SYENSIYA-**bilidad**

Enrichment Program to Improve the Quality of Feeders to S & T Human Resource Development

Developing **O**ne's **S**kills in **T**est-taking

SCIENCE EDUCATION INSTITUTE
Department of Science and Technology
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SYENSIYA-bilidad
D*eveloping* ***O****ne's* ***S****kills in* ***T****esting*

Enrichment Program to Improve the Quality of Feeders to S&T Human Resource Developmen

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FOREWORD

The Department of Science and Technology (DOST) through the Science Education Institute (SEI) is very happy to provide you with *SYENSIYA-bilidad*. This review material was designed to help you remember and master the skills and concepts needed to pass the DOST- SEI Undergraduate Scholarship Examination.

SYENSIYA-bilidad, as a concept, centers on DOST's focus on the teaching and learning of science, technology and mathematics and all related sciences. It reflects our commitment to assist as many promising high school students as possible in their desire to become one of our scholars. It is our goal at DOST to have the most deserving Filipino students as scholars who will eventually join the pool of scientists and engineers in the country. Through this review material, we hope that you may have better chances of being one of them.

Happy learning! Be a DOST scholar!

FILMA G. BRAWNER, Ph.D.
Director

ABOUT THIS MATERIAL

This review material is based on the "Primer for the DOST-SEI Aptitude Test Battery for Science and Technology Courses" and contains questions on Biological Science, Physical Science, Mathematics and Linguistics. The questions are grouped into two: Intellective Speed Test and Intellective Power Test.

Questions measuring Intellective Speed require answers under time pressure. This test has three sections: a) working memory, b) sensorimotor, and c) inspection. Items under this category help you practice mental alertness, precision and accuracy of your thoughts and actions. To obtain the best results when taking a test under time pressure, you must maintain your composure at all times.

The Intellective Power Test, on the other hand, allows you a longer period of time to give your answers. This part has five sections: a) scientific ability, b) quantitative ability, c) mechanical-technical ability, d) imagery, and e) linguistic ability. Items on this category expose you to problems that will measure your cognitive abilities in applying scientific skills, mathematical and numerical concepts, and understanding mechanical relationships. Similarly, you will also be exposed to test items which measure your ability to visualize and transform images. Finally, the linguistic items are focused on measuring your understanding and application of the rules of language arts.

To further help you, explanations to the correct answers are provided for better understanding.

Good Luck.

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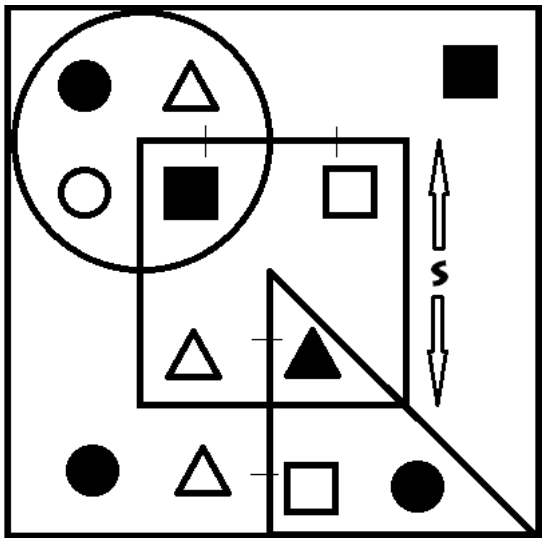
PART I: Intellective Speed Test

I.A. WORKING MEMORY

The following items aim to test your ability to hold as many parts of a complex figure and/or verbal stimuli at one time. You will be given one (1) minute to study each figure and will be required to answer multiple choice questions without looking at the stimuli. It must be noted that the following items do not only require rote memorization of relative positions of symbols but require analysis and utilization of previously-taught concepts. Shade the letter of the **BEST** answer on your answer sheet.



1. How many shaded polygons are inside the largest square?
   A. 3 B. 4 C. 5 D. 6

2. What figure is inside both the circle and the smaller square?

   A ■ B △ C □ D ▲

3. What is the area of the bigger circle?
   A. $A = \pi s^2$ B. $A = \frac{1}{2}\pi s^2$ C. $A = \frac{1}{4}\pi s^2$ D. $A = 2\pi s^2$

4. What is the area of the bigger right triangle?
   $A = s^2$ B. $A = \frac{1}{2}s^2$ C. $A = \frac{1}{4}s^2$ D. $A = 2s^2$

5. What is the perimeter of the largest square?
   $P = 2s$ B. P= $4s$ C. $P = 6s$ D. $P = 8s$

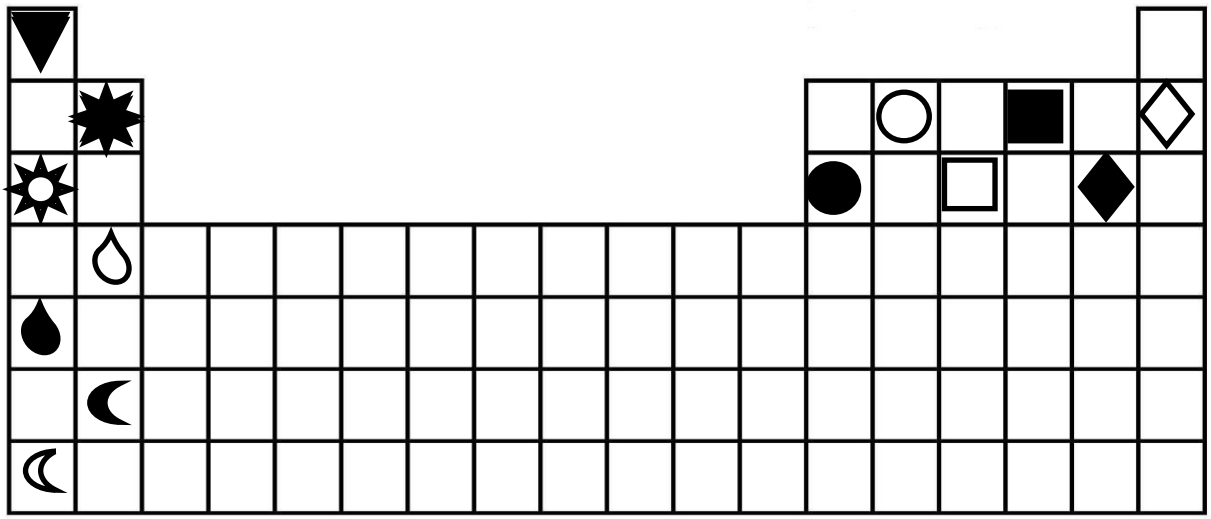
6. The sequence of metallic elements in Planet X represents **INCREASING** reactivity. Which of the following single-replacement reactions is IMPOSSIBLE to occur?

Fs	Ru	Io	Ge	Hg	Ta	Er	Nu	Eo	Dc
Fussium	Rulenium	Iowanium	Gelium	Hygronium	Talanum	Erium	Nuptium	Emonium	Ducarium

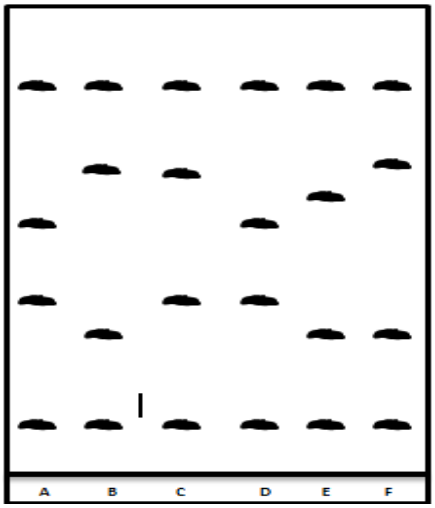
A. $Ge_3Re_2 + 3Nu^{2+} \rightarrow Nu_3Re_2 + 3Ge^{2+}$
B. $Hg_2Xr + 2Ge^{+} \rightarrow Ge_2Xr + 2Hg^{+}$
C. $2IoJz + Ta^{2+} \rightarrow TaJz_2 + 2Io^{+}$
D. $3Er_2Mc + 2Eo^{3+} \rightarrow Eo_2Mc_3 + 6Er^{+}$

7. Consider the periodic table with hypothetical elements shown below. Which of the following could be combined with metallic element ♥$^{2+}$ to produce the ionic compound ♥$_2$ ▬ ?

A. ◇ B. ✸ C. ■ D. ○

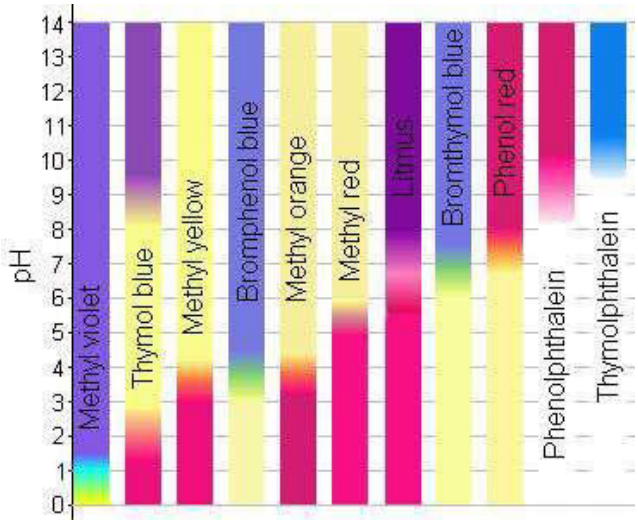


8. Chromatography is a method of separating components of a mixture through elution of the sample dissolved in a mobile phase along a stationary phase such as a filter paper. The previous figure shows chromatographic profile of six black ball pen inks. Which of the following pairs represent the same brand?



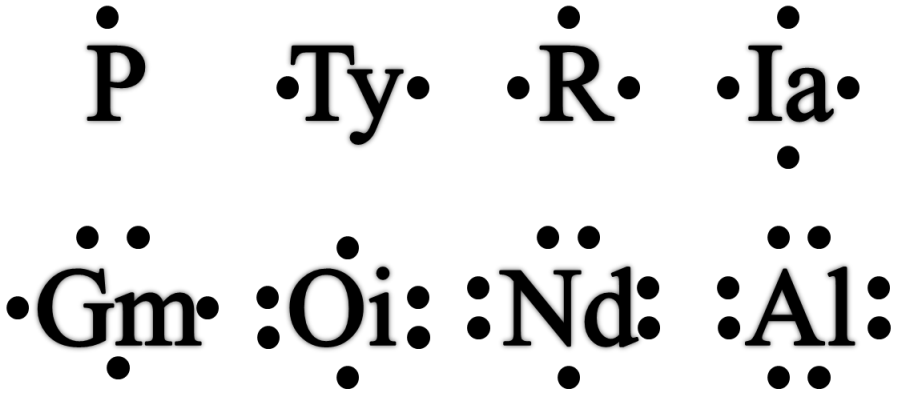
A. B and C B. C and E C. A and D D. B and F

9. Acid rain is one of the most common ecological problems that directly affect growth of crops and economic productivity of a region in general. Shirley, a fourth year student from Central Luzon wishes to test the pH level of soil in their rice farm to determine if it is suitable for the rice with preferred pH 5.5-6.5. After raining, she collected soil samples and brought it to laboratory for testing. Which of the following indicators should she use?

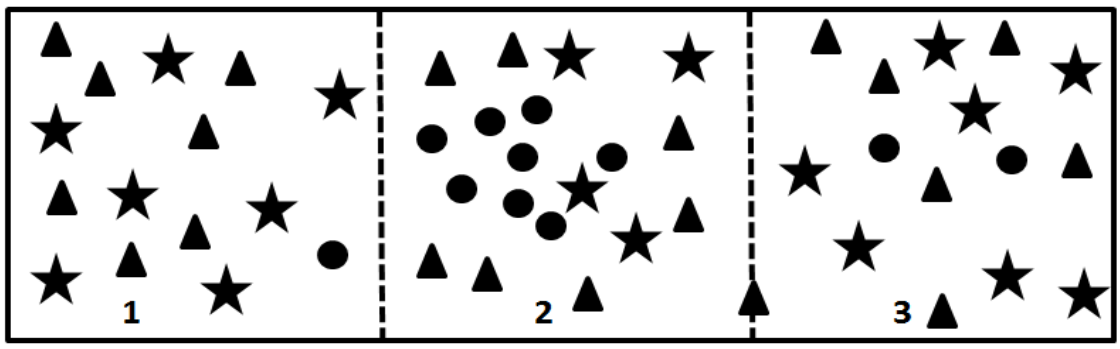


A. Thymolphthalein
B. Bromphenol blue
C. Methyl violet
D. Methyl red

10. Which among the previously presented hypothetical elements, if combined with Hydrogen, can form a stable molecule with a trigonal pyramidal geometry?



A. Gm B. Nd C. R D. Oi



FOR ITEMS 11-13

The figure shown above represents an ecosystem with three distinct regions as indicated by the broken line. The shapes found in the ecosystem represent the different living organisms: circle for beetle, star for mango tree, and triangle for bird.

11. Which region of the ecosystem produces the most heat?

A. 1
B. 2
C. 3
D. Mango trees are evenly distributed in all three regions.

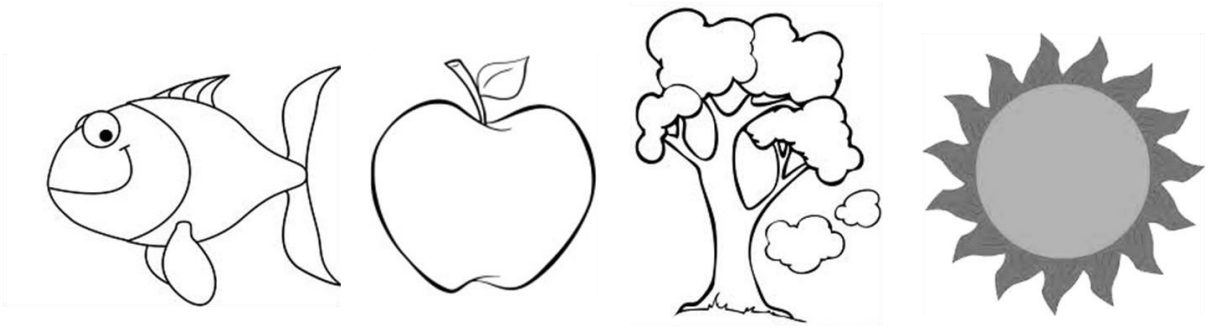
12. What could account for the species distribution in image 1?

A. The birds dominate the others.
B. The beetles died because of starvation.
C. The birds preyed on the beetles.
D. Mango trees in image 1 do not produce as much fruit as the others in images 2 and 3.

13. Which two ecosystems have the same number of any two organisms?

A. 1 and 2
B. 2 and 3
C. 1 and 3
D. The population size of organisms in each region is different.

FOR ITEMS 14 and 15



A B C D

14. What is the role of the third figure in a food chain?

A. Primary consumer
B. Producer
C. Secondary consumer
D. Tertiary consumer

15. Which two images belong to the same trophic level?

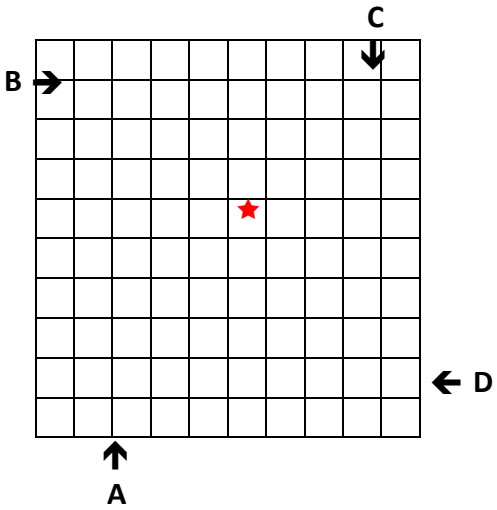
A. First and second
B. Second and third
C. Third and fourth
D. First and fourth

I.B. SENSORIMOTOR

The following items will test your ability to focus and sustain attention, maintain perceptual vigilance in a stimulus-discrimination task, and to follow directions in a two-dimensional space with speed, accuracy and precision. Shade the letter of the BEST answer on your answer sheet.

FOR ITEMS 1-3

Consider 4 robots A, B, C, and D facing in the direction indicated by the arrows. The robots are programmed to move along the segments in the following sequence of steps: move 2 units forward then turn right and move one unit then turn left and move one unit then turn right and move 2 units then turn left and move 3 units.



1. Which robot will pass the point marked ★ first?

   A. robot A B. robot B C. robot C D. robot D

2. Which robot will land exactly on the point marked ★?

   A. robot A B. robot B C. robot C D. robot D

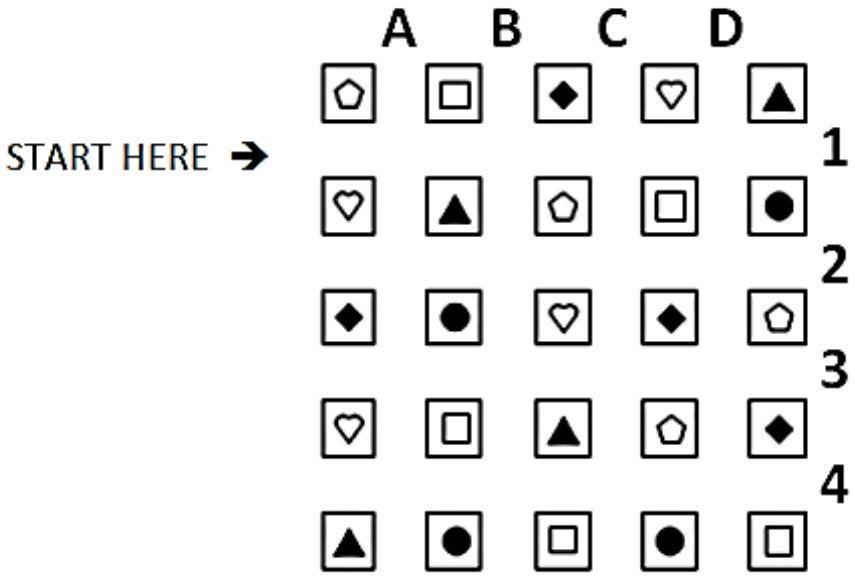
3. Which robot will NOT pass the point marked ★?

   A. robot A B. robot B C. robot C D. robot D

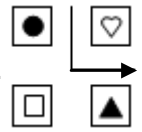
FOR ITEMS 4-5

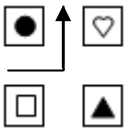
Consider the spaces between squared objects as pathways. Follow the rules specified below.

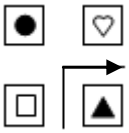
> *If you meet a shaded circle on your RIGHT, turn LEFT after passing it; if you meet either an unshaded triangle or unshaded square on your LEFT, turn RIGHT after passing it; otherwise keep going straight.*

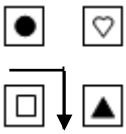


4. Which best represents the direction you took at the intersection B3?

A. 

B. 

C. 

D. 

5. Which is the last intersection traversed before leaving the pathway?

A. D1 B. D2 C. D3 D. D4

Below is a map of Batangas province. You are in for a long – weekend vacation with your family. You are about to take a long ride from Manila to Batangas. Inspect the map and the path that you will take and follow the directions below:

You are to inspect the road map from Sto. Tomas to Nasugbu. The red line marks the main road. There are only 4 stops for the trip - Lipa, Batangas City, Taal, and Balayan. For each stop, cut and use the ruler below to draw and estimate the resultant vector from the initial or previous stop.

