INTERNATIONAL OLYMPIAD ACADEMY
CSAR Learning Solutions Pvt. Ltd. initiative

SAMPLE PAPER
2025-26

GRADE – 9 & 10
CATEGORY: EDISON

CSAR INTERNATIONAL SCIENCE OLYMPIAD

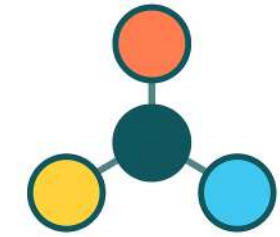
Basic: (3 Points)

1. A student introduces a glowing splint into a sealed gas jar. The splint is immediately extinguished. The gas neither supports combustion nor burns itself. However, when the gas is bubbled through limewater, the solution turns milky. Which of the following gases is most likely present in the jar?

(A) Hydrogen gas (B) Oxygen gas (C) Carbon dioxide gas

(D) Nitrogen gas (E) Methane gas

2. The diagram below shows a molecule consisting of one central atom X bonded to three identical outer atoms Y.



● = central atom X
○ = outer atom Y
(Three single covalent bonds; trigonal-planar arrangement.)

Which pair of electronic configurations (K–L–M shells) could belong to (Y, X) for this molecule?

Option	Outer atom (Y)	Central atom (X)
(A)	1	2, 3
(B)	2, 6	2, 5
(C)	2, 7	2, 3
(D)	2, 8, 7	2, 5
(E)	2, 8	2, 8, 3

3. Two different elements, P and Q, react separately with oxygen to form their respective oxides.

- The oxide of P turns red litmus paper blue.
- The oxide of Q turns blue litmus paper red.

Based on these observations, what can be inferred about the metallic character of P and Q?

Option	Statement
(A)	P is a non-metal; Q is a metal.
(B)	P is a metal; Q is a non-metal.
(C)	Both P and Q are metals.
(D)	Both P and Q are non-metals.
(E)	P is an inert gas; Q is a halogen.

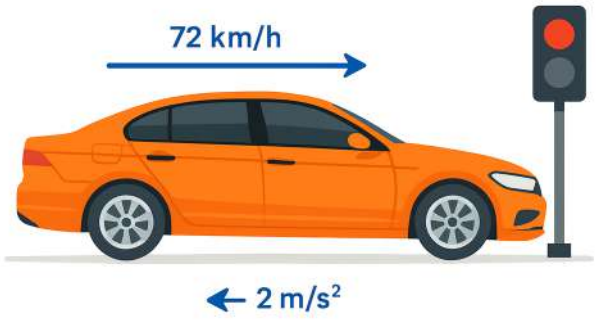
4. A healthy person's blood sugar level is regulated by insulin. If a person's pancreas is unable to produce sufficient insulin, what long-term health condition might they develop, and how can it be managed?

Option	Statement
(A)	High blood pressure; managed by diuretics
(B)	Anemia; managed by iron supplements
(C)	Arthritis; managed by anti-inflammatory drugs
(D)	Thyroid dysfunction; managed by hormone replacement therapy
(E)	Diabetes; managed by insulin injections or medication

5. Riya has a decorative electric bulb marked 100 W – 220 V, which glows brightly when connected to her home supply of 220 V. One day, she uses the same bulb at her friend's place, where the supply voltage is only 110 V. Assuming the resistance of the filament remains unchanged, what will be the approximate power consumed by the bulb now?

(A) 100 W (B) 50 W (C) 25 W (D) 200 W (E) 75 W

6. Arjun is driving his car on a smooth highway at a constant speed of 72 km/h. Suddenly, the traffic light ahead turns red, and he immediately applies the brakes. The car decelerates uniformly at a rate of 2 m/s² until it comes to a stop.



How much time will the car take to stop completely?

(A) 5 seconds (B) 10 seconds (C) 20 seconds (D) 36 seconds (E) 144 seconds

7. During a sunny afternoon, Aarav looks into a swimming pool and notices that the bottom of the pool appears closer to the surface than it really is. His friend wonders whether this is due to reflection or refraction of light.

