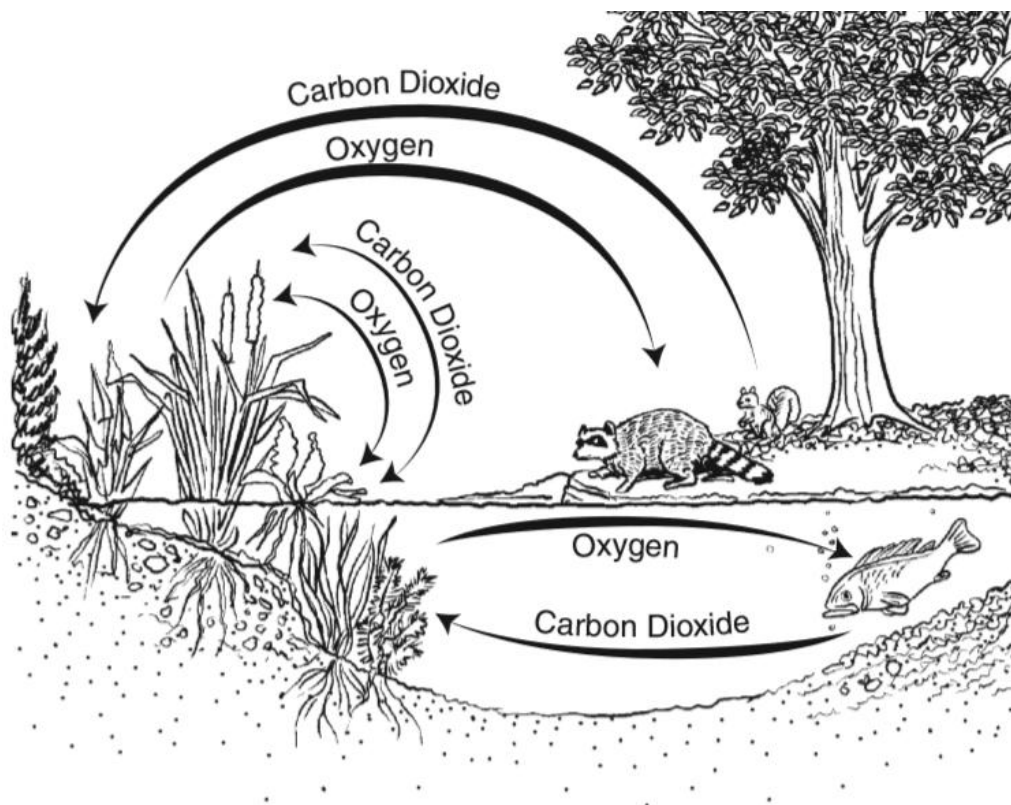
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**Q20. Only about 50% of the solar energy directed toward Earth penetrates directly to the surface. What happens to the rest of the radiation?**

- A. It is absorbed or reflected by the atmosphere.
- B. It loses energy traveling through space.
- C. It is reflected off the Moon and back into space.
- D. It loses energy overcoming the Sun's gravity.

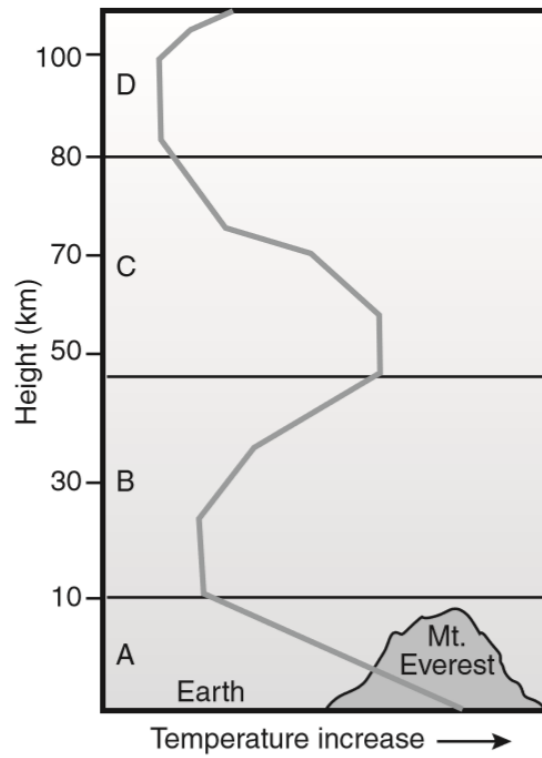
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**Q21. Which of these statements is best illustrated by this diagram?**