Figure 1: http://www.google.com.ph/imgres?q=map+of+Southern+tagalog+region&hl=tl&client=firefox-a&rls=org.mozilla:en-US:official&biw=1024&bih=447&gbv=2&tbm=isch&tbnid=qh6Y3XTu9r-xkM:&imgrefurl=http://www.batangasnow.com/citiesdistricts.html&docid=mpxxlsgg6AjKIM&

6. Which of the following best represents the resultant vector from Sto. Tomas to Lipa City?

A.

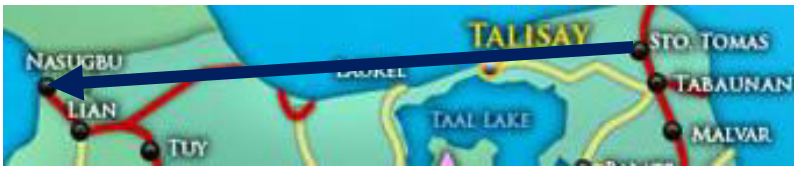
C.

B.

D.

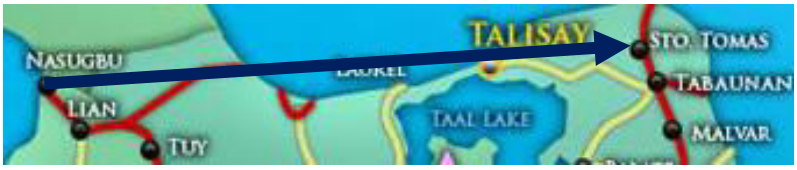
7. Which of the following best represents the total resultant vector of the whole trip?

A.



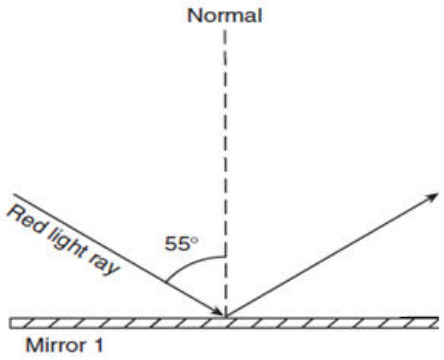
B.

C.



D.

8. Below is an illustration of a light ray incident to the mirror at 55°. You will be given 2 additional mirrors. You are to position the second mirror perpendicular to the first mirror (Mirror 1). Then place the third mirror perpendicular to the second. How many mirrors are needed to attain a final incident and reflected angles equal to 55°?



A. 2 mirrors B. 3 mirrors
C. 4 mirrors D. 5 mirrors

9. What must be the angles between the succeeding mirrors to complete the task required?
A. 35° B. 45° C. 55° D. 90°

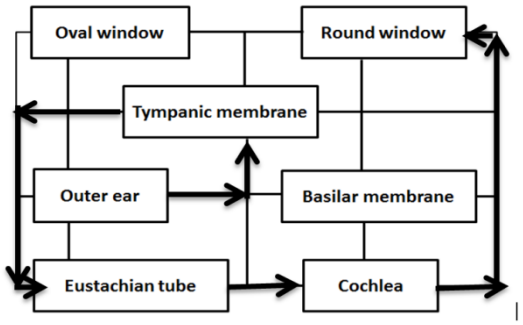
10. Below are illustrations of the idealized model of the thermodynamic processes in a gasoline engine. This is not arranged according to sequence. Your task is to arrange the strokes to complete the otto-cyle. Do this by placing the corresponding number according to sequence. Which stroke comes after the power stroke in the complete thermodynamic cycle?

A. Compression Stroke C. Intake Stroke
B. Exhaust Stroke D. Spark Stroke

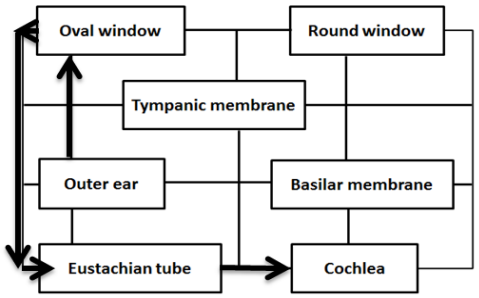
FOR ITEMS 11-13

11. Sound waves are received by our ears which enable us to hear. If you were to trace the path of sound waves into the ear, what of the following diagrams will accurately represent the pathway taken by these waves starting from the outer ear?

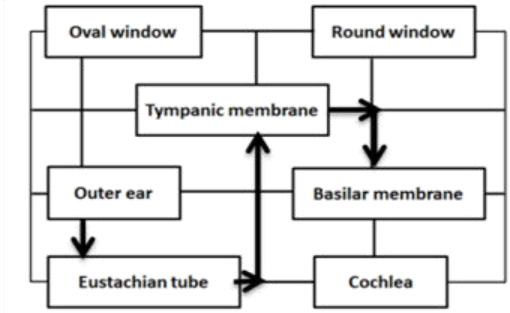
A.



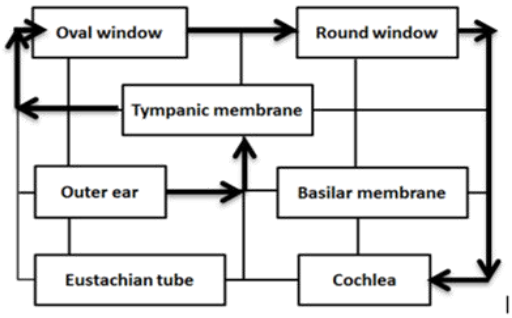
C.



B.

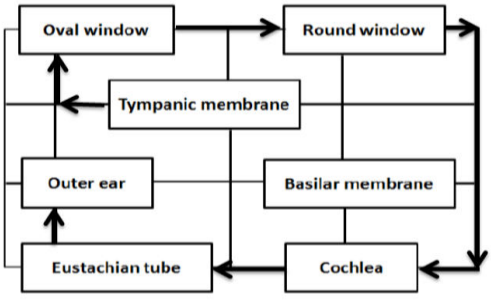


D.

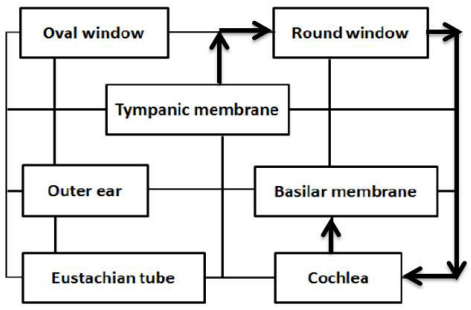


12. What is the correct sequence of parts to represent the pathway of sound waves to the basilar membrane starting from the tympanic membrane?

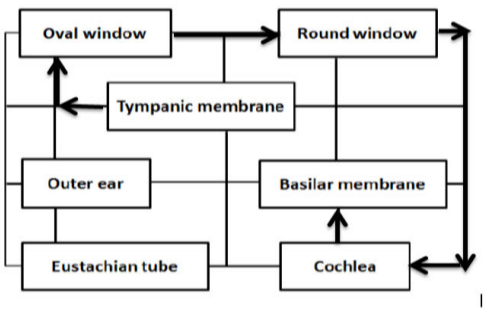
A



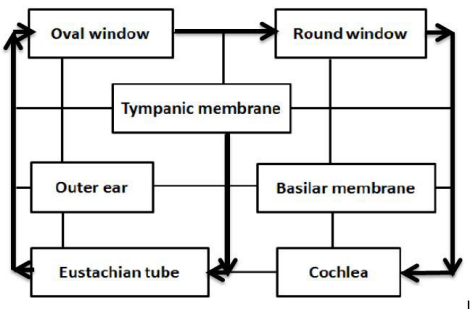
C



B



D

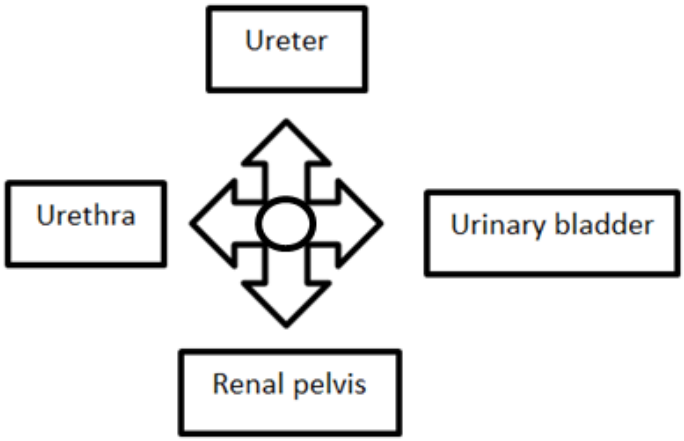


13. Which part will you ***NOT*** pass through in receiving sound waves starting from the outer ear?

    A. Basilar membrane
    B. Cochlea
    C. Eustachian tube
    D. Round window

For items 14 and 15

The diagram below shows the parts of the urinary system that are positioned on the four cardinal directions. Refer to this diagram in answering items 4 and 5.



14. If you were to trace the path of urine through the urinary system, what pathway would you take based on the given figure? Begin with the circle on the diagram.

    A. south, north, southwest, east
    B. south, west, northeast, southeast
    C. south, north, east, west
    D. south, east, north, west

15. If the urine is in the urinary bladder, what pathway would it take to get to the urethra?

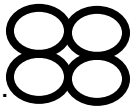
    A. Southeast, east
    B. South, north, east
    C. northeast
    D. West

PART I: Intellective Speed Test

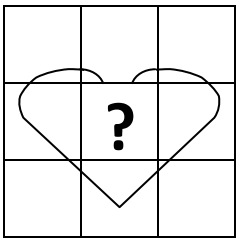
I.C. INSPECTION

This is a test that will measure your capability to quickly detect differences and similarities of different choices with given stimuli. Shade the letter of the BEST answer on your answer sheet.

1. What is the next figure in the sequence?

A.  B.  C.  D. 

2. Which of the following will best complete the indicated closed figure?



A.  B.  C.  D. 

3. Which of the following is a mirror image of the given figure along the dotted line?

A.  B.  C.  D. 

4. Which of the following figures is different from the others?

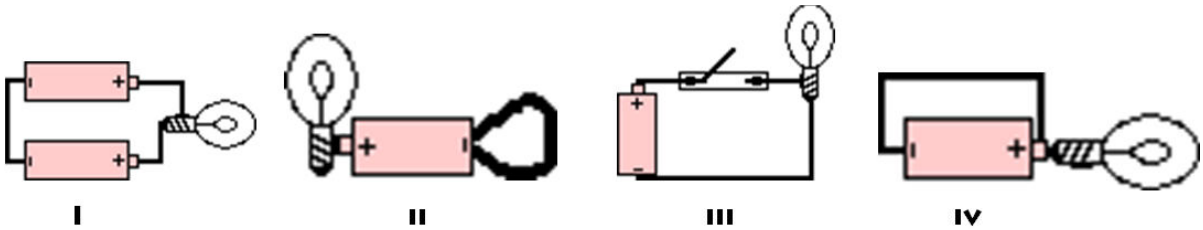
A.  B.  C.  D. 

5. Determine which of the choices in Column II is exactly the same as the stimulus in Column I.

Column I	Column II
YyYWwwOOo **♣♦♥♣♠♦♥** **100100010000**	A. **YyYWwwOOo** **♣♦♥♣♠♦♥** **10001000100** B. **YyYWwwOOo** **♣♦♥♣♠♦♥** **100100010000** C. **YyYwWwOOo** **♣♦♥♣♠♦♥** **100100010000** D. **YyYWwwOOo** **♥♦♣♠♥♦♣** **100100010000**

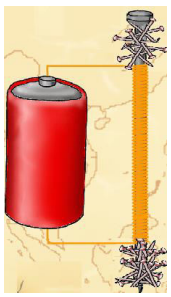
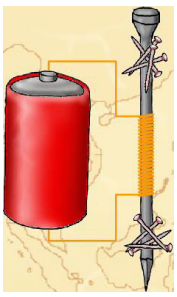
A. B B. D C. A D. C

6. If the battery voltage ratings are identical, which of the following circuits will NOT allow the flow of electrons?



A. II only B. II and III only C. I, II, III D. II, III, IV

7. Which of the following DO NOT give approximate number of nails attracted to an electromagnet having different turns?

A.  B.  C.  D. 

8. Below is the Electromagnetic Spectrum (EM) and the Color spectrum. When these are viewed from a plane mirror and the resulting image is again viewed from another plane mirror, which one will be exactly the same as the resulting image?

RWMWIRVL(ROYGBIV)UVXRGR

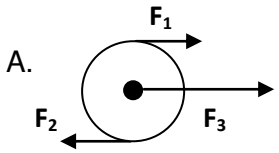
A. **RWIRMWVL(ROYGBIV)XRUVGR**

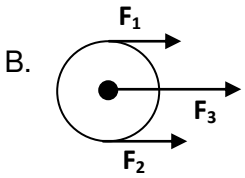
B. **GRXRUV(ROYGBIV)VLIRMWRW**

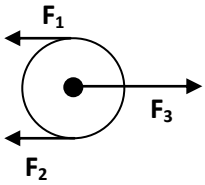
C. **RWMWIRVL(VIBGYOR)UVXRGR**

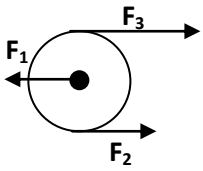
D. **RWMWIRVL(ROYGBIV)UVXRGR**

9. $\mathbf{F_1}$ and $\mathbf{F_2}$ have the same magnitude while $\mathbf{F_3}$ is twice as $\mathbf{F_1}$. Which of the following configuration of forces $\mathbf{F_1}$, $\mathbf{F_2}$, and $\mathbf{F_3}$ will make the ball attain static equilibrium?

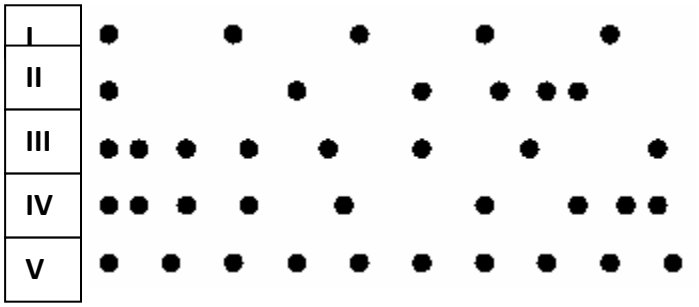
A. 

B. 

C. 

D. 

10. Five motion diagrams in which points represent the positions of an object at equal time intervals are shown below. Which statement is correct about the objects?

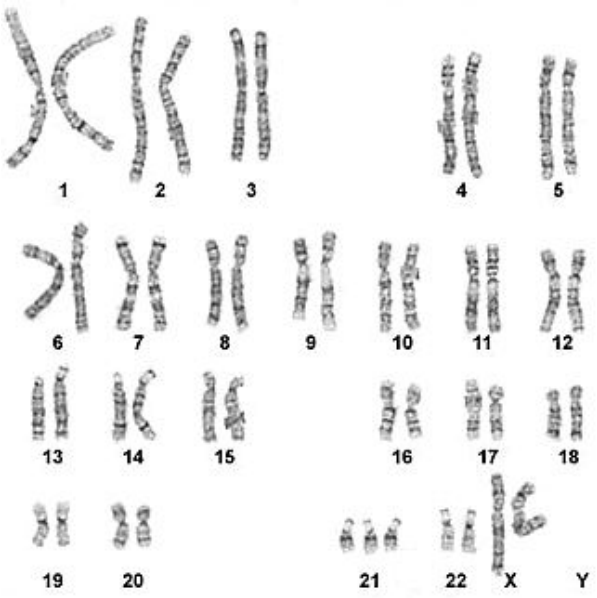


A. III has decreasing speed
B. V speeds up and then slows down
C. IV speeds up and then slows down
D. I has the greatest speed and the greatest acceleration

11. DNA sequence **ATGCAAGTCAACCGTA** was speculated to have caused a very rare disease that is manifested by the presence of a complement mRNA sequence. Which is the transcript formed from the previous sequence?

A. ATGCAAGTCAACCGTA
B. UACGUUCAGUUGGCAU
C. TACGTTCAAGTGGCAT
D. UACGUCCAUGUGGCAU

12. Assess the given karyotype.



A. The subject is male, having 2 sets of chromosomes.
B. The subject is female with 2 sets of chromosomes.
C. The sex of the subject is unknown; abnormality due to missing Y chromosome.
D. The subject is female with an extra chromosome at 21.

13. Which age pyramid shows instant success in breeding of endangered species?

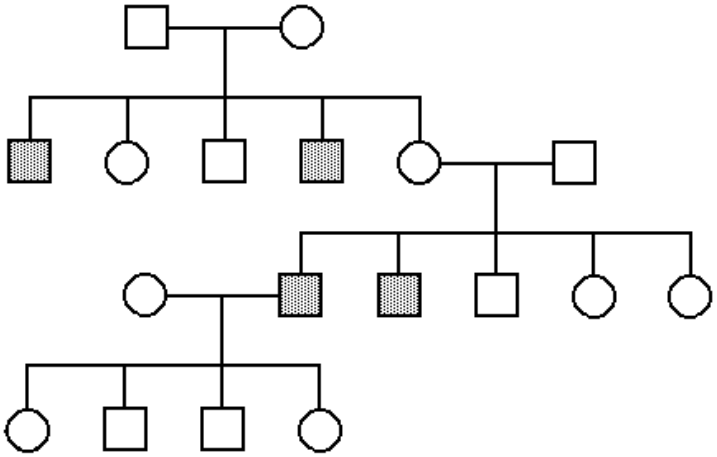
A. 

C. 

B. 

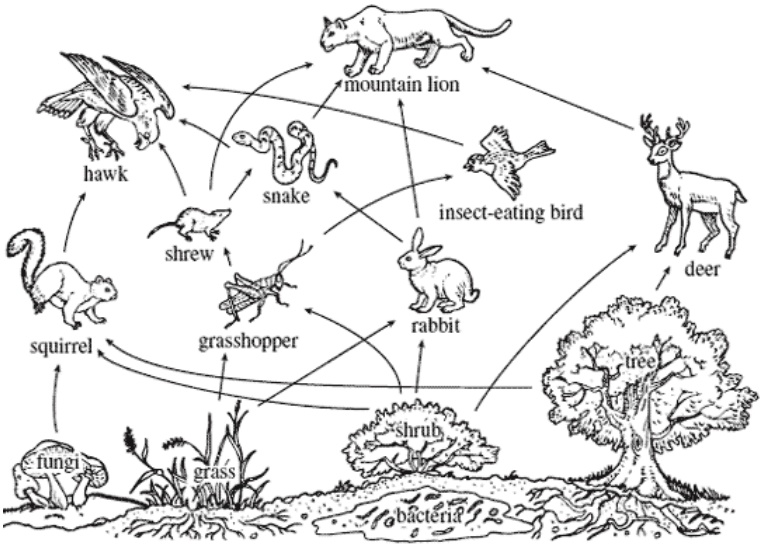
D. 

14. The diagram below shows a four-generation pedigree of a family. Some members are afflicted with a certain sex-linked disease. What can be said about the nature of the gene causing the disease?