Now, read the statements carefully and answer:

Assertion (A): The bottom of a swimming pool appears shallower than it actually is.

Reason (R): Light rays coming from the bottom of the pool undergo total internal reflection as they pass from water to air.

(A) Both A and R are true, and R is the correct explanation of A.

(B) Both A and R are true, but R is NOT the correct explanation of A.

(C) A is true but R is false.

(D) A is false but R is true.

(E) Both A and R are false.

8. A student conducts a science experiment by keeping a healthy green plant in a completely dark room for several days. After this period, when she moves the plant back into sunlight, she notices that some of its leaves have turned yellowish or pale instead of staying green.

Which biological process was most directly affected, causing this change in leaf color?

(A) Respiration, leading to energy depletion.

(B) Transpiration, causing water loss.

(C) Photosynthesis, resulting in chlorophyll degradation.

(D) Osmosis, leading to cell turgidity loss.

(E) Reproduction, affecting seed formation.

9. During a classroom activity on the flow of energy in ecosystems, Rohan creates a simple food chain on the board:

Grass → Grasshopper → Frog → Snake

If the producers (grass) at the beginning of the food chain have 10,000 Joules of energy, and energy transfer follows the 10% law, how much energy will be available to the tertiary consumers (the snakes)?

(A) 10,000 Joules (B) 1,000 Joules (C) 100 Joules (D) 10 Joules (E) 1 Joule

10. During a classroom demonstration on the human digestive system, the teacher uses simple activities to show how different organs function. Students are asked to identify which activity best represents the function of the esophagus — the tube that connects the mouth to the stomach and moves food through peristaltic motion.

(A) Shaking a small piece of chalk inside a plastic bottle.

(B) Cutting a clay cube into smaller and smaller pieces.

(C) Placing a small piece of egg in dilute hydrochloric acid.

(D) Squeezing a small greased ball through a plastic tube.

(E) Absorbing colored water using a paper towel.

Foundation: (4 Points)

11. In a chemistry lab, five types of reactions are being studied. Each has a distinct pattern showing how reactants form products. Match the type of reaction in Column A with its correct description in Column B.

Column A (Type of Reaction)	Column B (Description / General Equation)
a) Combination	1) AB → A + B
b) Decomposition	2) A + B → AB
c) Displacement	3) AB + CD → AD + CB
d) Double Displacement	4) A + BC → AC + B
e) Neutralization	5) Acid + Base → Salt + Water

(A) a–2, b–1, c–4, d–3, e–5 (B) a–1, b–2, c–3, d–5, e–4

(C) a–2, b–3, c–1, d–4, e–5 (D) a–3, b–1, c–4, d–2, e–5

(E) a–5, b–4, c–3, d–2, e–1

12. A space research student, Maya, conducts an experiment to understand how gravity changes with height. She takes a 10 kg object from the Earth's surface to a height equal to the radius of the Earth (R). Given that the acceleration due to gravity on the Earth's surface is g, what will be the approximate value of gravitational acceleration at that height?

(A) g (B) g/2 (C) g/4 (D) 2g (E) 4g

13. You are given three unlabelled bottles, each containing one of the following:

- Dilute hydrochloric acid (HCl)
- Sodium hydroxide solution (NaOH)
- Distilled water

You are provided only red and blue litmus papers, and no other indicators or reagents.

Design a logical sequence of tests to correctly identify each liquid. Then, select the option that best represents your testing method and reasoning.

(A) Test all samples with red litmus paper only.

(B) Use blue litmus first, then red litmus on the remaining samples based on results.