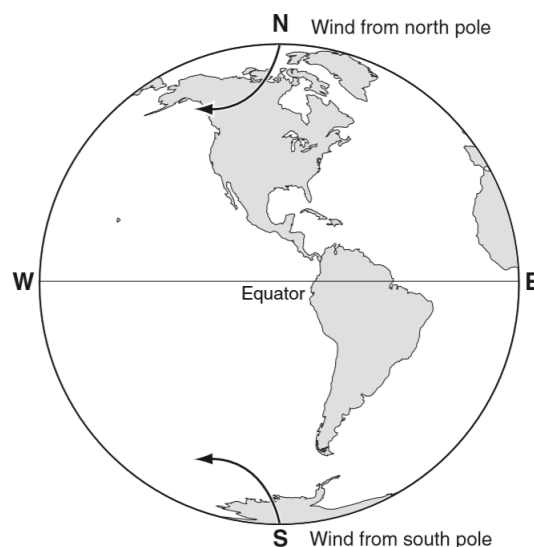
- A. Animals under water eat plants.
- B. Land animals exhale oxygen into water.
- C. Water-dwelling animals breathe carbon dioxide.
- D. Plants can take in carbon dioxide from air or water.

**Q22.** The diagram below shows four layers of Earth's atmosphere. Which of the following correctly labels the layers represented by A, B, C, and D (from Earth moving upward) in the correct sequence?



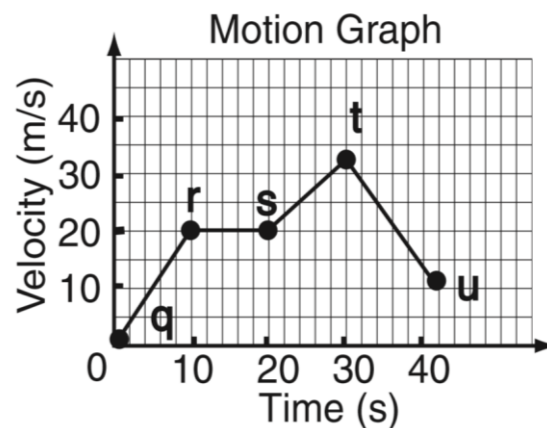
- A. troposphere, stratosphere, mesosphere, thermosphere
- B. thermosphere, mesosphere, stratosphere, troposphere
- C. troposphere, mesosphere, thermosphere, stratosphere
- D. mesosphere, troposphere, thermosphere, stratosphere

**Q23.** What causes the wind deflection from the north and south poles?



- A. the rotation of Earth on its axis
- B. the oblate shape of Earth
- C. the tilt of Earth's axis relative to its orbital plane
- D. the difference in total land mass of the two hemispheres

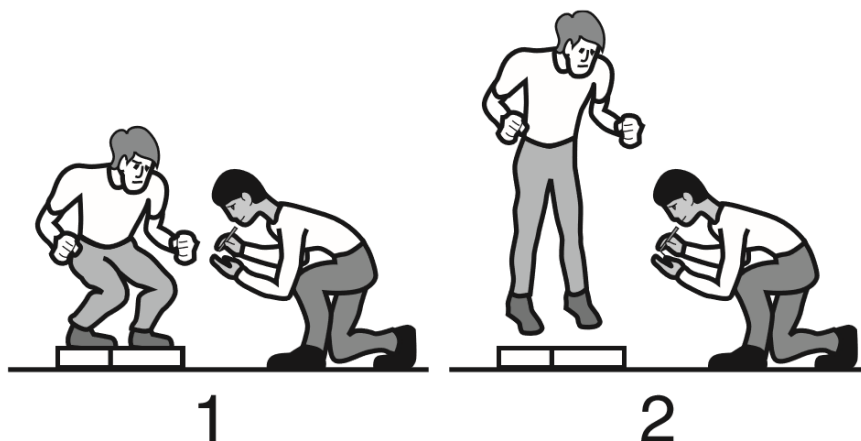
**Q24. The graph below shows the velocity of a car that is moving in a straight line.**



**During which of the following intervals are forces on the car balanced?**

- A. q to r
- B. r to s
- C. s to t
- D. t to u

**Q25. A student in a lab experiment jumps upward off a common bathroom scale as the lab partner records the scale reading.**