A. Y-linked and recessive
B. X-linked and recessive
C. X-linked and dominant
D. Limited to females only

Below is a diagram of a food web in a terrestrial environment.



15. Which organisms serve as a secondary consumer and a final consumer at the same time?

A. mountain lion and hawk
B. hawk and deer
C. mountain lion and snake
D. squirrel and hawk

PART II: Intellective Power Test

II.A. SCIENTIFIC ABILITY

The following items focus on areas of concept formation, critical thinking, logical reasoning, pattern recognition, simplicity of explanation, objectivity of observation, planning and organization and research problem generation. Shade the letter of the BEST answer on your answer sheet.

1. What is the next number in the sequence? 1, 1, 2, 3, 5, 8, 13, 21, 34, ___

   A. 45 B. 47 C. 55 D. 57

2. What is the missing element in the sequence? J, 30, J, ___, A, 31, S, 30, O, 31, N, 30

   A. 29 B. 30 C. 31 D. 32

3. What are the missing elements in the sequence? E, 5, I, 9, O, ___ , ___ , 21

   A. 15, U B. 17, 13 C. 13, 17 D. U, 15

4. Suppose MIMI is more than MOMO and MOMO is less than MEME. Which statement is true about MIMI?

   A. It is less than MEME.

   B. It is more than MEME.

   C. It is the same as MEME.

   D. It cannot be compared to MEME.

5. Suppose all teachers are good-natured. If Lizza is a teacher, what can be said about her character?

   A. Lizza is good-natured.

   B. Lizza may not be good-natured.

   C. Lizza cannot be good-natured.

   D. Lizza is not good-natured.

6. Suppose some mathematicians are physicists. If all physicists are scientists then which statement is true about mathematicians?

   A. All mathematicians are scientists.

   B. Some mathematicians are scientists.

   C. Mathematicians cannot be scientists.

   D. Mathematicians are not scientists.

7. Suppose all squares are rhombi. If all squares are rectangles as well then which statement is true about rectangles?

   A. All rectangles are rhombi.

   B. No rectangle is a rhombus.

   C. Some rectangles are rhombi.

   D. Rectangles and rhombi are not related.

8. The quantity of bacteria b present in an organism after time t (in hours) is given by the equation $b = b_0(3^{-2t})$, where b_0 is the initial number of bacteria. How many bacteria are present after one hour if the initial number of bacteria is 2700?

   A. 24,300 B. 900 C. 300 D. – 900

9. A certain scale for weighing registers a mass of only 6 kg. A person who wants to know the weight of one package each of chicken, beef, and pork weighed every possible pair of these packages and got the following results. The chicken and the beef weighed 7 kg. The chicken and the pork weighed 8 kg. The beef and the pork weighed 9 kg. What is the weight of the package of pork?

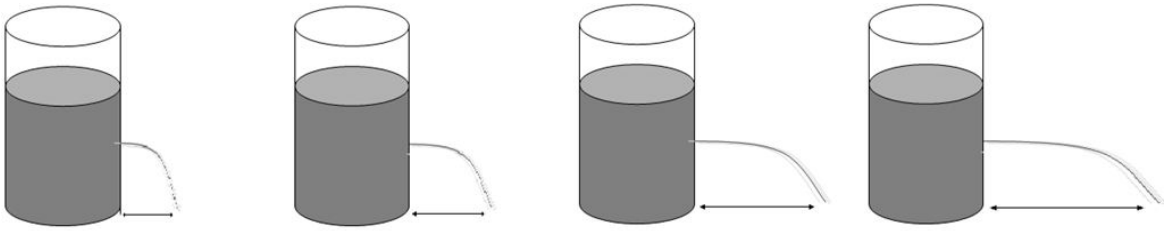
   A. 2 kg B. 3 kg C. 4 kg D. 5 kg

10. The radius of a big wheel is 1.5 feet. If the wheel rotates at a full rate of 1,760 revolutions per minute, how many miles will a point at the tip of a blade travel in one hour? (1 mile = 5,280 feet)

    A. 40π B. 45π C. 48π D. 60π

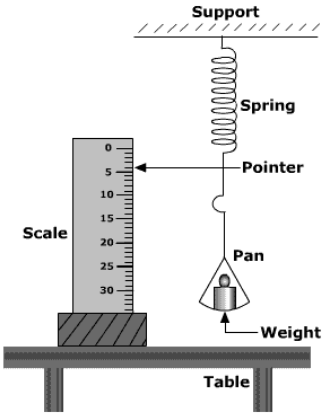
11. Equal amounts of freshwater, seawater, ethyl alcohol and oil are in identical containers with hole in each side as shown in the figure below. Which among the containers contains oil? (densities of different liquids: d_{oil} = 924 kg/m^3 , $d_{seawater}$ = 1025 kg/m^3 , d_{water} = 1000 kg/m^3 , $d_{ethyl\ alcohol}$ = 789 kg/m^3)

A B C D

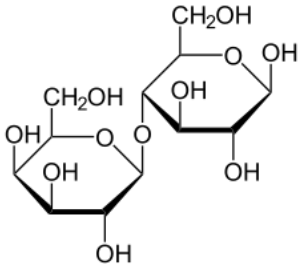


12. In which of the following places will the Hooke's Law set up measure the longest elongation?

A. Earth
B. Moon
C. Jupiter
D. Same anywhere



13. Most Asians cannot digest lactose, a disaccharide found in milk and dairy products, due to lack of enzyme called "lactase." This sugar then stays in the intestine and cause loose bowel movement (LBM). Which of the following statements BEST explains occurrence of this symptom?



Molecular structure of Lactose

A. Lactose, being a carbohydrate is processed by bacteria in the intestines which facilitates their growth. These bacteria then cause LBM.

B. Loose bowel movement is a form of excretion mechanism of lactose intolerant people to get rid of a nutrient that their body could not process.

C. Lactose irritates the lining of the intestines which allows release of water to flush them out of the digestive system that causes LBM.

D. Lactose, when undigested can form extensive hydrogen bonds with water in the intestines leading to watery stool.

14. Below are different samples of liquid and their respective specific gravity. If you place these liquids in a big and long glass container, which liquid will settle at the bottom?

Material	Specific Gravity
Maple syrup	**1.37**
Light Karo syrup	**1.33**
Water with food coloring	**1.00**
Glycerin (colorless)	**1.26**
Vegetable oil	**0.91**
Diswashing liquid	**1.03**
Rubbing alcohol	**0.87**
Lamp oil	**0.80**
Honey	**1.36**
Baby oil	**0.82**

A. Honey
B. Lamp oil
C. Maple Syrup
D. Rubbing Alcohol

Below are common situations or applications of Newton's Laws of motion.

- Dislodging ketchup from the bottle
- Tightening the hammerhead on the handle
- Launching rocket
- Pushing a heavy object
- Colliding billiard balls
- Dropping a ball

15. Which classification best represent examples or applications of the 3 laws of motion?

A.

1st Law	2nd Law	3rd Law
• Dislodging ketchup from the bottle • Pushing a heavy object	• Tightening the hammerhead on the handle • Dropping a ball	• Colliding billiard balls • Rocket launching

B

1st Law	2nd Law	3rd Law
• Dislodging ketchup from the bottle • Pushing a heavy object	• Tightening the hammerhead on the handle • Colliding billiard balls	• Dropping a ball • Rocket launching

C.

1st Law	2nd Law	3rd Law
• Dislodging ketchup from the bottle • Tightening the hammerhead on the handle	• Pushing a heavy object • Dropping a ball	• Colliding billiard balls • Rocket launching

D.

1st Law	2nd Law	3rd Law
• Tightening the hammerhead on the handle • Dropping a ball	• Pushing a heavy object • Dislodging ketchup from the bottle	• Colliding billiard balls • Rocket launching

16. As an engineer, you are about to build a bridge with gaps and ridges as shown in figure 1. If you are to choose among the materials with their corresponding coefficient of linear expansion below, which of the materials will best achieve the purpose of having gaps in bridges?

Figure 2: Gaps in Bridges

Material	Coefficient of Linear Expansion (K^{-1} or C^{o-1})
Brass	2.0×10^{-5}
Copper	1.7×10^{-5}
Nickel-Iron Alloy	0.09×10^{-5}
Steel	1.2×10^{-5}

A. Brass B. Copper C. Nickel-Iron Alloy D. Steel

17. A gas in a sealed cylinder is heated. Which of the following does *not* increase as the gas is heated?

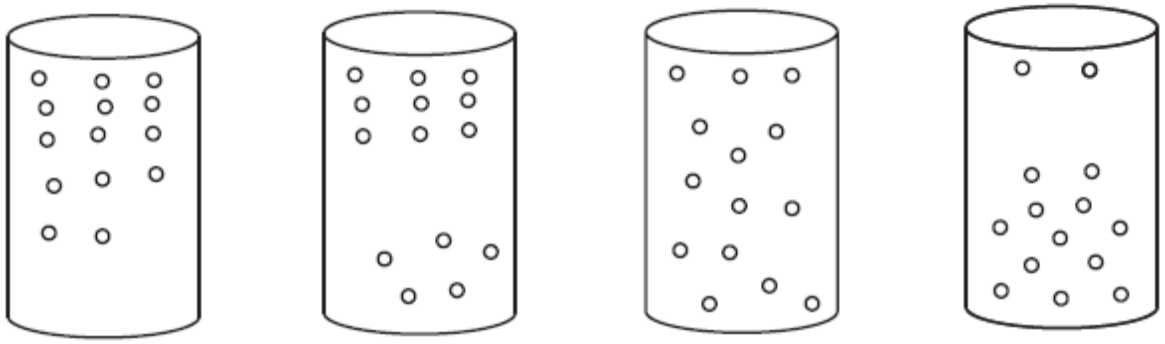
A. the average number of gas molecules hitting the cylinder walls per second
B. the average kinetic energy of the gas molecules
C. the average speed of the gas molecules
D. the average distance between the gas molecules

18. Dino is designing an experiment to investigate how heat transfer is affected by the type of medium through which they travel. Which is the independent variable?

A. temperature C. speed of heat transfer
B. type of medium D. thermal energy

19. Nitrogen molecules within a glass tube are allowed to move randomly. Which figure shows the molecules in a state of greatest entropy?

A. B. C. D.



20. A heated gas expands, raising a piston. Which of the following describes the energy exchanges in this process?

A. Energy is transferred to the gas by the piston, and to the piston from the heat source.
B. Energy is transferred to the gas from the heat source, and to the raised piston from the gas.
C. Energy is transferred to the gas in the form of heat and work done by the piston.
D. Energy is transferred directly to the piston from the heat source.

21. Pig, chicken, snake, frog, milkfish _____. What comes next?

A. rat
B. shark
C. whale
D. worm

22. Pigeon:beak; elephant:trunk; snake:mouth; man:_____

A. lips
B. mouth
C. hands
D. teeth

23. Based on the roles of each organism in a food chain, which of the following pairings is ***INCORRECT***?

    A. plant: producer
    B. eagle:final consumer
    C. phytoplankton:primary consumer
    D. mice:secondary consumer

24. Joshua picked 3 small guavas from a tree growing in their backyard. All guavas were ripe and had pinkish flesh. Two of the guavas had a worm located near the seeds, but only one guava was punctured. What could be said about the presence of worms in the guavas?

    A. Only one guava was infected at first then a worm transfers to the other guava.
    B. Two guavas were infected from the beginning.
    C. One guava was infected while it was still a flower while the other one was when it was already a fruit.
    D. It is normal to find worms in guavas because they are filled with seeds.

25. Which does **NOT** belong to the group?

Squid	Dugong	Tunicates	Eel
Sea star	Whale	Fish	Sting ray

    A. Tunicates
    B. Squid
    C. Sea star
    D. Fish

26. The symptoms of a certain inherited disorder in humans include difficulty in breathing and, in males, infertility. Which is a reasonable hypothesis for the molecular basis of this disorder?

    A. A defective enzyme in the mitochondria
    B. Defective actin molecules in cellular microfilaments
    C. Defective dynein molecules in cilia and flagella
    D. Abnormal hydrolytic enzymes in the lysosomes

27. Kim noticed the increase in frog population in October. She found small frogs and tadpoles swimming in one area of their garden. Six months later, she looked around the garden to see if there had been a change in the frog population but she could not even see a frog or even a tadpole, and the garden was completely dry. What could be the best explanation for this?

    A. Frogs needed water not only in performing their metabolic activities but also in reproduction.
    B. Frogs migrated to their garden but died due to dehydration.
    C. Poaching should be blamed for the loss of frogs.
    D. Frogs drowned because of too much water in their habitat.

28. Mice were used as subjects in a research funded by a drug company on the effectiveness of their drug for arthritis. How many groups and subjects should the research team have in order to get a good result?
    A. Just one mouse receiving different drug in three months
    B. Two arthritic mice, one for each group
    C. A case and a control group having two mice each
    D. A placebo, a positive control, and a case group having at least three mice

For items 29-30

> Poison ivy has a distressing toxic action on the skin of people who become exposed to it. The offending substance is a type of plant oil present throughout the entire plant. The said oil binds with at least one of the molecules involved in the production of ATP.

29. Which organelle would be most affected upon exposure to this oil?
    A. Lysosomes
    B. Mitochondria
    C. Peroxisomes
    D. Endoplasmic reticulum

30. Which organ system would be most affected if you touch this plant?
    A. Skeletal
    B. Integumentary
    C. Circulatory
    D. Digestive

PART II: Intellective Power Test

II.B. QUANTITATIVE ABILITY

The following items will measure your ability to apply mathematical and numerical concepts, principles and relationships in solving symbolic or verbal problems. The test consists of items in Arithmetic, Mathematics and Mathematical Reasoning. Shade the letter of the BEST answer on your answer sheet.

1. The figure below consists of four congruent externally tangent circles inscribed in a rectangle. Which statement is correct about the shaded portion?

   A. It is greater than the area of the unshaded region.

   B. It is less than the area of the unshaded region.

   C. It is equal to the area of the unshaded region.

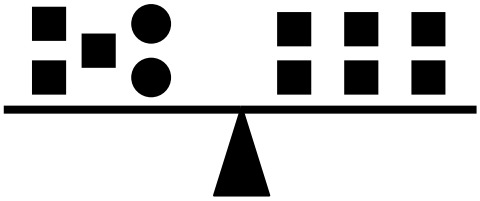
   D. It cannot be determined.

2. If the area of  is 1 square unit, then what is the area of the shaded region in square units?

   A. 4 B. $4\frac{1}{2}$ C. $4\frac{2}{3}$ D. 5

FOR ITEMS 3-4

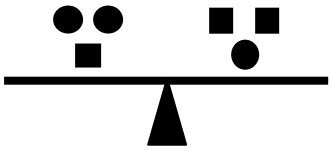
Consider the balanced scale.

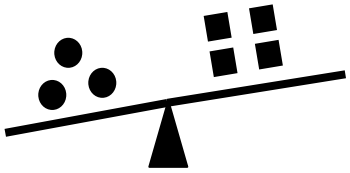


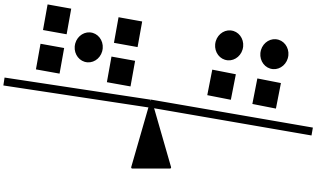
3. If four circles are added on the right side, how many squares must be added on the left to keep it balanced?

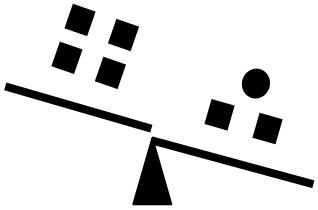
   A. 2 B. 3 C. 5 D. 6

4. Which of the following is consistent with the given balanced scale?

   A. 

   C. 

   B. 

   D. 

5. Seventy percent of my tuition fee is subsidized by the government. If I paid 500 pesos per unit then, how much is shouldered by the government for three units?

   A. 500 pesos B. 1500 pesos C. 3500 pesos D. 5000 pesos

6. Jasmine will prepare candy bags with equal number of candies in each bag for her niece's birthday party. If she has 350 candies, which of the following CANNOT be the number of candy bags she can prepare?

   A. 35 B. 25 C. 20 D. 14

7. If $n^2 = m^3$ and $m^2 = 16$, then what is the positive product of m and n?

   A. 8 B. 12 C. 16 D. 32

8. If ***a*** = $(2^3)(3^4)(5)$ and ***b*** is a positive integer, what is the greatest number of values for ***b*** such that $\frac{a}{108b}$ is an integer?

A. 5 B. 6 C. 7 D. 8

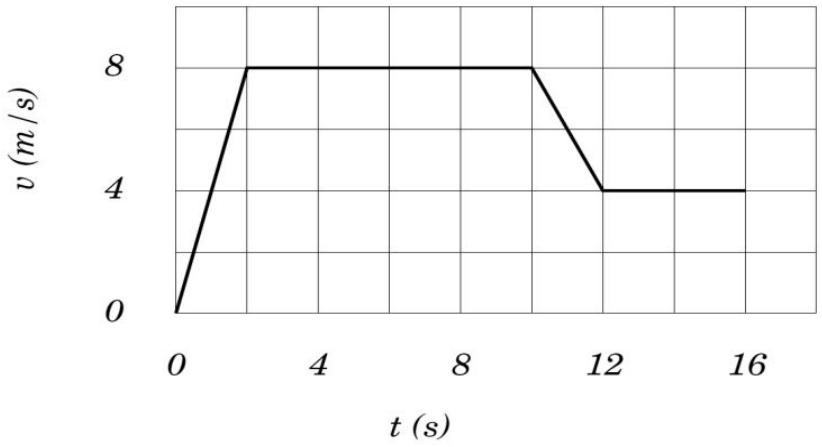
9. If 25% of ***s*** is 20, then what is 30 % of ***s***?

A. 16 B. 24 C. 32 D. 40

10. Nilda intended to place a mark $2\frac{1}{4}$ cm from one end of a narrow rod $9\frac{1}{4}$ cm long, but she mistakenly placed the mark $2\frac{1}{4}$ cm from the other end. How far, in cm, is her mark from the location where she intended to place it?

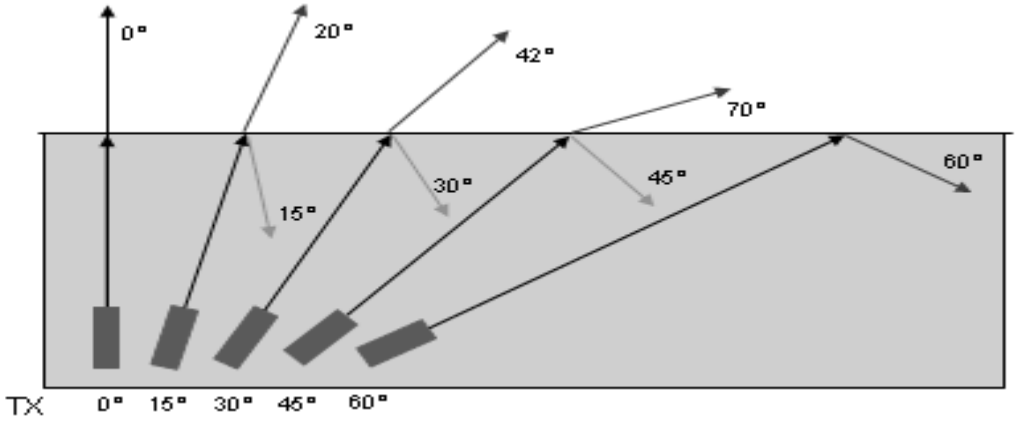
A. $4\frac{1}{4}$ B. $4\frac{3}{4}$ C. $5\frac{1}{4}$ D. $5\frac{3}{4}$

11. Consider the motion of the object whose velocity-time graph is given in the diagram below. If the area under the curve of a velocity – time graph is the displacement, what is the net displacement of the object between times t = 0 and t = 16?