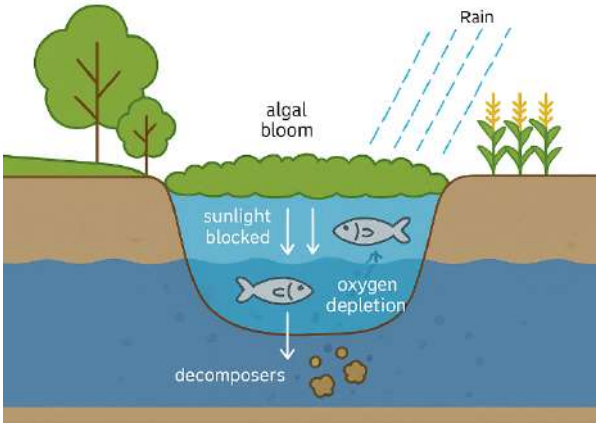
(C) Test with red litmus first, then mix the identified solutions to confirm.

(D) Test all with phenolphthalein for quicker identification.

(E) Taste and compare each liquid for difference in acidity or alkalinity.

14. After heavy rains, a small pond near a farming village receives runoff water rich in fertilizers and nutrients from nearby crop fields. Within a few weeks, the pond's surface becomes covered with thick green algae — a phenomenon known as an algal bloom.

Which of the following sequences best describes the long-term impact of this event on the pond's biodiversity and oxygen levels?



(A) Increased initial oxygen; stable biodiversity; eventual nutrient depletion.

(B) Blocked sunlight → decomposer increase → decreased oxygen → reduced biodiversity.

(C) Enhanced photosynthesis → increased oxygen → higher biodiversity → clearer water.

(D) Nutrient absorption by algae → cleaner water → increased fish population.

(E) Algal growth → increased food for fish → increased fish population → stable ecosystem.

15. In a controlled laboratory experiment, a clean strip of zinc metal is immersed in a blue solution of copper (II) sulfate ($CuSO_4$). After some time, students observe noticeable changes in color and appearance.

Which of the following observations and explanations best describe what happens in this reaction?

(A) No visible change occurs because zinc is less reactive than copper.

(B) A blue precipitate forms, but the solution remains blue throughout.

(C) The blue color of the solution fades, and a reddish-brown deposit forms on the zinc surface.

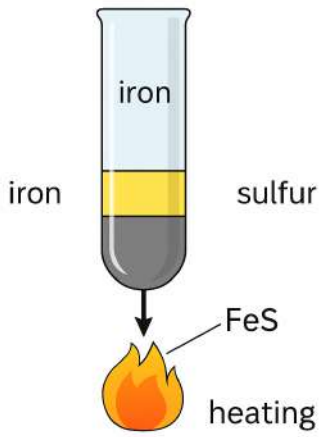
(D) The solution becomes colorless, and hydrogen gas is released due to metal–acid reaction.

(E) The zinc piece dissolves completely, and the solution turns green due to formation of a new complex.

16. A student performs an experiment by strongly heating a mixture of iron filings and sulfur powder in a test tube. After the reaction, a black solid is formed — iron (II) sulfide (FeS). The balanced chemical equation is:

$$Fe\ (s) + S\ (s) \rightarrow FeS\ (s)$$

If 28 g of iron completely reacts with 16 g of sulfur, calculate the total mass of the iron(II) sulfide formed, and state the law of chemical combination that supports your conclusion.



(Atomic masses: Fe = 56, S = 32)

(A) 28 g; Law of Constant Proportions.

(B) 16 g; Law of Multiple Proportions.

(C) 44 g; Law of Conservation of Mass.

(D) 56 g; Law of Reciprocal Proportions.

(E) 72 g; Law of Definite Proportions.

17. A student constructs two separate electric circuits using three identical bulbs, each with a resistance of 10 Ω, connected to a 6 V battery with negligible internal resistance.

Case 1: The three bulbs are connected in series with the battery.

Case 2: The same three bulbs are connected in parallel across the same 6 V battery.

Which setup will produce brighter bulbs?

(A) Case 1 – all bulbs carry the same current, so they glow equally bright.

(B) Case 2 – higher total resistance gives greater power dissipation per bulb.