**What does the lab partner observe during the instant the student pushes off?**

- A. The scale reading will remain unchanged during the entire time the student is in contact with the scale.
- B. The scale reading will increase momentarily then will decrease as the student is moving upward from the scale.
- C. The scale reading will increase during the entire time the student is in contact with the scale.
- D. The scale reading will decrease momentarily then will increase as the student is moving upward from the scale

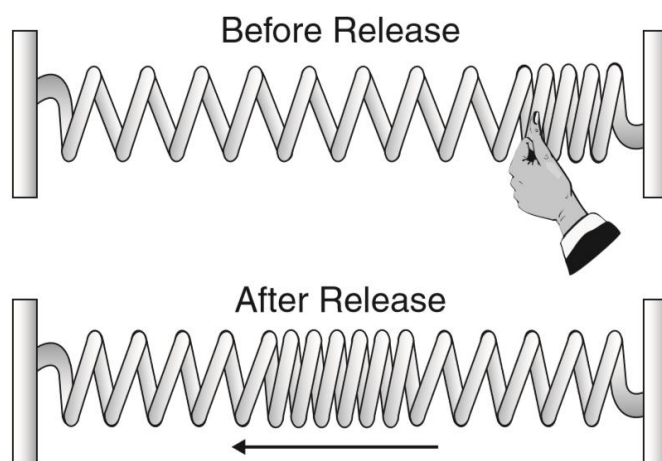
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**Q26. A proposed ideal heat engine would run with a high temperature reservoir at 800 kelvin and a low temperature reservoir at 300 kelvin. When the engine is running, it extracts 400 joules of energy from the hot reservoir and does 250 joules of work each minute. How much energy is expelled to the low temperature reservoir each minute?**

- A. 150 J
- B. 250 J
- C. 300 J
- D. 400 J

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**Q27. A stretched spring attached to two fixed points is compressed on one end and released, as shown below.**

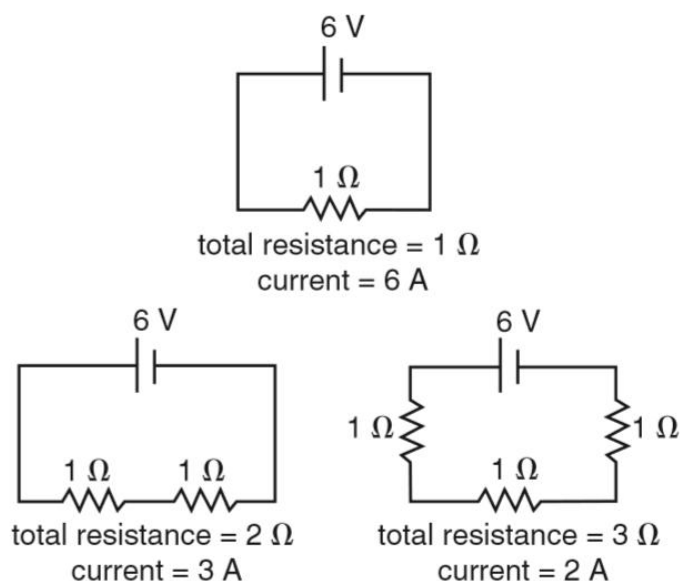


**The resulting wave travels back and forth between the two fixed ends of the spring until it comes to a stop. This mechanical wave is an example of a**

- A. Transverse wave.
- B. longitudinal wave.
- C. Super positioned wave.
- D. refracted wave.

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**Q28. How many amperes of current will flow when four 1-ohm resistors are in this series circuit**



- A. 0.5 ampere
- B. 1.0 ampere
- C. 1.5 amperes
- D. 2.0 amperes

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**Q29. Two oppositely charged particles are held in place near each other. When the particles are released, they will most likely**

- A. accelerate away from each other.
- B. accelerate toward each other.
- C. rotate in a clockwise direction.
- D. rotate in a counterclockwise direction.

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**Q30. An engineer in a moving train blows the train's horn. The train is moving away from a person standing on the ground. Compared to the frequency of the sound that the engineer hears, the person standing on the ground hears a sound with**

- A. the same wavelength.
  - B. more variation in tone.
  - C. greater amplitude.
  - D. a lower frequency.
-



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