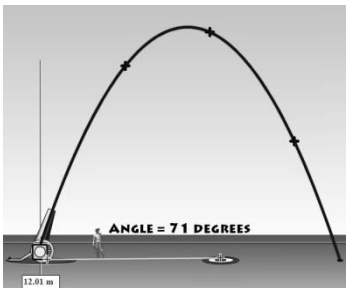
A. 100 m B. 104 m C. 128m D. 160m

12. Total internal reflection happens when light passes obliquely from denser to less dense medium beyond the critical angle. If the incident angle equals critical angle of 24.42°, what is the index of refraction of the denser medium in air-diamond interface? (Note: n_{air}=1.0003)

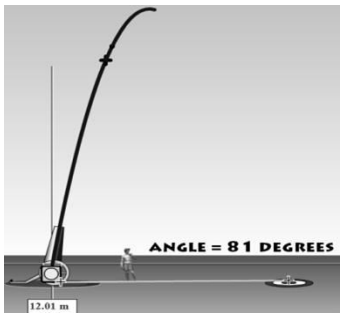


A. 1.33 B. 2.42 C. 0.41 D. Cannot be deteremined

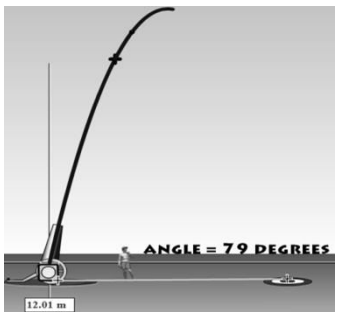
13. A projectile launched at 71 degrees with 18m/s initial speed did not hit the target 12.01m from the canon. Which angle must the projectile be launched in order to hit the center of the target board?



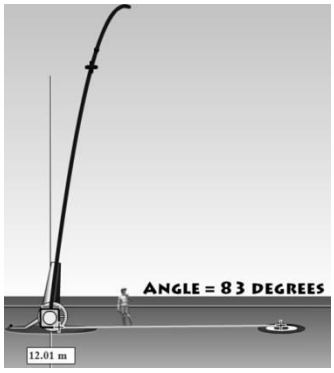
A.



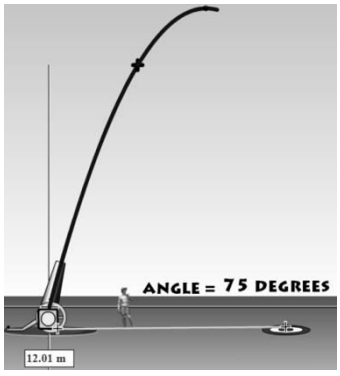
C.



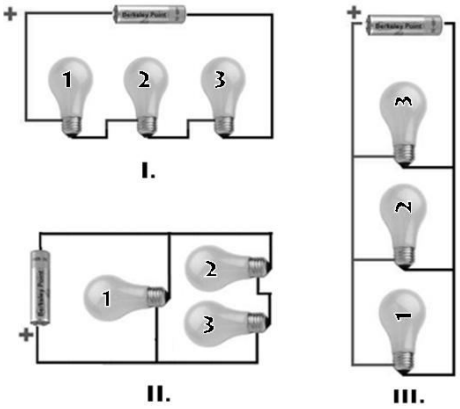
B.



D.



14. Three identical bulbs are connected in a circuit as shown in the figures at the right. If same voltage was applied in each circuit, which would give the highest equivalent resistance?



A. I only
B. II only
C. III only
D. same for all circuits

15. An object is placed in front of a concave mirror with focal length of 20 cm. What distance from the mirror should you place the object in order to get an inverted image that is the same size as the object?

A. 40 cm B. 20 cm C. 30 cm D. cannot be determined

16. What temperature degree in the Celsius and Fahrenheit scale will give the same reading?

A. - 20 degrees B. 40 degrees C. 20 degrees D. - 40 degrees

17. The following figure shows a block that is being pulled along the floor. What is the acceleration of the block?

A. 2 m/s^2
B. 3 m/s^2
C. 4 m/s^2
D. 6 m/s^2

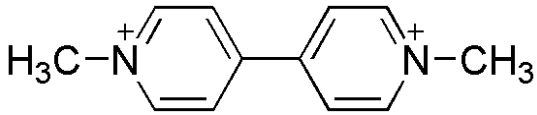
18. The figure on the right shows a bucket hanging motionless from a rope. Assuming that the rope has no mass. What is the net force on the bucket?

A. 0.0 N
B. 2.0 N
C. 9.8 N
D. 20 N

19. A string of holiday lights has 15 bulbs with equal resistances. If one of the bulbs is removed, the other bulb still glows. But when the entire string of bulbs is connected to a 120-V outlet, the current passing through the bulbs is 5.0 A. What is the resistance of each bulb?

    A. 24 Ω
    B. 12 Ω
    C. 6.0 Ω
    D. 1.6 Ω

20. Paraquat is a widely used herbicide against Marijuana plant (Cannabis sativa). This herbicide is a photosynthesis inhibitor with a half-life of 1000 days. Studies revealed that it can cause Parkinson's disease in mice samples, eye irritation, liver and kidney damage to humans hence it was banned both in the US and in the Philippines. The safe soil concentration of Paraquat is 0.028g/m^2. If the soil in a farm contains 1.8 g/m^2 of this herbicide, what is the shortest period of time that it would reach a safe level?



Molecular structure of Paraquat

    A. 6.43 X 10^4days
    B. 2.14 X 10^5days
    C. 6.01 X 10^3days
    D. 1.77 X 10^3days

21. Laura is normally-pigmented with straight hair and has no history of haemophilia but her father is an albino. Greg, on the other hand, has haemophilia, curly hair, and his mother is an albino. What is the probability that Laura and Greg will have an albino son with wavy hair and haemophilia?

    A. 75%
    B. 50%
    C. 25%
    D. 0%

For items 22 and 23

> Sixty frogs and 80957 ladybugs inhabit a 60 m^2 lot with a swamp measuring one and a quarter square meters.

22. What is the population density of ladybugs in the 60 m^2 lot?

    A. 1,394.28 ladybugs/m^2
    B. 1,432.38 ladybugs/ m^2
    C. 1,379.92 ladybugs/ m^2
    D. 1,349.28 ladybugs/ m^2

23. What is the difference between the density of the ladybugs and that of the frogs taking into consideration the area that each population occupies?

    A. 1,376.99 ladybugs/ m^2
    B. 1,348.28 ladybugs/ m^2
    C. 1,439.28 ladybugs/ m^2
    D. 1,276.99 ladybugs/ m^2

For items 24-26

> There are approximately 36 ATPs produced from 1 glucose molecule after respiration, where 2 ATPs come from glycolysis.

24. If 268 ATPs are produced from glycolysis alone, how much ATP would be produced if the entire process is completed?

    A. 4,824 ATPs
    B. 4,284 ATPs
    C. 2,842 ATPs
    D. 134 ATPs

25. How many glucose molecules are used to produce 268 ATP in glycolysis?

A. 128
B. 134
C. 143
D. 536

26. How many ATPs are produced after the entire respiratory process, disregarding the products of glycolysis?

A. 34
B. 4481
C. 4822
D. 4556

FOR ITEMS 27-30

> Doctors have recovered a foreign tissue from a man's body after an operation. After close examination, it was found that there were 986 cells in that mass of tissue, each having 8 chromosomes. The cells were actively dividing and they were surprised to find that the cells divide every 18 hours.

27. How many cells would the tissue have after 48 hours if all cells would undergo mitosis?

A. 1972
B. 3944
C. 47328
D. 7888

28. How many chromosomes would each cell have?

A. 8
B. 16
C. 4
D. 32

29. How many cells would the tissue have after 18 hours if half of the total number of cells would undergo meiosis?

A. 1763
B. 1972
C. 3944
D. 7888

30. How many chromosomes would each product of meiosis have?

A. 8
B. 16
C. 4
D. 32

PART II: Intellective Power Test

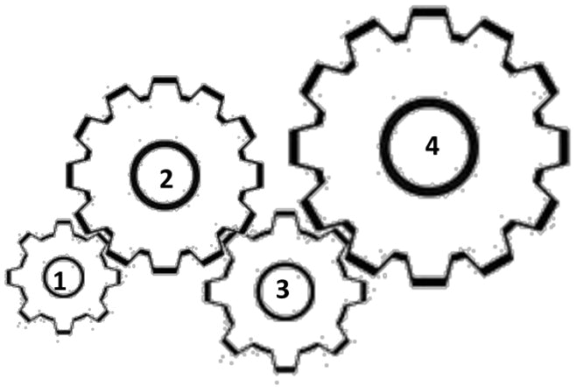
II.C. MECHANICAL TECHNICAL ABILITY

This test will measure your capacity to acquire information about everyday physics and to comprehend mechanical relationships. Specifically, this includes items on appreciation of principles of common physical forces, comprehension and analysis of electrical and electronic principles and electronic circuits, comprehension of mechanical principles and analysis of mechanical movements. Shade the letter of the BEST answer on your answer sheet.

1. Which exhibits the property similar to the property common to the three clocks?

A. 
B. 
C. 
D. 

2. Consider the 4 gears shown below. Which of the following happens when gear 3 turns clockwise?



A. Gears 1 and 4 turn clockwise.
B. Gears 2 and 4 turn clockwise.
C. Gear 1 turns counter clockwise.
D. Gear 2 turns counter clockwise.

3. A ball is dropped from 16 ft above level ground. After the third bounce, it rises to a height of 2 ft. If the height to which the ball rises after each bounce is always the same fraction of the height reached on its previous bounce, what is this fraction?

A. $\frac{1}{8}$ B. $\frac{1}{4}$ C. $\frac{1}{3}$ D. $\frac{1}{2}$

4. On a map, $\frac{1}{4}$ inch represents 20 feet. If a driveway is 50 feet long, what is its length in inches on the map?

A. $\frac{3}{8}$ B. $\frac{5}{8}$ C. $\frac{3}{4}$ D. $2\frac{1}{2}$

5. A complete cycle of a traffic light takes 80 seconds. During each cycle, the light is green for 40 seconds, yellow for 10 seconds, and red for 30 seconds. When a car approaches the traffic light, what is the probability that the light will NOT be red?

A. $\frac{7}{8}$ B. $\frac{5}{8}$ C. $\frac{4}{8}$ D. $\frac{3}{8}$

6. When traffic is heavy, Mr. Tongco takes an alternative route to his office. This alternative route is 7 kilometers longer than the direct route. When he goes by the alternative route and returns by the direct route, the round trip is 45 kilometers. How many kilometers is the direct route?

A. 38 B. 26 C. 19 D. 18

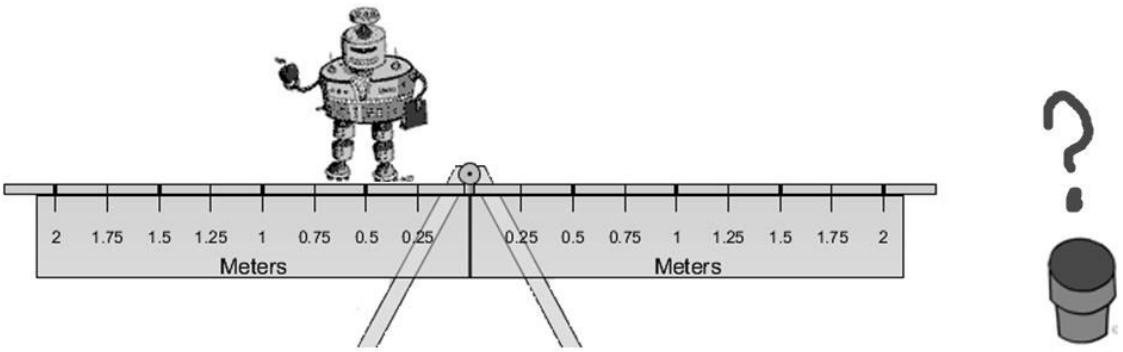
7. Airplane A and airplane B fly along parallel paths each 3,000 miles long. A flies at a constant speed of 600 miles per hour and B flies at a constant speed of 580 miles per hour. If they start at the same time, how many more miles are left for B to fly after A completes its flight?

A. 60 B. 100 C. 120 D. 150

8. If a ball is thrown straight up at a certain speed, its height ***h***, in feet, after ***t*** seconds is given by the formula $h = 40t - 16t^2$. How many feet high will the ball be one second after it is thrown?

A. 12 B. 16 C. 24 D. 32

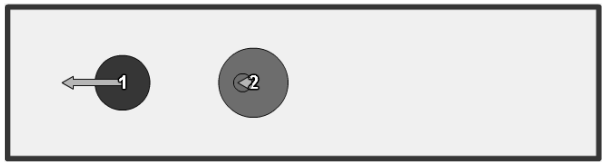
9. Where the 5 kg plant pot be placed on the lever in order to balance it with 15 kg robot at 0.5 m from the fulcrum?



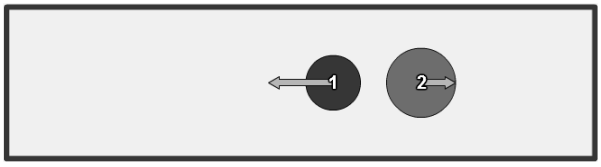
A. 0.5 m B. 1.0 m C. 1.5 m D. 2.0 m

10. Mass 2 is twice mass 1 while the magnitude and direction of their velocities are represented by arrows. What will happen to the velocities of the two bodies if they undergo elastic collision?

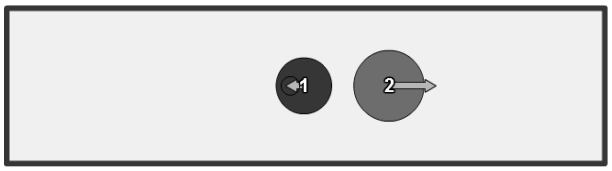
A.



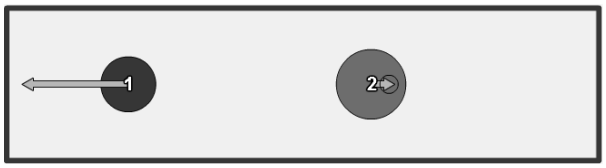
C.



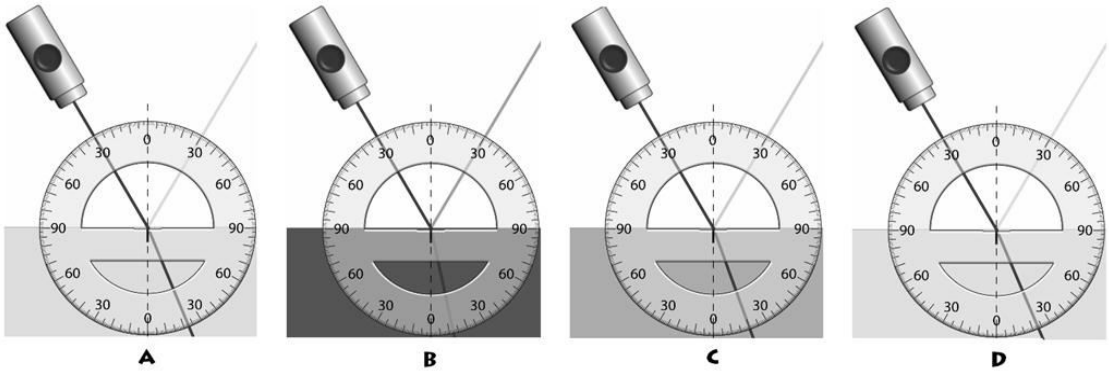
B.



D.

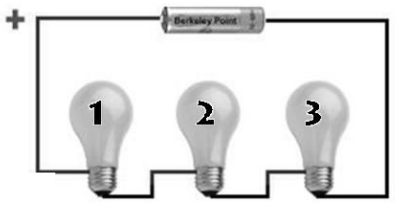


11. Refraction is the bending of light as it passes obliquely from one medium to another. Based on the illustration below, which diagram accurately shows the bending of light from air to glass (n_{air} = 1.0003, n_{glass} = 1.72)

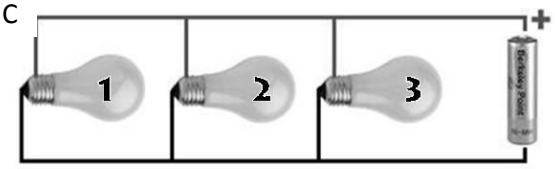


12. If there are three bulbs connected in a circuit, how are you going to arrange it in a way that only one bulb will glow if bulb 2 or 3 burn out?

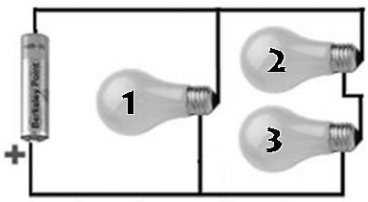
A



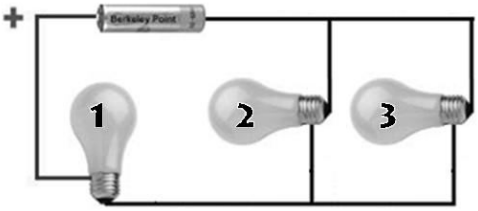
C



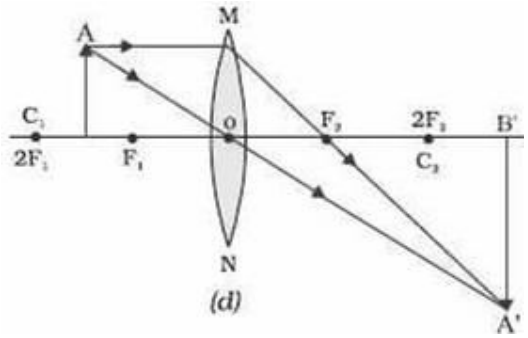
B



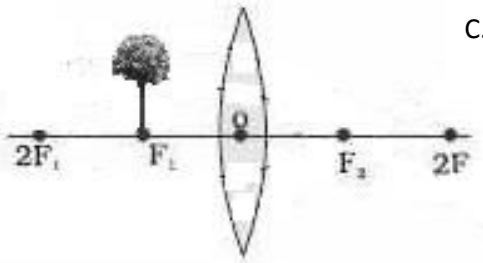
D



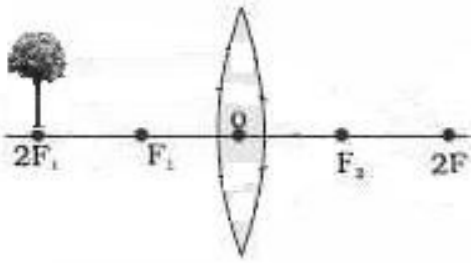
13. The figure below shows an image was formed in different location when the object was placed in front of a double concave lens. Where must the object (tree) be placed in front of the converging lens in order to get a virtual magnified image?



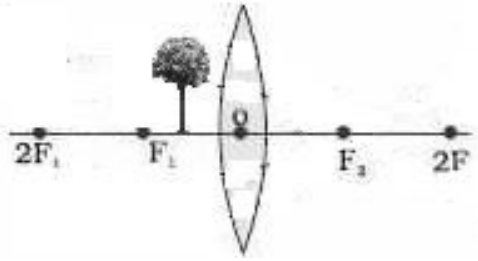
A.