(C) Case 1 – each bulb receives more voltage, hence greater brightness.

(D) Case 2 – each bulb receives full battery voltage, so power per bulb is higher.

(E) Both cases show equal brightness since the same battery is used.

18. Inside every living cell, ATP (adenosine triphosphate) acts as the cell's universal energy currency. The process of ATP hydrolysis can be represented as: $ATP + H_2O \rightarrow ADP + Pi + Energy$

A student learns that this reaction occurs millions of times each second in active cells. Which of the following statements best explains what always happens as a result of ATP hydrolysis within cells?

(A) Water is produced as a byproduct of the reaction.

(B) Chemical energy is released and used to drive cellular processes.

(C) Phosphorus atoms are used up permanently within the cell.

(D) Complex carbohydrates are synthesized directly from the energy released.

(E) Heat energy is absorbed, making the cell cooler during metabolism.

19. A ray of light enters from air (refractive index = 1.0) into a transparent medium X. The angle of incidence is 45°, and the angle of refraction is 30°. Later, the same ray emerges from medium X into another medium Y. It is observed that the speed of light in Y is greater than in X, but less than in air. Which of the following conclusions is most accurate regarding the refractive indices of X and Y?

(A) $n_Y < n_X < 1$ (B) $n_X > n_Y > 1$ (C) $n_Y = n_X$ (D) $n_Y > n_X > 1$

(E) It is not possible to compare n_X and n_Y without knowing the color of light.

20. A 1 kg block rests on a 30° inclined plane and is connected by a light inextensible string passing over a smooth pulley to a 5 kg hanging mass, as shown in the diagram. The coefficient of friction is such that the frictional force along the ramp is 10 N. The system is released from rest, and the 5 kg mass moves downward by 10 cm.

Assume $g = 9.8\ m/s^2$. Calculate the speed of the 1 kg block after it has moved 10 cm. Neglect air resistance and mass of the pulley.

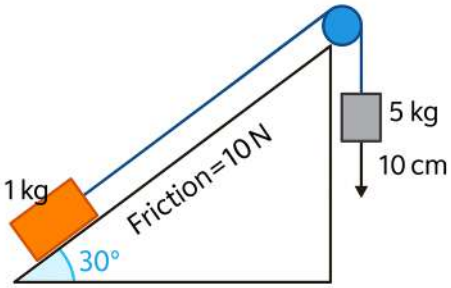
(A) 0.5 m/s

(B) 0.8 m/s

(C) 1.1 m/s

(D) 1.7 m/s

(E) 2.5 m/s



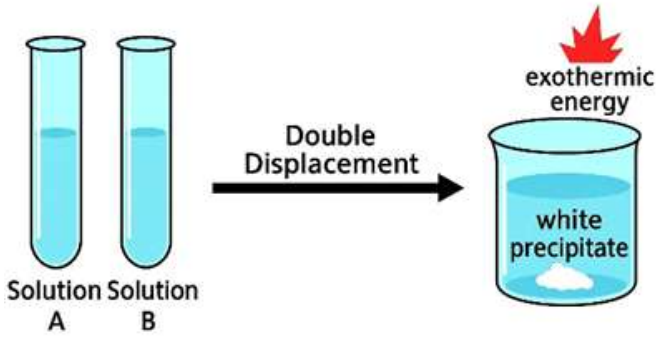
Exploration: (5 Points)

21. A student mixes two colorless aqueous solutions, labeled Solution A and Solution B. Immediately after mixing, the student observes:

- The temperature of the beaker rises significantly.

- A white solid precipitate appears, which does not dissolve when more of either solution is added.

Based on these observations, identify the most probable type of chemical reaction and select a specific example that satisfies both observations. Provide the balanced chemical equation for the reaction.



(A) Combination reaction — $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$ (exothermic, but no precipitate formed).

(B) Decomposition reaction — $2H_2O(l) \rightarrow 2H_2(g) + O_2(g)$ (endothermic, no solid formed).