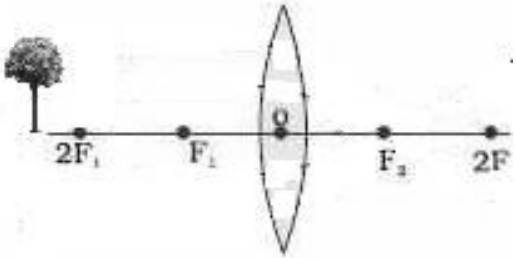
C.



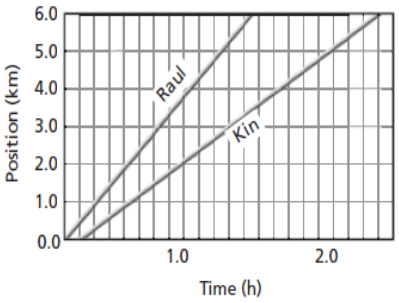
B.



D.



14. The position-time graph on the right represents two walkers. Which walker is the faster one? Give your explanation?



A. Raul, because according to the graph, he started first.
B. Kin, because his position-time graph looks longer.
C. Raul, because the slope of his position-time is steeper, meaning he covered a farther distance in a given time period.
D. Kin, because the area under his graph is greater.

15. Ming estimated the average velocity of a vehicle to be 26.82 ± 0.20 m/s. Four other students also estimated the average velocity of the vehicle. Their estimates are shown in the table. Which student's estimate is consistent with Ming's?

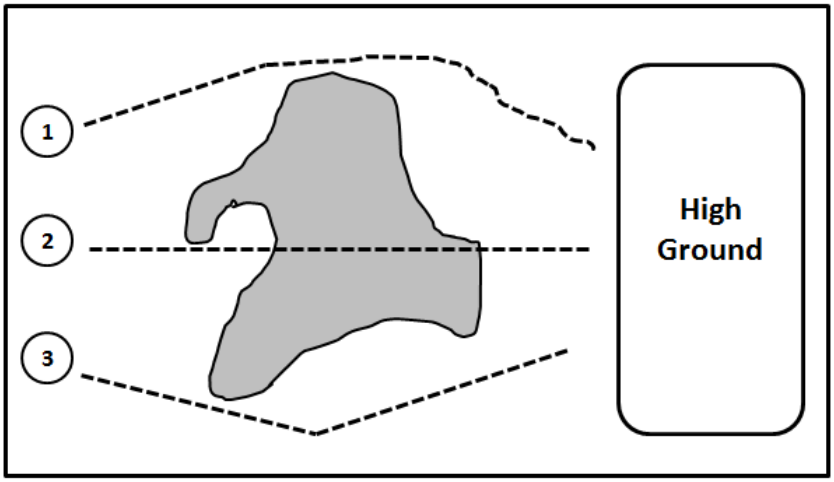
Estimates of Average Velocity

Student	Estimate (m/s)
1	25.34 ± 0.25
2	26.42 ± 11.5
3	27.15 ± 11.5
4	27.22 ± 11.5

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

FOR ITEMS 16 AND 17

Three organisms were to cross a lake in order to get to a high ground in time for summer. The route taken by each is represented by the broken line. The distance travelled by organism 1 to the high ground is 5 km, organism 2 travelled 10 km, and 15 km for organism 3. All three organisms travel at 3 km/hr.



16. Which of them will finish first if organism 3 had a three-hour lead, and organism 2 started an hour before organism 1 started?

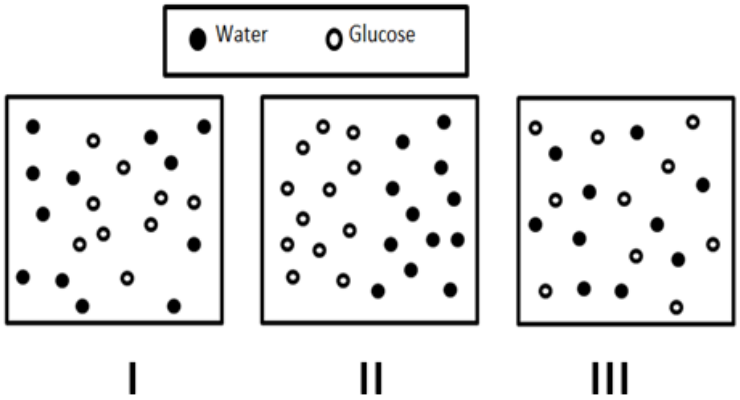
A. Organism 1
B. Organism 2
C. Organism 3
D. A tie between organisms 1 and 2

17. Each organism has a mass of 10 kg and the volume of circle is $3m^3$, star is $4.5m^3$ and heart is $5m^3$. Which will float on water if it has a density of 999 kg/m^3?

A. Circle
B. Heart
C. Star
D. All of them

For items 18 and 19

Glucose is placed in a beaker containing water.



18. Which of the images shown above represents the distribution of the molecules after a few hours?

A. I
B. II
C. III
D. Any of the three

19. Which of the three images is the least concentrated?

A. I
B. II
C. III
D. All of the three

20. Why does a person shiver in cold environments?

A. To trap the warm air
B. Muscles insulate the body from the cold
C. Low temperature tingles the muscles
D. The body generates heat through muscle contraction

21. In a food chain, which organism would have the least amount of energy obtained from the producer?

A. Decomposer
B. Final consumer
C. Primary consumer
D. Secondary consumer

22. Bats are nocturnal although they are blind at night. They use the sound that they produce to familiarize themselves with their surroundings. In which environment would a bat find most difficult to move around?

A. Cage made of marble
B. Cage made of metal
C. Cage made of wood
D. Cage made of corrugated carton

23. The flagellum of a newly discovered photosynthetic bacterium is fastened to a stratum. Light is introduced into the medium containing the bacterium to stimulate movement. How would you describe the movement of the bacterium?

A. The cell will move up and down.
B. The movement cannot be predicted.
C. The cell will rotate in place either clockwise or counterclockwise.
D. There will be no movement since the flagellum is attached to a substratum.

24. Why do animals in deserts have lighter-colored fur compared to those in other biomes?

A. Lighter fur colors absorb less heat than darker ones.
B. Water retention is promoted by light-colored fur.
C. Lighter fur color helps the animals locate their mate.
D. Lighter fur color absorbs moisture from the environment.

25. Which feature would be very helpful for an amphibian?

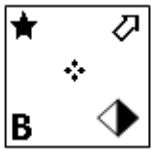
A. Webbed feet
B. Gills
C. Fins
D. Transparent eyelid

PART II: Intellective Power Test

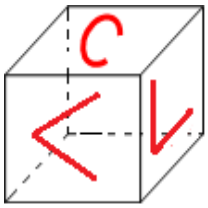
II.D. IMAGERY

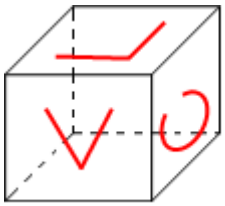
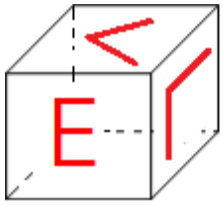
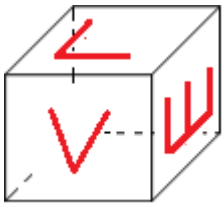
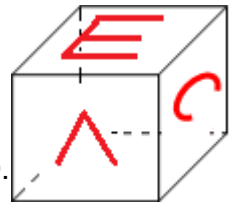
The following items aim to measure your ability to visualize and transform images in your mind and judge correctness of alternative visual stimuli given the parameters of the mental transformation. Shade the letter of the BEST answer on your answer sheet.

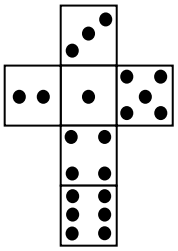
1. Which of the following CANNOT result from rotating the card at the point marked ❖ in any direction?

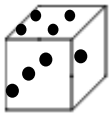
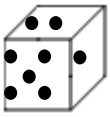
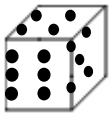
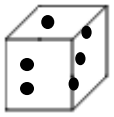
A. 
B. 
C. 
D. 

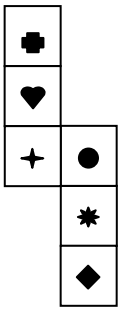
2. Which might happen when the cube is tipped to the left?

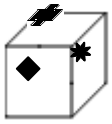
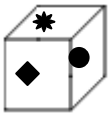
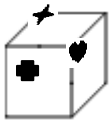
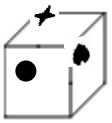


A. 
B. 
C. 
D. 

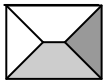
3. Which is the result when the figure on the right is folded to form a box? 

A.  B.  C.  D. 

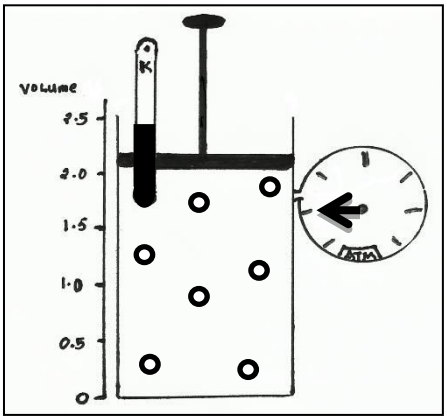
4. Which will result when the figure on the right is folded to create a box? 

A.  B.  C.  D. 

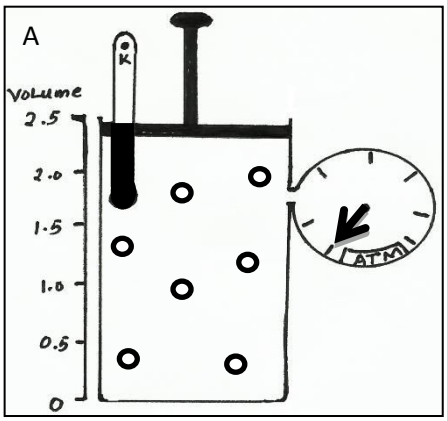
5.  is to  as  is to _____ ?

A.  B.  C.  D. 

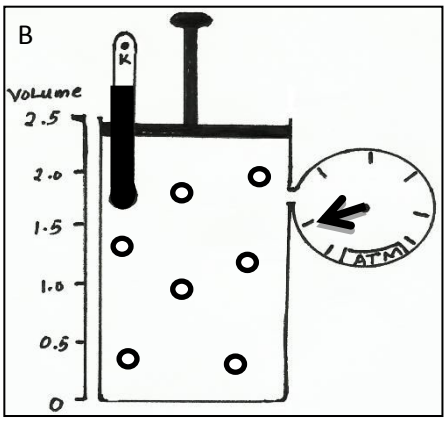
6. Consider the initial conditions below. Which of the following illustrations is INCORRECT based on concepts of behavior of an ideal gas?



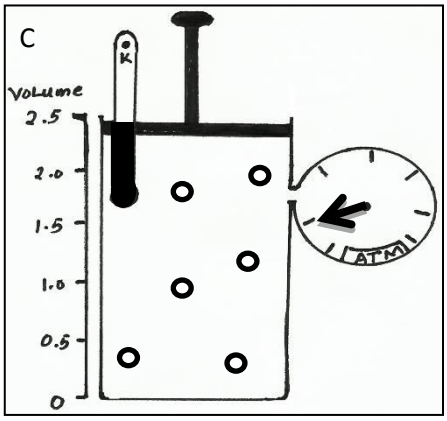
A



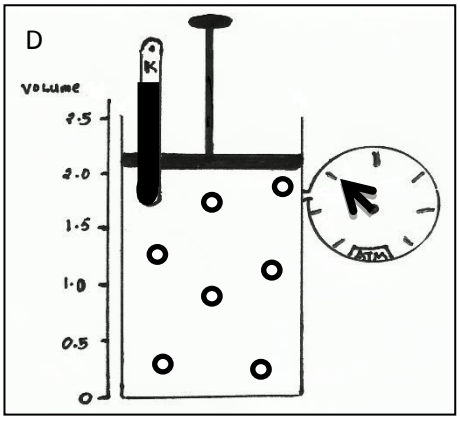
B



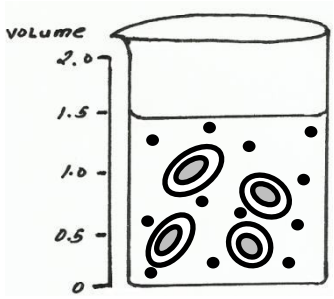
C

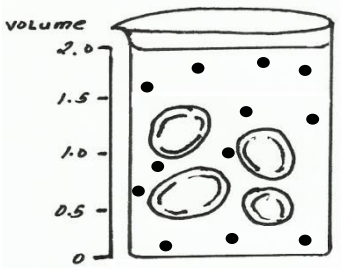


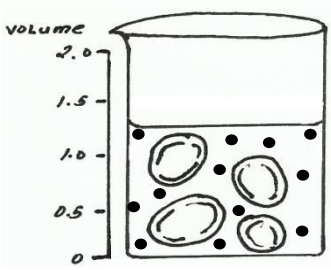
D

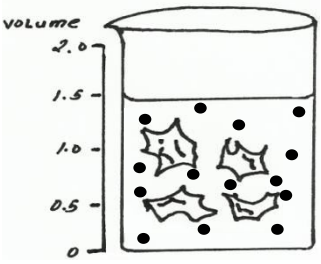


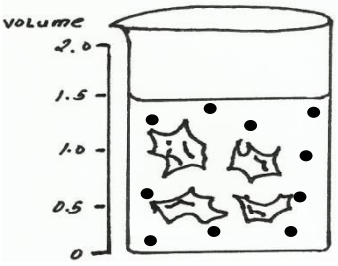
7. Red blood cells are in an isotonic saline solution as shown below. When changes are made in the concentration of the solution, which pair of setups is INCORRECT?



I. 

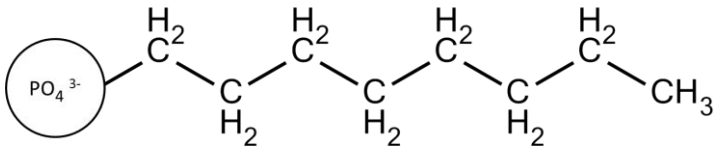
II. 

III. 

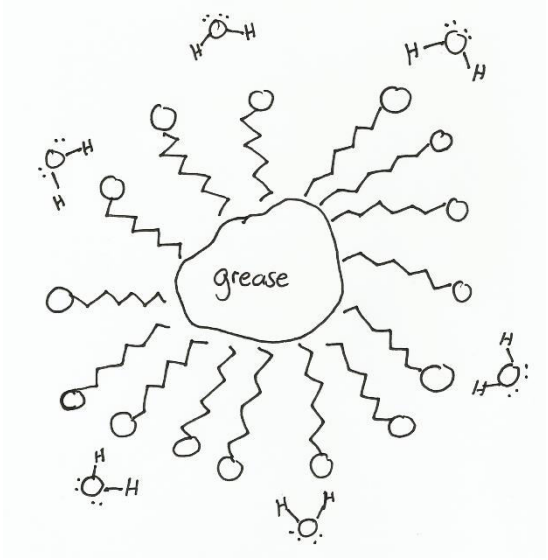
IV 

A. and II B. I and III C. II and III D. II and IV

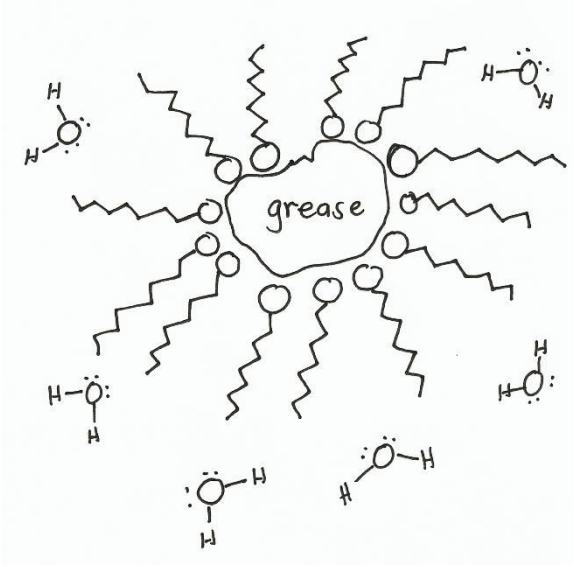
8. The molecular structure of a detergent molecule is shown below. Which of the following illustrations correctly depicts the action of detergent molecules removing grease?



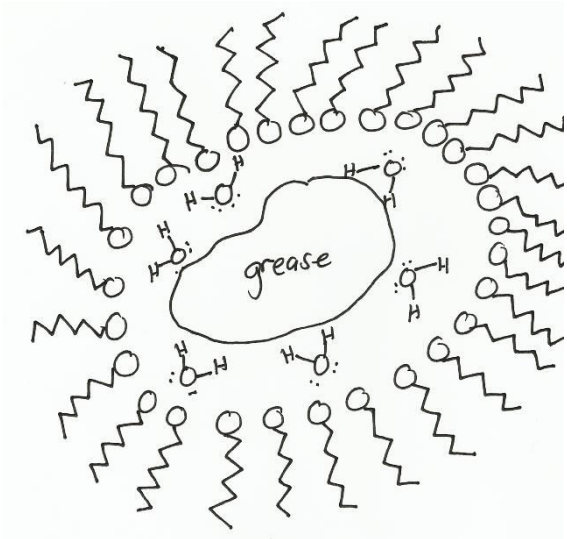
A



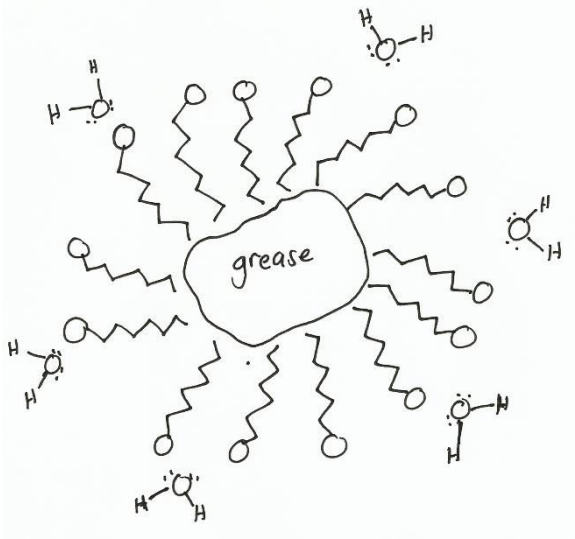
C

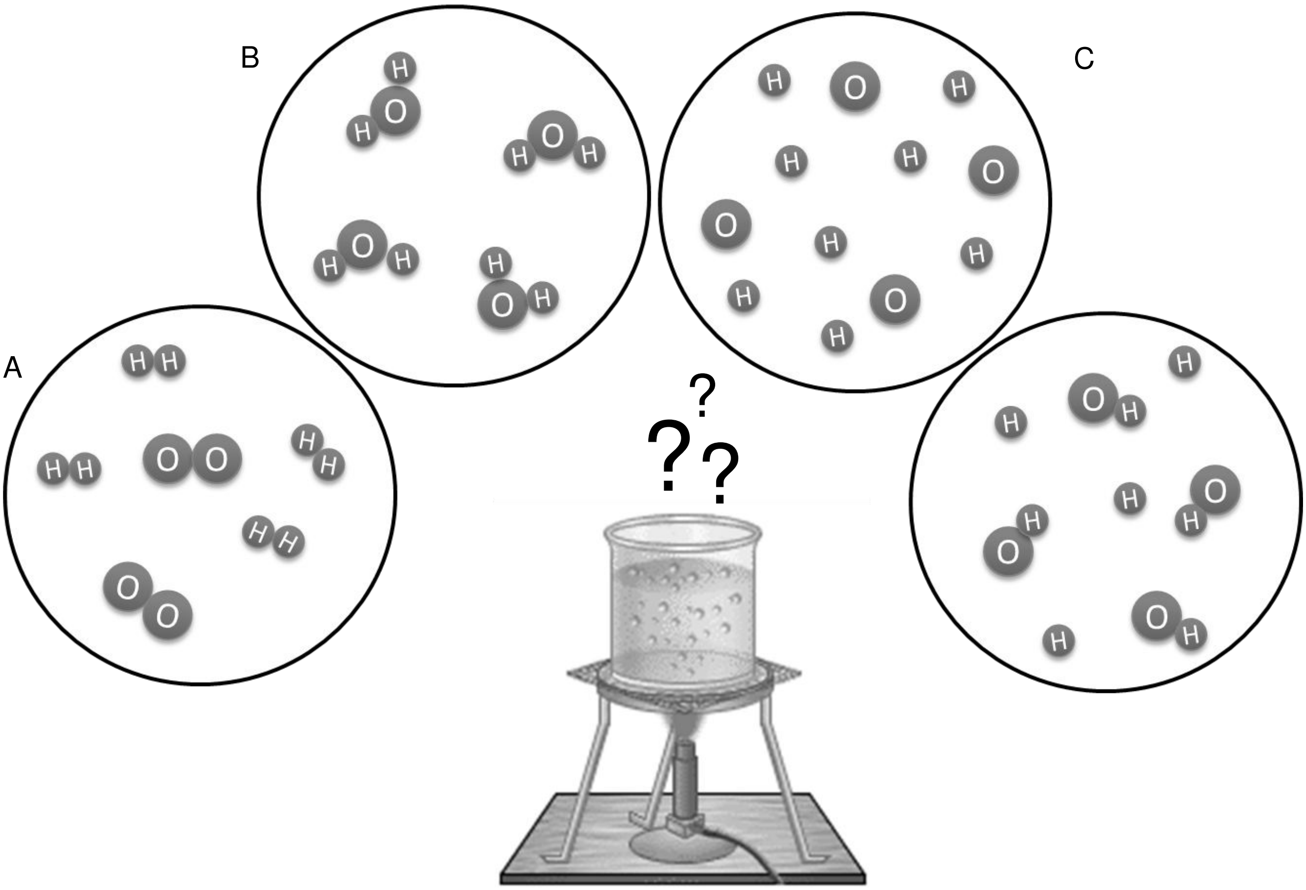


B



D





9. Which of the given illustration BEST shows the change that occurs to the molecules of liquid water when boiled?

10. Leonardo wrote the word RENAISSANCE on a piece of cardboard and placed it upright in front of a plane mirror. How would the image look like?

A. 

C. 

B. 

D. 

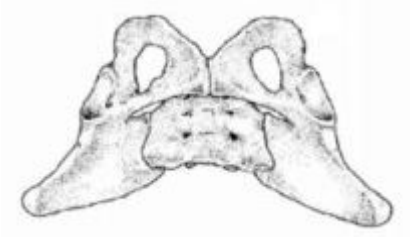
11. Which of the following diagrams supports bipedal gait or walking using only two limbs?

A.

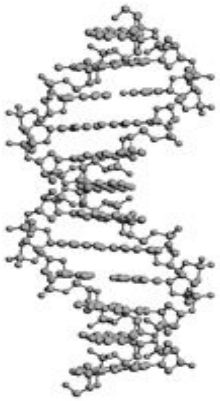
C.

B.

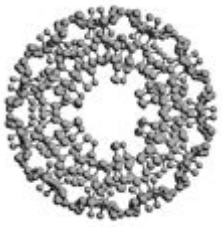
D.



12. The picture below shows the front view of a DNA. Which of the following shows the most probable top view of the number 3. DNA illustration given below?

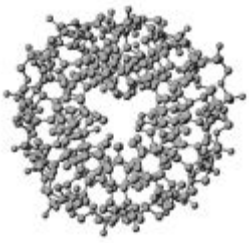


A

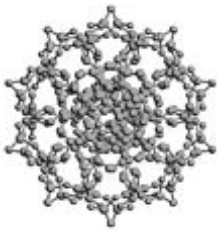


B

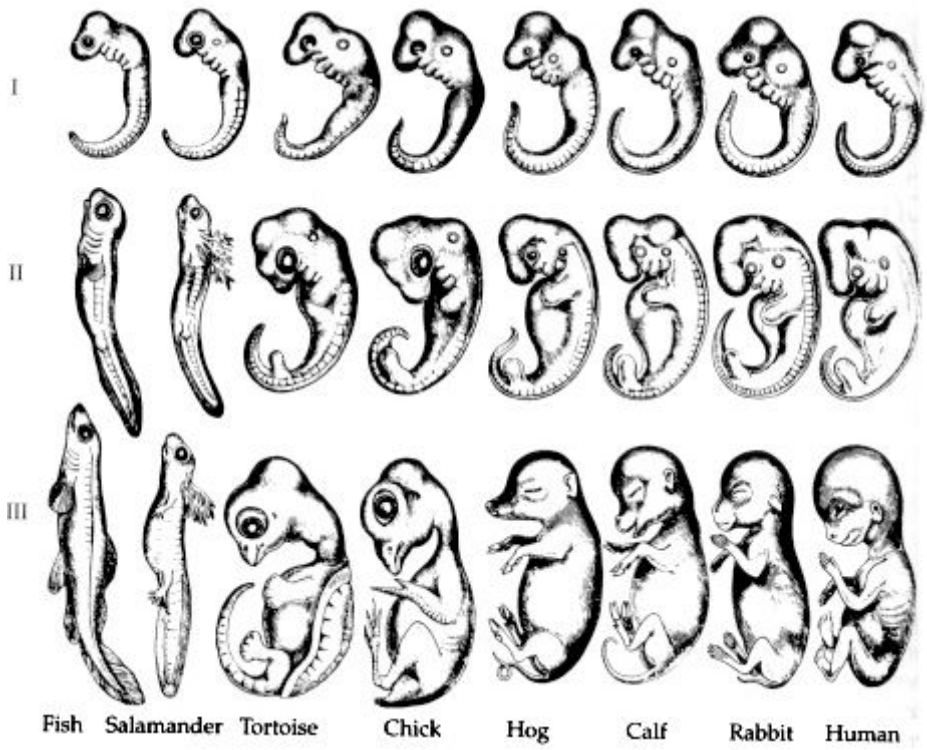
C



D

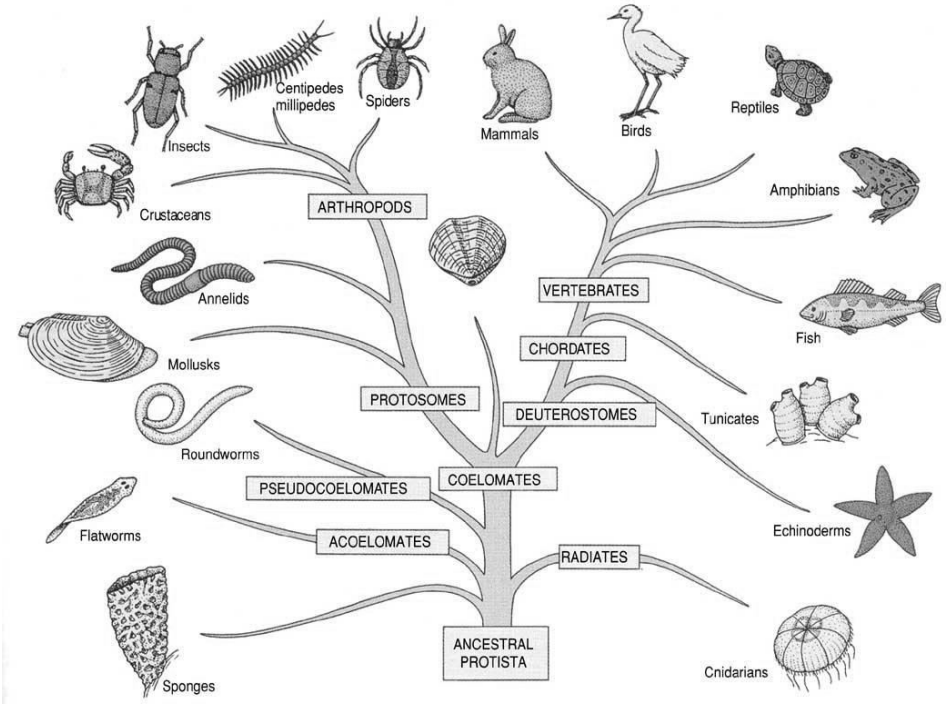


13. A diagram of the three embryonic stages of representative species of the vertebrates is shown below. How would you associate embryonic development to evolutionary relationship based on this diagram?



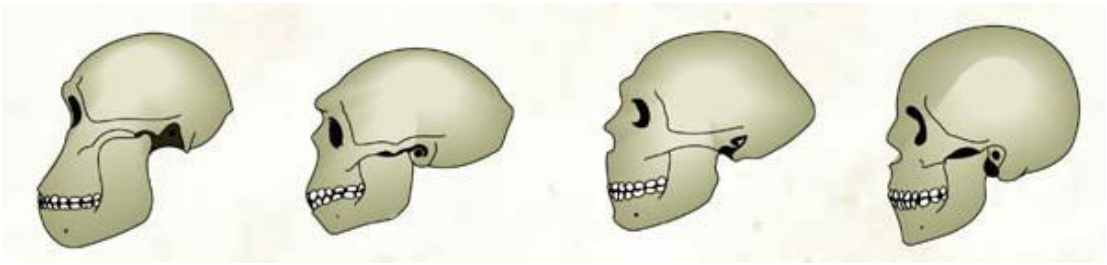
A. All vertebrates look alike at stage one of the given embryonic development.
B. Fish and salamander are close relatives compared to the others which are their distant relatives.
C. Differences in their embryonic development account for their close evolutionary relationship.
D. Similarity in their appearance at certain stage accounts for their shared ancestry.

14. A hypothetical tree of the animal kingdom is shown below. Which organism(s) is/are the youngest in the vertebrate group based on this illustration?



A. Birds and reptiles
B. Fish and amphibian
C. Mammals and birds
D. Mammals only

15. Below shows the evolution of the human skull. Which of the following statements is correct based on the diagram?



Australopithecus **Java man** **Neanderthal man** **Modern man**

A. The modern man has ears while the others have none.
B. The Java man has the biggest eyes to hunt better.
C. The modern man has the biggest brain because of its enlarged cranium.
D. Neanderthal man has the ideal skull because it has medium-sized jaw and

PART III: Linguistic Ability Test

IIIA. Shade the letter of the BEST answer on your answer sheet.

1. The average of 3 numbers is 14 and the smallest of these numbers is 10. If one of the other two numbers is 8 less than the other number, which of the following equations represents the relationship of the numbers?

   A. $3x + (x - 8) + 10 = 14$

   B. $3\{x + (x - 8) + 10\} = 14$

   C. $\frac{x+(x-8)+10}{3}=14$

   D. $\frac{x+(x-8)}{3}+10=14$

2. Mineral water leaks out of a container at the rate of ***g*** gallons in ***h*** hours. If the mineral water costs PhP30 per gallon, how much, in pesos, will be lost in ***x*** hours?

   A. $\frac{30gx}{h}$ B. $\frac{gx}{30h}$ C. $\frac{30h}{gx}$ D. $\frac{gh}{30x}$

FOR ITEMS 3-5

Below is a passage about Scientific Method. Choose the appropriate term that will best fit the blanks among the following options.

a. Theories b. Laws c. Hypothesis d. Experimentation

Three containers were half-filled with water with different temperatures; hot, tap (room temperature) and cold. If a drop of red dye is placed in each container, which will show fastest rate of diffusion? This question represents a problem to which students may pose a tentative answer called _____. The student may say that the dye dropped in the container with hot water will demonstrate fastest rate of diffusion. This can be verified through _____. If the students' observation proves that their tentative answer is correct, it can be reported as their conclusion. However, conclusion in a broader sense is referred to as _____.

3. Crime investigations using DNA as evidence is made possible by Polymerase Chain Reaction. A minute DNA sample can be <u>amplified</u> in order to properly identify the people involved in the crime. What does the underlined word mean?
   A. Hasten the process
   B. Increase the amount
   C. Verify the correctness
   D. Improve the quality

4. Which of the following sentences is grammatically correct?
    A. There was been several species of cat throughout its evolution.
    B. The group of birds have had encounter a challenge that resulted to their extinction.
    C. Mammoth was extinct because of its inability to adapt to change.
    D. Modern man has a much larger brain compared to its ancestors.

5. One of the tenets of the cell theory states that “all cells _____ from pre-existing cells”.
    A. come
    B. comed
    C. comes
    D. was coming

Read the excerpt from **Emma,** written by Jane Austen. Then answer the questions which follow.

“Emma Woodhouse, handsome, clever, and rich, with a comfortable home and happy disposition, seemed to unite some of the best blessings of existence; and had lived nearly twenty-one years in the world with very little to distress or vex her.

She was the youngest of the two daughters of a most affectionate, indulgent father; and had, in consequence of her sister's marriage, been mistress of his house from a very early period. Her mother had died too long ago for her to have more than an indistinct remembrance of her caresses; and her place had been supplied by an excellent woman as governess, who had fallen little short of a mother in affection.

Sixteen years had Miss Taylor been in Mr. Woodhouse's family, less as a governess than a friend, very fond of both daughters, but particularly of Emma. Between them it was more the intimacy of sisters. Even before Miss Taylor had ceased to hold the nominal office of governess, the mildness of her temper had hardly allowed her to impose any restraint; and the shadow of authority being now long passed away, they had been living together as friend and friend very mutually attached, and Emma doing just what she liked; highly esteeming Miss Taylor's judgment, but directed chiefly by her own.

The real evils, indeed, of Emma's situation were the power of having rather too much her own way, and a disposition to think a little too well of herself; these were the disadvantages which threatened alloy to her many enjoyments. The danger, however, was at present so unperceived, that they did not by any means rank as misfortunes with her.

Sorrow came—a gentle sorrow—but not at all in the shape of any disagreeable consciousness—Miss Taylor married. It was Miss Taylor's loss which first brought grief. It was on the wedding-day of this beloved friend that Emma first sat in mournful thought of any continuance. The wedding over, and the bride-people gone, her father and herself were left to dine together, with no prospect of a third to cheer a long evening. Her father composed himself to sleep after dinner, as usual, and she had then only to sit and think of what she had lost.”

JANE AUSTEN *Emma* (1815)

IIIB. GRAMMAR. The following sentences may contain errors in formal written English. Choose the letter which corresponds to the part of the sentence that contains the error. If there is no error, choose the letter E.

1. Emma's difficulty lies (A) in the fact that (B) her comfortable life under (C) Miss Taylor is over (D). No error (E)

2. The relationship of (A) Emma and Miss Taylor is (B) that with (C) friends rather than (D) ward and governess. No error (E)

3. Since her (A) sister got (B) married, Emma has (C) been the mistress of his (D) father's house. No error (E)

4. They (A) used (B) to dine (C) together—Mr. Woodhouse, Miss Taylor, and her (D). No error (E)

5. "How shall I find a new friend"? (A) That must have been Emma's thoughts as she watched (B) her happily-married (C) former governess in (D) the arms of her husband. No error (E)

6. The real evil of (A) Emma's situation is this, (B) her (C) being too strong-willed (D). No error (E)

7. For (A) Miss Taylor, her sixteen years with (B) the Woodhouses (C) are (D) hard to forget. No error (E)

8. Emma hardly (A) remember (B) her mother for (C) she had (D) died a long time ago. No error (E)

9. Although (A) her mother had (B) died early on, Emma was (C) fortunate to have a friend in (D) Miss Taylor. No error (E)

10. Miss Taylor's intimacy with (A) Emma didn't (B) helped (C) in (D) restraining the latter's spirit. No error (E)

11. Having (A) a comfortable home and a happy disposition (B), Emma have lived (C) a worry-free (D) life. No error (E)

12. To (A) Emma, Miss Taylor is (B) not only (C) a governess but a (D) friend. No error (E)

13. After (A) working for sixteen (B) years as a governess to Emma, Miss Taylor left (C) the Woodhouses and had married (D) the man of her dreams. No error (E)

14. Miss Taylor decided (A) to hold the wedding in (B) a small (C) chapel with her close friends and (D) family. No error (E)

15. Either Emma is dejected about (A) the wedding nor (B) she already longs (C) for Miss Taylor's (D) company. No error (E)

IIIC. VOCABULARY. Using context clues, choose the option whose meaning is closest to that of the underlined word in the sentence.

16. Emma Woodhouse is a handsome woman, consistent with her single-mindedness.
A. A woman with a beautiful face
B. A woman with a mature face
C. A woman with a man's good looks
D. A woman with a stubborn demeanor
E. A woman with imposing good looks

17. Despite the early loss of her mother, Emma has a happy disposition.
A. character
B. heart
C. home
D. life
E. situation

18. Her solitude after Miss Taylor's wedding is certainly going to vex her.
A. abhor
B. annoy
C. incense
D. insult
E. tease

19. Emma's indulgent father gives her everything she asks for.
A. affectionate
B. diligent
C. generous
D. loving
E. wealthy

20. When her mother died, Emma became the mistress of the house.
A. A woman who is married
B. A woman having an illicit affair
C. A woman in a position of authority
D. A woman who owns her own house
E. A woman who earns her living by sewing

21. Emma and Miss Taylor's intimacy is seldom seen considering their disparate situations in life.
A. alliance
B. attachment
C. attraction
D. partnership
E. relationship

22. Emma and Miss Taylor are like sisters; the latter's position as governess is only nominal.
A. fictitious
B. fitting
C. temporary
D. titular
E. traditional

23. Mr. Woodhouse must esteem Miss Taylor's wisdom to employ her as his daughter's governess.
A. admire
B. believe
C. engage
D. share
E. trust

24. Emma's unrestrained self-confidence tends to alloy her good life.
A. bind
B. blend
C. demean
D. ruin
E. unify

25. Miss Taylor's happy marriage is going to bring Emma unperceived distress.
A. unacceptable
B. undeniable
C. undisputed
D. unexpected
E. unwelcome

IIID. READING COMPREHENSION. Read the passage carefully, then answer the questions on the basis of what is stated or implied.

Concerning Things For Which Men, And Especially Princes, Are Praised Or Blamed

IT REMAINS now to see what ought to be the rules of conduct for a prince towards subject and friends. And as I know that many have written on this point, I expect I shall be considered presumptuous in mentioning it again, especially as in discussing it I shall depart from the methods of other people. But, it being my intention to write a thing which shall be useful to him who apprehends it, it appears to me more appropriate to follow up the real truth of a matter than the imagination of it; for many have pictured republics and principalities which in fact have never been known or seen, because how one lives is so far distant from how one ought to live, that he who neglects what is done for what ought to be done, sooner effects his ruin than his preservation; for a man who wishes to act entirely up to his professions of virtue soon meets with what destroys him among so much that is evil.

Hence it is necessary for a prince wishing to hold his own to know how to do wrong, and to make use of it or not according to necessity. Therefore, putting on one side imaginary things concerning a prince, and discussing those which are real, I say that all men when they are spoken of, and chiefly princes for being more highly placed, are remarkable for some of those qualities which bring them either blame or praise; and thus it is that one is reputed liberal, another miserly, using a Tuscan term (because an avaricious person in our language is still he who desires to possess by robbery, whilst we call one miserly who deprives himself too much of the use of his own); one is reputed generous, one rapacious; one cruel, one compassionate; one faithless, another faithful; one effeminate and cowardly, another bold and brave; one affable, another haughty; one lascivious, another chaste; one sincere, another cunning; one hard, another easy; one grave, another frivolous; one religious, another unbelieving, and the like. And I know that everyone will confess that it would be most praiseworthy in a prince to exhibit all the above qualities that are considered good; but because they can neither be entirely possessed nor observed, for human conditions do not permit it, it is necessary for him to be sufficiently prudent that he may know how to avoid the reproach of those vices which would lose him his state; and also to keep himself, if it be possible, from those which would not lose him it; but this not being possible, he may with less hesitation abandon himself to them. And again, he need not make himself uneasy at incurring a reproach for those vices without which the state can only be saved with difficulty, for if everything is considered carefully, it will be found that something which looks like virtue, if followed, would be his ruin; whilst something else, which looks like vice, yet followed brings him security and prosperity.

NICCOLO MACHIAVELLI
The Prince (1532)

26. The author implies that for the prince to endure he must learn to be

A. ideal
B. immoral
C. cautious
D. practical
E. trusting

27. The author's attitude towards humanity is

A. ambivalent
B. contemptuous
C. hopeful
D. neutral
E. pitiful

28. The author mentions all of the following virtues and vices for which princes are praised or blamed EXCEPT

A. brave and cowardly
B. compassionate and cruel
C. liberal and miserly
D. selfless and selfish
E. sincere and chaste

29. If the author were to observe current world conditions, which of the following questions would he find to be most significant?

A. Was I wrong?
B. What has changed?
C. What else can I do?
D. Are humans inherently evil?
E. Did I help in making the world a better place to live in?

30. The expression 'abandon himself to' (line 26) nearly means

A. indulge oneself
B. inhibit oneself
C. escape from peril
D. leave a situation
E. renounce one's right

31. All of the following can be inferred from the reading material EXCEPT

A. People are idealists.
B. A vicious prince will not succeed.
C. A virtuous prince will not succeed.
D. People expect the prince to be vicious.
E. People expect the prince to be virtuous.

32. The word 'evil' in line 10 is best taken to mean

A. harmful
B. immoral
C. malevolent
D. treacherous
E. unpleasant

33. It can be inferred that the reading material is about

A. culture
B. economics
C. ethics
D. politics
E. religion

34. Which of the following, if true, would demolish the author's contentions regarding the prince?

I. Humans are inherently good
II. Humans do not need princes
III. Humans are immortal

A. I only
B. II only
C. III only
D. I and II only
E. I, II, and III

35. Which of the following best describes the author's technique in handling his material?

A. Close examination of preconceptions.
B. Description and interpretation of observations.
C. Description of evidence to support a theory.
D. Generalization from a particular viewpoint.
E. Presentation of facts without comment.

The Velveteen Rabbit
(an excerpt)

There was once a velveteen rabbit, and in the beginning, he was really splendid. He was fat and bunchy, as a rabbit should be; his coat was spotted brown and white; he had real thread whiskers, and his ears were lined with pink sateen. On Christmas morning, when he sat wedged in the top of the Boy's stocking, with a sprig of holly between his paws, the effect was charming.

There were other things in the stocking: nuts and oranges and a toy engine, and chocolate almonds and a clockwork mouse, but the Rabbit was quite the best of all. For at least two hours, the Boy loved him, and then Aunts and Uncles came to dinner, and there was a great rustling of tissue paper and unwrapping of parcels, and in the excitement of looking at all the new presents, the Velveteen Rabbit was forgotten.

For a long time, he lived in the toy cupboard or on the nursery floor, and no one thought very much about him. He was naturally shy, and being only made of velveteen, some of the more expensive toys quite snubbed him. The mechanical toys were very superior, and looked down upon everyone else; they were full of modern ideas, and pretended they were real. The model boat, who had lived through two seasons and lost most of his paint, caught the tone from them and never missed an opportunity of referring to his rigging in technical terms. The Rabbit could not claim to be a model of anything, for he didn't know that real rabbits existed; he thought they were all stuffed with sawdust like himself, and he understood that sawdust was quite out-of-date and should never be mentioned in modern circles. Even Timothy, the jointed wooden lion, who was made by the disabled soldiers, and should have had broader views, put on airs and pretended he was connected with Government. Between them all the poor little Rabbit was made to feel himself very insignificant and commonplace, and the only person who was kind to him at all was the Skin Horse.

The Skin Horse had lived longer in the nursery than any of the others. He was so old that his brown coat was bald in patches and showed the seams underneath, and most of the hairs in his tail had been pulled out to string bead necklaces. He was wise, for he had seen a long succession of mechanical toys arrive to boast and swagger, and by-and-by break their mainsprings and pass away, and he knew that they were only toys, and would never turn into anything else. For nursery magic is very strange and wonderful, and only those playthings that are old and wise and experienced like the Skin Horse understand all about it.

"What is REAL?" asked the Rabbit one day, when they were lying side by side near the nursery fender, before Nana came to tidy the room. "Does it mean having things that buzz inside you and a stick-out handle?"

"Real isn't how you are made," said the Skin Horse. "It's a thing that happens to you. When a child loves you for a long, long time, not just to play with, but REALLY loves you, then you become Real."

"Does it hurt?" asked the Rabbit.

"Sometimes," said the Skin Horse, for he was always truthful. "When you are Real you don't mind being hurt."

"Does it happen all at once, like being wound up," he asked, "or bit by bit?"

"It doesn't happen all at once," said the Skin Horse. "You become. It takes a long time. That's why it doesn't happen often to people who break easily, or have sharp edges, or who have to be carefully kept. Generally, by the time you are Real, most of your hair has been loved off, and your eyes drop out and you get loose in the joints and very shabby. But these things don't matter at all, because once you are Real you can't be ugly, except to people who don't understand."

"I suppose *you* are real?" said the Rabbit. And then he wished he had not said it, for he thought the Skin Horse might be sensitive. But the Skin Horse only smiled.

"The Boy's Uncle made me Real," he said. "That was a great many years ago; but once you are Real you can't become unreal again. It lasts for always."

- Margery Williams

36. Where is the setting of the story?

A. Farm
B. Toy store
C. Nursery
D. Bedroom
E. Stockroom

37. Based on the selection, what does it mean to be real?

A. To be hurt
B. To be loved
C. To be a human
D. To be a new toy
E. To be a real rabbit

38. What does the line “When you are real, you don’t mind being hurt,” mean?

A. Being real endures pain.
B. Being real requires sacrifices.
C. Being real entails martyrdom.
D. Being real shows selflessness.
E. Being real results to insensitivity.

39. Which of the following statements is TRUE?
I. Toys can be real.
II. The horse is a real animal.
III.There is no chance to be real.
IV. The main character is a real animal.
V. The main character thought he is real.

A. I, II and III
B. II and III
C. I, III, and IV
D. IV and V
E. I and V

40. What does the horse mean when he said, “Generally, by the time you are Real, most of your hair has been loved off, and your eyes drop out and you get loose in the joints and very shabby. But these things don’t matter at all because once you are Real you can’t be ugly…”

A. Real things do not have hair and eyes.
B. Only those which are beautiful can be real.
C. Being real is not concerned with appearance.
D. Being ugly is one characteristic of real things.
E. There is no way one can be ugly when he is real.

41. What do the mechanical toys symbolize?

A. Progress
B. Materialism
C. Technology
D. Self-confidence
E. Superiority complex

42. What word in paragraph 1 is synonymous with wonderful?

A. charming
B. splendid
C. bunchy
D. wedged
E. velveteen

43. What made the horse real?

A. He was never broken.
B. He was superior in the nursery.
C. He was loved by the boy’s uncle.
D. He became a friend of the rabbit.
E. He was the oldest toy in the nursery.

44. What is the meaning of this statement: “When a child loves you for a long, long time, not just to play with, but REALLY loves you, then you become real.”?

A. Being real is being loved.
B. Being real is hard to achieve.
C. Being real is a matter of time.
D. Being real is a matter of choice.
E. Being real is a matter of chance.

45. Which paragraph contains the transitory appreciation the rabbit experienced from the boy?

A. Paragraph 2
B. Paragraph 3
C. Paragraph 4
D. Paragraph 6
E. Paragraph 10

46. Who is the wisest character in the selection?

A. The skin horse
B. The model boat
C. The mechanical toys
D. The velveteen rabbit
E. The jointed wood lion

47. What does the line: "…because once you are Real you can't be ugly, except to people who don't understand" imply?

A. People have subjective standards in understanding others.
B. Reality lies in the realization of one's strengths and weaknesses.
C. Humans are judged according to our appearance and attitude.
D. Reality depends on observable facts and knowledge of the world.
E. True appreciation of our qualities depends on how others value us.

48. What is the best summary for the selection?

A. Toys reveal the faces of reality.
B. Toys bring joy to children of all ages.
C. Toys leave sentimental value to children.
D. Toys become real inthe hearts of their owner.
E. Toys have magic that give wonderful experiences.

49. What happened to the rabbit upon knowing the qualities of the other toys?

A. He suddenly felt inferior.
B. He got scared and anxious.
C. He appreciated his uniqueness.
D. He was amazed by their diversity.
E. He became excited yet nervous.

50. What does the selection underscore?

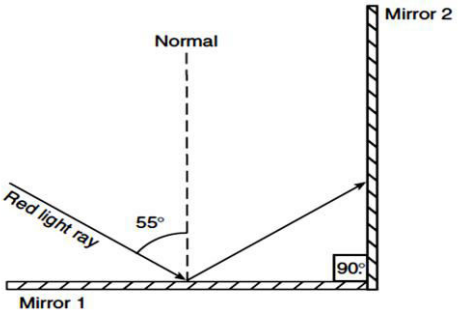
A. Love and acceptance
B. Diversity and tolerance
C. Friendship and humility
D. Individuality and confidence
E. Uniqueness and appreciation

ANSWER KEY

I.A. WORKING MEMORY

Item No.	Answer	Rationalization
1	A	
2	A	
3	C	
4	B	
5	D	The largest square in the figure is the boundary in which all other polygons are found. The side of the smaller square is 1s, hence the perimeter is 4s while the largest square has a side of 2 s and therefore the perimeter is 8s.
6	B	Single replacement reaction can only occur if the incoming cation (in this problem) possesses higher reactivity than what was initially combined with non-metal in a compound. Element Ge has lower activity than Hg since the elements were arranged in increasing order of reactivity.
7	D	Option D has a charge of 4 which when combined with metallic hypothetical element with charge of 2+, would result in the correct answer. It must be considered that ionic compounds are represented by empirical formula.
8	C	Ball pen inks with the same brand would have the most similar chromatographic profiles since ball pen inks A and D are made up of same components, option C is the correct answer.
9	D	Shirley needs an indicator that is, sensitive to pH changes within the range of 5.5 to 6.5. Option D is the correct answer.
10	A	Element Gm has five valence electrons thus will combine with three Hydrogen atoms to satisfy octet rule and will exhibit a trigonal pyramidal molecular geometry. The lone pair of element Gm will occupy a space in the three-dimensional structure, hence, will repel the bonding electrons. Option C is expected to have a trigonal planar structure while option D will be bent.
11	B	Region 2 has the most number of organisms that performs various activities. Heat is released in the activities that they perform.
12	C	Diminished number of beetles is a result of predation. Birds are possible predators of beetles.
13	C	There are equal numbers of birds and mango trees in ecosystems 1 and 3.
14	B	The third figure is a tree, a photosynthetic organism capable of transforming the energy coming from the sun into chemical energy made available to members of the ecosystem, thus calling them the producer.
15	B	The second image is a fruit belonging to the same trophic level as the tree. The second and third images are both producers.

I.B SENSORIMOTOR

Item No.	Answer	Rationalization
1	C	Robot C passes through ★on the 7th segment
2	A	Robot A lands on ★ on the 9th segment
3	D	Robot D does not pass through ★
4	A	Just follow the path on the figure.
5	C	Just follow the path on the figure.
6	B	Resultant vector is a straight-line path from the initial position (Sto. Tomas) to the final position (Lipa City).
7	A	Resultant vector is a straight-line path from the initial position (Sto. Tomas) to the final position (Nasugbu).
8	A	
9	D	
10	C	Diesel cycle: Intake → Compression → Power → Exhaust
11	D	
12	B	
13	C	
14	A	
15	D	

IC. INSPECTION

Item No.	Answer	Rationalization
1	A	The next prime number is 11.
2	B	Make ends meet. Other choices will not close the figure.
3	D	Mirror image
4	A	B, C, D are rotations of the same figure.
5	A	Identify which are exactly the same.
6	C	To allow the flow of electrons, the circuit must be closed, connecting the different parts of the circuit including the load, connecting wires, drycell/ battery and [switch]-optional. Since the voltage ratings are identical, there will be no charge flow in letter A. Since options A and B are open circuits, no charges can flow.
7	B	The greater the number of turns, the stronger the electromagnet becomes. Therefore, more nails will be attracted to the electromagnet. Since option B has less turns it should have lesser attracted nails compare to option A.
8	D	The EM spectrum and the color spectrum are arrangement of EM radiation and color lights of increasing frequency or energy. For the 1st reflection, the EM and Color spectrum would appear reversed. The 2nd reflection would reverse the reversed spectrum and would result to the original spectra.
9	C	The configuration of the forces satisfies the two conditions for static equilibrium. The Sum of all the forces in configuration C is zero and the torque or the spinning effect of force 1 and 2 cancel out each other, hence, the object is neither moving nor spinning.
10	C	The distances between the points in diagram V at the first five dots have increasing distances which means that the object covers larger distances within the same time interval hence the object has increasing speed. The converse happens at the remaining points for diagram V.
11	B	The answer is B since it contains the sequence of RNA bases complementary to the given. Letters A and C are DNA sequences and letter D has a different set of RNA bases.
12	D	As seen in the diagram, the karyotype shows that chromosome 21 has three chromosomes, where there should only be two, and that two chromosomes occupy X making the subject a female.
13	D	The diagram clearly outlines the threat to extinction that it nearly faced as shown by its narrow middle portion, and the success in breeding is shown as the wide base of the diagram. Letter A shows success in increasing the number of juveniles, however, the increase in number is steady compared to the dramatic increase shown by letter D.
14	B	In the given pedigree, the parents are not afflicted with the disease, but two of their sons are suffering from the disease while their two daughters and one son are normal. The next generation also shows

		the same condition, but in the last generation where the afflicted son marries a normal female, none of their children are stricken with the disease. It only shows that the gene is X-linked since males are more prone to inheriting this disease because they only have one X chromosome which comes from their mother. The first generation shows no sign of the disease, although the mother is a carrier of the X-linked recessive gene. It was not manifested by the females since this is a recessive allele, and the males may manifest the disease because they will inherit X-chromosomes carrying the recessive allele from their mother.
15	**A**	Only mountain lion and hawk serve as final consumers and several food chains of the food web, and they also serve as secondary consumers. For the hawk, it is a secondary and final consumer in the food chain shrub/tree – squirrel – hawk, while for the mountain lion it is shrub – rabbit – mountain lion and tree – deer – mountain lion.

IIA. SCIENTIFIC ABILITY

Item No.	Answer	Rationalization
1	C	Fibonacci sequence
2	C	First letter of the month and the corresponding number of days
3	A	Vowels and corresponding order in the alphabet
4	D	O < I and O < E but the relation between I and E cannot be established definitely
5	A	Operative word: all
6	B	Operative word: some
7	C	A square is both a rectangle and a rhombus.
8	C	b = 2700 (3^{-2}) = 300
9	D	Set up the 3 equations and use techniques to solve a system of equations.
10	D	Use dimension analysis.
11	B	Same height (h) and acceleration due to gravity(g) but different densities (ρ) of liquids : ethyl alcohol, oil, freshwater and sea water (from lowest to highest). Since P=pgh, liquid pressure varies. Lowest pressure, shortest stream in ethyl alcohol while highest pressure, farthest stream in seawater.
12	C	According to Hooke's Law (F = -kx), elongation depends on the spring constant and restoring force. Since, the same setup were used in different places, elongation is not dependent on the mentioned quantities. Instead, the force of gravity may affect the elongation since it is opposite the restoring force. The greater the force of gravity, the greater the elongation. $F(Hooke's\ Law) = F_g(Weight)$ $-kx = mg$ $x = -\frac{k}{m}g$
13	D	Lactose, when undigested can form extensive hydrogen bonds with water in the intestines leading to watery stool.
14	C	Buoyancy of a substance is determined by its specific gravity $\left(\frac{\rho_{Object}}{\rho_{Water}}\right)$. The one with the smallest specific gravity floats while the one with the largest specific gravity sinks or stays at the bottom layer. From the table, maple syrup has the greatest specific thus sinks.
15	C	• 1st law of motion – law of inertia (constant state of motion without the application of net force) • 2nd law of motion – law of acceleration (net force creates an acceleration) • 3rd law of motion – law of interaction (for every action is an equal but opposite reaction)

16	**A**	The higher the coefficient of expansion, the greater is the expansion, the better it is to be used for constructing gaps in bridges for safety purposes.
17	**D**	According to the definition of Ideal Gas Law (PV=nRT), as the gas is heated the pressure, temperature, and volume will have a corresponding increase. In this case the average number of particles hitting the container (pressure) will increase and the average kinetic energy will also increase. However, since the cylinder is sealed the volume will remain the same as the heat is applied, hence, the average distances between the molecules will not vary for changes in temperature.
18	**C**	In Dino's experiment, he is essentially trying to relate the changes in the temperature of the system for different media since faster change in temperature would mean that the heat is being transferred more effectively. Thus, the independent variable is the medium of heat transfer since this is the variable by which temperature changes will depend on.
19	**C**	Entropy, in essence, is the measure of the disorder of a certain system. The higher the disorder, the higher the entropy becomes. Among the four cylinders (system) the most disorderly is the third cylinder which means that its entropy is also the highest
20	**B**	Energy is needed for the gas in the piston to expand. The energy needed would be in the form of heat extracted from the heat source. As the gas expands it converts the energy to work as it pushes the pistol upwards.
21	**B**	The animals given above are representative animals of the different classes of vertebrates. Letters A and C are representatives of class Mammalia, while D is an invertebrate. The only class which has not been represented is Chondrichthyes, or the cartilaginous fishes, where sharks belong.
22	**C**	Given are animals and their corresponding structures used in food acquisition. Man uses its hands for getting food.
23	**C**	Phytoplanktons are photosynthetic making them a producer.
24	**C**	The absence of hole on the guava is sign that the worm was already present in the fruit while it was still a flower, while the presence of the hole on the other guava tells you that the fruit has already developed when the worm was introduced.
25	**A**	All of those given are aquatic organisms capable of locomotion, except for Tunicates that are attached to the seafloor, hence immobile.
26	**C**	Defective dynein molecules in cilia and flagella
27	**A**	
28	**D**	
29	**B**	
30	**B**	

IIB. QUANTITATIVE ABILITY

Item No.	Answer	Rationalization
1	B	The four quarter circles add up to one. The square is also a rectangle. Area of shaded is $16 - 3\pi$ whereas the area of the unshaded is $3\pi \approx 9.42$
2	B	Separate into polygonal regions because it is easier to use area addition postulate than Pick's Theorem.
3	D	2 circles is equivalent to 3 squares
4	C	Remember that 1 circle is "as heavy as" 1.5 squares.
5	C	1500 = 0.3T so Tuition fee should be 5000 and 3500 is shouldered by the government.
6	C	20 does not divide 350
7	D	m = 4 and n = $\pm$ 8
8	D	b can either be 1, 2, 3, 5, 6, 10, 15, or 30
9	B	s = 80 so 30% of it 24
10	B	2.25 + 4.75 + 2.25 = 9.25
11	A	Displacement is the area under the v-t graph and there are three different geometrical figures namely: 2 squares, 2 right triangles and 1 rectangle. Adding the area of different geometrical figures: Area of Squares ($A=s^2$) = $4^2 + 8^2$ = 16 + 64 = 80 Area of right triangles (A=1/2 bh) = ½ (2)(8) + ½ (2)(4) = 8 + 4 = 12 Area of Rectangle (A=lw) = (2)(4) = 8 TOTAL Area = 100 = NET DISPLACEMENT (Δd) Other Solution (higher approach): This can also be solved using integral equation with slopes (m) of different line graphs. Since, $$\Delta d = \int_0^2 v dt + \int_2^{10} v dt + \int_{10}^{12} v dt + \int_{12}^{16} v dt$$ Using also the point-slope form to determine the equation of each line: $$y - y_1 = m(x - x_1) \qquad m = \frac{y_2 - y_1}{x_2 - x_1}$$ By applying point-slope form and slope formula, Equations of the lines are y = 4x ; y = 8 ; y = -2x +28 ; y = 4 respectively. Slope represents the acceleration, y represents velocity and x represents time. Equations of the lines become v = 4t (from t=0 to t=2s) ; v = 8 (from t=2s

		to t=10s) ; v = -2t +28 (from t=10sto t=12s) ; v = 4 (from t=12s to t=16s) respectively $\Delta d = \int_0^2 (4t)dt + \int_2^{10} (8)dt + \int_{10}^{12} (-2t+28)dt + \int_{12}^{16} (4)dt$ $\Delta d = 2t^2\Big\|_0^2 + 8t\Big\|_2^{10} + (-t^2+28t)\Big\|_{10}^{12} + 4t\Big\|_{12}^{16}$ $\Delta d = (16-0)+(80-16)+(192-180)+(64-48) = \mathbf{100m}$
12	**B**	Light must travel from DIAMOND to AIR. Since incident angle equals the critical angle: $\text{Using } SNELL's \ \ LAW:$ $n_1 \sin\theta_1 = n_2 \sin\theta_2$ $n_1 \sin\theta_C = n_2 \sin\theta_2 \quad \text{For Total Internal Reflection: } \theta_2 = 90^0, \sin 90 =$ $n_1 = \frac{n_2 \sin\theta_2}{\sin\theta_C} = \frac{(1.0003)(\sin(90))}{\sin(24.42)}$ $n_1 = 2.42$
13	**B**	The students may trace the trajectory path of the projectile to know the answer. Solution: $R = \frac{v_i^{\ 2}\sin 2\theta}{g}$ $= \left(\frac{(18m)^2 \sin((2)(79^O))}{9.8m/s^2}\right)$ $= 12.38m \approx 12.00m$
14	**C**	I. Bulbs in Series Circuit: $R_{eq} = R_1 + R_2 + R_3$ II. Bulbs in Parallel Circuit: $1/R_{eq} = 1/R_1 + 1/R_2 + 1/R_3$ III. Bulbs in Complex Circuit: First Step: $R_{23} = R_2 + R_3$ $1/R_{eq} = 1/R_1 + 1/R_{23}$ Based from the formula above, Bulbs in series circuit will have the highest equivalent resistance since it is not in fractional form. Solution: **SERIES CIRCUIT:** $R_{eq} = R_1 + R_2 + R_3$ $= 3R$ **PARALLEL CIRCUIT** $1/R_{eq} = 1/R_1 + 1/R_2 + 1/R_3$ $= 1/R + 1/R + 1/R$ $= 3/R$ $= 1/3\ R$

COMPLEX CIRCUIT

$R_{23} = R_2 + R_3$
$= R + R$
$= 2R$

$1/R_{eq} = 1/R_1 + 1/R_{23}$
$= 1/R + 1/2R$
$= 3/2\ R$
$= 3/2\ R$
$R_{eq} = 2/3\ R$

15 **A**

Using the magnification formula,

$$\frac{-s_i}{s_o} = \frac{-d_i}{d_o} \qquad since \quad s_i = -s_o$$

$$1 = \frac{d_i}{d_o}$$

$$d_o = d_i$$

Using the mirror eqn formula,

$$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i} \qquad since \quad d_i = d_o$$

$$\frac{1}{20cm} = \frac{1}{d_o} + \frac{1}{d_o}$$

$$\frac{1}{20cm} = \frac{2}{d_o}$$

$$d_o = 40cm$$

16 **D**

Using the temperature conversion from Fahrenheit to Degree Celsius

$T_C = 5/9\ (T_F - 32)$
Let $T_F = T_C$
$T_C = 5/9\ (T_C - 32)$
$T_C - 5/9\ T_C = -17.78$
$T_C = -40$ degrees $= T_F$

17 **A**

$$\sum F = ma; the\ net\ force\ applied\ on\ an object\ is\ proportional\ to\ its\ accelerati\ o$$

$$F_{Pull} - F_f = ma$$

$$50N - 10N = (20kg)(a)$$

$$a = 2m/s^2; directed\ along\ the\ direction\ of\ the\ pull\ force$$

18 **A**

$\sum F = ma$; The net force applied on an object is proportional to its acceleration. Since the bucket is at rest and its acceleration is zero, then it is NOT subject to a net force

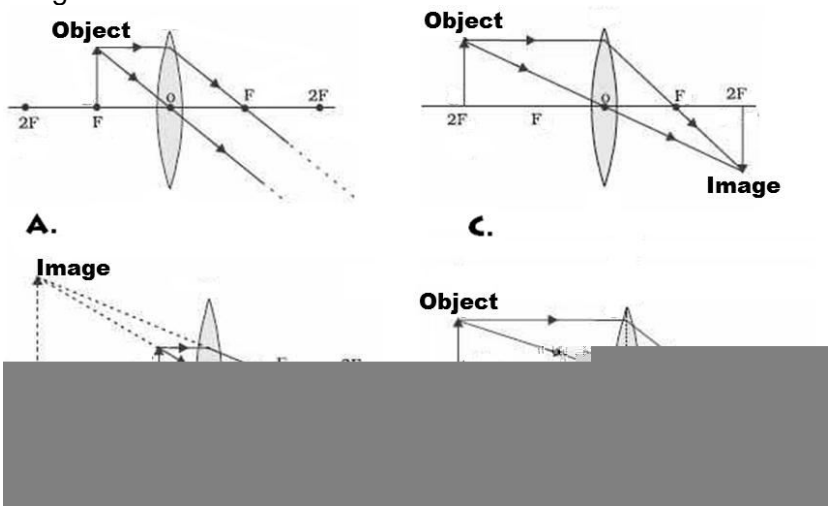
19	A	The resistors are connected in parallel since the other bulbs continue to glow even if one of the bulbs is removed. Hence we use the equations for current (I), voltage (V), and resistance (R) for parallel circuits: Current: The total current in a parallel circuit is the sum of the currents in each resistor. $$I_{total} = I_1 + I_2 + I_3 + I_4 + \cdots + I_{15}$$ $$I_{total} = \mathbf{15\ (5A) = 75\ A}$$ Resistance: The reciprocal of the effective resistance of several resistors connected in parallel with each other is the sum of the reciprocal of the resistance of each of the resistor. $$\frac{1}{R_{eff}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \cdots + \frac{1}{R_{15}}$$ $$\frac{1}{R_{eff}} = \frac{\mathbf{15}}{\mathbf{R}}\mathbf{\Omega} \Longrightarrow R_{eff} = \frac{\mathbf{R}}{\mathbf{15}}\ \mathbf{\Omega}$$ Ohm's Law: Voltage, current, and resistance are related via Ohm's Law which is given by: $$V = I_{total}\, R_{eff}$$ $$\mathbf{120\ V = (75\ A)\left(\frac{R}{15}\Omega\right) \Rightarrow R = 24\ \Omega}$$ Alternate Solution: - The resistors are connected in parallel since the other bulbs still glow even if one of the bulbs is removed. - Voltages across resistors connected in parallel are the same - Since the resistors have the same resistances, the current across each resistor will also be the same. Thus, $$V = IR \qquad R = \frac{V}{I} = \frac{120V}{5A} = 24\Omega$$
20	B	Half-life as related to environmental issues
21	D	Haemophilia gene is X-linked recessive and for a son to have haemophilia, the mother should carry a gene for this. In the given, Laura has no history of haemophilia making it impossible for a haemophilic son to be born even if Greg has haemophilia.
22	D	To get the density of ladybugs in the area, the population size of the ladybugs will be divided by the area that they occupy, that is 80957 ladybugs divided by 60 m^2, which will give you 1,349.28 ladybugs/m^2 lot.
23	A	The formula for the density of frogs and ladybugs is the same as shown in number 22, but since you should consider the actual area that they occupy you should subtract first the area of the swamp to the total area before using this as divisor for the density of ladybugs. This is because ladybugs do not live in swamps, only in terrestrial part of the lot. There is no need to do the same for the frogs since they are amphibian. After you have the density of both populations, subtract the density of the frogs from that of the ladybugs, where you will arrive with 1,376.99 ladybugs/sq.m. lot.

24	**A**	The number of glucose that allowed formation of ATP in glycolysis can be obtained by dividing the number of ATPs derived from glycolysis by two, so that would be 268 divided by 2 which equals to 134 glucose. The number of ATP from the entire process is derived by multiplying 134 by 36, resulting to 4,824 ATPs.
25	**B**	
26	**A**	
27	**B**	
28	**A**	
29	**B**	
30	**C**	

IIC. MECHANICAL TECHNICAL ABILITY

Item No.	Answer	Rationalization
1	A	What time is it? Letters B, C, and D are impossible configurations of a working clock. Choice A reads 4 o'clock.
2	D	Adjacent gears move in reverse: 1 and 3 clockwise while 2 and 4 counter clockwise
3	D	$2 = 16\ x^3$
4	B	(5/2)(1/4) = 5/8
5	B	not red ≈ green + yellow ≈ 40 + 10 = 50 out of 80 seconds
6	C	D + 7 = A and A + D = 45 so D = 19
7	B	A finishes in 5 hours when B only travelled 2900 miles.
8	C	Substitute t = 1
9	C	Static Equilibrium (summation of Torques and Forces must be equal to zero). In order to balance it, the heavier object should be located near the fulcrum. Since the robot is three times heavier than the plant pot, the pot should be located three times farther from the fulcrum (3*0.5m = 1.5m). Solution: $\sum \boldsymbol{\tau} = \mathbf{0}$ $= \mathbf{F_i r_i \sin\theta} = \mathbf{m_i g r_i \sin 90}$ $= \mathbf{m_i g r_i}$ $\quad \sin ce \sin 90 = 1$ $0 = (15kg)(9.8m/s^2)(0.5m) - (5kg)(9.8m/s^2)(r)$ $\mathbf{r} = \frac{(15kg)(9.8\cancel{m/s^2})(0.5m)}{(5kg)(9.8\cancel{m/s^2})} = 3(0.5m) = \mathbf{1.5m}$
10	D	Solution: If $m_2 = 2m_1$, $v_1 = v_2$ P=P' $m_1v_1 + m_2v_2 = m_1 v_1' + m_2 v_2'$ $m_1 v_1 - 2 m_1 v_1 = -m_1 v_1' + 2m_1 v_2'$ - $m_1 v_1 = m_1 (2 v_2' - v_1')$ - $v_1 = (2 v_2' - v_1')$ Since - $v_1 = (2 v_2' - v_1')$, Therefore, $2v_2' < v_1'$; Twice the velocity of the second ball after collision is still less than the mass of first ball.
11	C	Refraction from less dense (air) to denser medium (glass), light bends towards the normal line (dash lines).

		Using $SNELL's\ \ LAW$: $\theta_1 = 30^o \qquad n_1 = 1.003(air) \quad n_2 = 1.003(glass)$ $n_1 \sin\theta_1 = n_2 \sin\theta_2$ $\theta_2 = \sin^{-1}\left(\frac{n_1 \sin\theta_1}{n_2}\right) = \frac{(1.0003)(\sin(30))}{1.52}$ $\theta_2 = 19.26^o \approx 20^o$
12	**B**	A- Bulbs connected in series circuit: If either bulb 2 or bulb 3 burns out, it becomes open circuit and none of the remaining bulbs glow. B- Bulbs connected in complex circuit: If either bulb 2 or bulb 3 burns out, there is only one pathway for the flow of electrons. Thus, only one remaining bulb glows. C- Bulbs connected in parallel circuit: If either bulb 2 or bulb 3 burns out, there are still two pathways for the flow of electrons. Thus, two remaining bulbs glow. D- Bulbs connected in complex circuit: If either bulb 2 or bulb 3 burns out, there is a single pathway with two bulbs for the flow of electrons. Thus, the two remaining bulbs glow.
13	**B**	If the object will be placed between F and O, the image that will be formed is a magnified virtual image. Solution: Using Lens Equation: $\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i} \qquad Let\ d_o = 1/2f$ $\frac{1}{f} = \frac{1}{0.5f} + \frac{1}{d_i}$ $\frac{1}{f} - \frac{2}{f} = \frac{1}{d_i}$ $d_i = -f \quad therefore, virtual\ image$ Magnification formula $\frac{s_i}{s_o} = \frac{-d_i}{d_o} \qquad \sin ce\ \ d_i = -f;\ d_o = 1/2f$ $\frac{s_i}{s_o} = \frac{-(-f)}{1/2f}$ $s_i = 2s_o, therefore\ \text{maximized}\ \ image.$

		Image formation for A – D: 
14	**C**	Raul, because the slope of his position-time graph is steeper, which means he travelled farther in a given period of time. $v = \frac{\Delta x}{\Delta t}$; the velocity of a moving object is the slope of the position-time graph of its motion. Since Raul's motion graph has greater slope, then Raul is moving with greater velocity than Kin.
15	**C**	Measurement is within the range prescribed by student 2, 3, and 4. Upon comparing the mean values, student 3's measurement is closest to Ming's measured velocity; hence, student 3 gave the most consistent measurement to Ming's estimated value. It is also worth noting that student 1's velocity estimate is the most precise since the deviation from the mean is small signified by the error value indicated.
16	**A**	
17	**D**	
18	**C**	
19	**A**	
20	**D**	
21	**B**	
22	**D**	
23	**C**	
24	**A**	
25	**A**	

IID. IMAGERY

Item No.	Answer	Rationalization
1	C	"B" is not on the dark side. YOU MAY ALSO TRY: Redraw the given figure on a separate sheet and rotate it then see which one is different or just turn your paper around. "B" always faces the unshaded side of the diamond.
2	A	Turn your head 90 degrees clockwise to see what's on top. Notice which side appears and which one is revealed. WARNING: Letters need not be distinct.
3	C	Opposite sides total 7
4	D	Use imagination.
5	D	Extend lengthwise.
6	C	Each option exemplifies a gas law. Option C is incorrect because according to Avogadro's law, volume of a gas is directly proportional to the number of moles. In letter C, there are fewer gas molecules compared to the initial condition provided but the volume increased from 2.0L to 2.5. Option A represents Boyle's law, option B is Charles' law while option D is Gay-Lussac's law.
7	D	Reducing the volume of solvent in option II will increase concentration of solution thus making it hypertonic and RBCs should crenate. Retaining solvent volume while decreasing solute (black dots) leads to lower concentration of saline solution, a hypotonic solution, that will cause the RBCs to swell or bloat.
8	A	Detergent molecules, being amphipathic, should mediate interaction between non-polar grease and polar water molecules as shown by options A and D. Considering that the polar head is a negatively-charged phosphate, it must attract Hydrogen with partially positive charge in a water molecule, hence, A is the correct answer.
9	B	Phase changes are physical changes. In boiling water, only intermolecular forces of attraction are broken but not the intramolecular covalent bonds.
10	B	Writing from left to right is also known as mirror image. One property of plane mirror reflection is the image is left-right reversed. This is the same effect as writing from right to left.
11	C	The sacrum and the pelvis that supports bipedal gait should be broader and more basin-like so as to support the visceral organs or internal organs and aid in walking. In quadrupedals, the pelvic girdle appears less basin-like since the supporting structure of the viscera is the rib cage.
12	C	The bases are found at the middle of the structure in the given diagram s. It can be observed that the bases for the number 3 DNA are very close to each other, so when viewed from top, it would appear as if the structure at the middle is very compact.
13	D	Stages in the embryonic development of organisms, in this case animals, shows similarity if the species are related to each other. The more stages they looked more alike, the closer their evolutionary relationship is. This means that organisms are said to look alike in

		certain stages of their embryonic development because of their shared ancestry.
14	**A**	In the branch of vertebrates, the divergence of birds and reptiles was last to occur as shown in the diagram. The ancestors of birds and reptiles diverged from that of mammals, and evolved into reptile and bird much later compared to evolution of the other vertebrates.
15	**C**	The cranium of modern man enlarged to accommodate the brain, which became more developed as man evolved.

IIIA. LINGUISTIC ABILITY TEST (SCIENCE-RELATED)

Item No.	Answer	Rationalization
1	C	
2	A	
3	C	
4	D	
5	A	
6	B	
7	D	
8	A	

IIIB. GRAMMAR

Item No.	Answer	Rationalization
1	C	with (While C (under) is acceptable, context clue would suggest that 'with' is more accurate.)
2	C	of (preposition expressing quality or characteristic)
3	D	her (the subject is Emma)
4	D	she (subjective pronoun)
5	A	Question mark (?) should be inside the parentheses
6	B	colon
7	D	is (unit of time)
8	B	remembers (S-V agreement)
9	E	
10	C	help (auxiliary verb requires a present tense main verb)
11	B	lived (simple past tense)
12	D	but also
13	D	married (tense consistency)
14	D	misplaced modifier
15	C	or (correlative conjunction)

IIIC. VOCABULARY

Item No.	Answer	Rationalization
16	E	
17	A	
18	B	
19	C	
20	C	
21	B	
22	D	
23	A	
24	C	
25	D	

IIID. READING COMPREHENSION

Item No.	Answer	Rationalization
26	D	
27	D	
28	D	
29	C	
30	A	
31	D	
32	D	
33	D	
34	D	
35	A	
36	C	
37	B	
38	A	
39	E	

40	**C**
41	**E**
42	**B**
43	**C**
44	**A**
45	**A**
46	**A**
47	**E**
48	**D**
49	**A**
50	**A**