(C) Double displacement (precipitation and exothermic) — $BaCl_2(aq) + Na_2SO_4(aq) \rightarrow BaSO_4(s) + 2NaCl(aq)$.

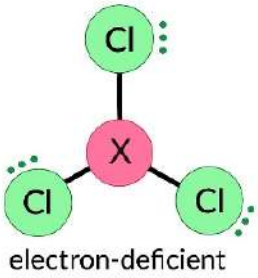
(D) Single displacement reaction — $Cu(s) + 2AgNO_3(aq) \rightarrow Cu(NO_3)_2(aq) + 2Ag(s)$ (may be exothermic, but initial reactants are not both clear solutions).

(E) Neutralization reaction — $HCl(aq) + NaOH(aq) \rightarrow NaCl(aq) + H_2O(l)$ (exothermic, but no precipitate).

22. An unknown element X, belonging to Period 2 of the Modern Periodic Table, reacts vigorously with chlorine to form a volatile compound having the molecular formula XCl_3. The compound does not conduct electricity in molten or aqueous state and exists as discrete molecules.

Based on these observations, identify:

1. The most probable element X,
2. The type of chemical bond formed, and
3. A key characteristic feature of this bonding type.



(A) X = Carbon (C); Ionic bond; involves complete transfer of electrons.

(B) X = Oxygen (O); Covalent bond; forms a diatomic molecule.

(C) X = Lithium (Li); Ionic bond; shares 3 valence electrons.

(D) X = Boron (B); Covalent bond; forms electron-deficient compounds.

(E) X = Nitrogen (N); Covalent bond; involves triple bonding between atoms.

23. Gregor Mendel crossed a pure tall pea plant (TT) with a pure dwarf pea plant (tt). All F_1 plants were tall. When these F_1 plants were self-pollinated, Mendel obtained both tall and dwarf plants in the F_2 generation. However, imagine that during this experiment, an unexpected environmental factor caused some heterozygous (Tt) plants to express intermediate height under nutrient deficiency, while homozygous plants expressed normally.

Based on this modified scenario, which of the following outcomes would best describe the observed F_2 generation?

(A) A strict 3:1 phenotypic ratio of Tall: Dwarf plants, unaffected by environmental conditions.

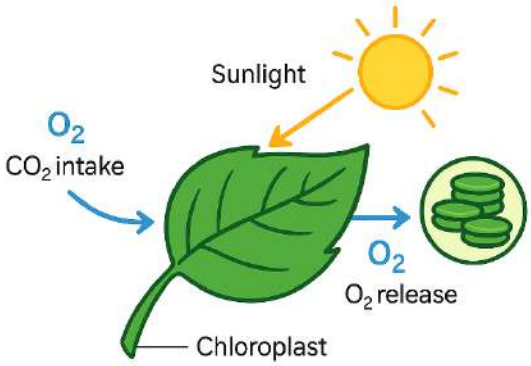
(B) A 1:2:1 genotypic ratio (TT: Tt: tt), with phenotypes showing variation due to environmental influence — some heterozygous plants being medium-height.

(C) All plants appear tall because tallness is dominant, regardless of genotype or environment.

(D) Equal numbers of tall, medium, and dwarf plants appear because genotype and environment contribute equally.

(E) Only homozygous tall (TT) and homozygous dwarf (tt) plants survive; heterozygous (Tt) plants fail to grow due to nutrient stress.

24. During a controlled experiment, a healthy green plant was exposed to sunlight while supplied with adequate carbon dioxide and water. Over time, tiny oxygen bubbles were observed emerging from the submerged leaf surfaces. When the light intensity was gradually reduced, the rate of bubble formation decreased significantly.



Based on this observation, which of the following chemical equations and statements correctly describe the process, along with the precise roles of chlorophyll and stomata?

(A) $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$; Chlorophyll absorbs water molecules, and stomata release glucose formed during photosynthesis.

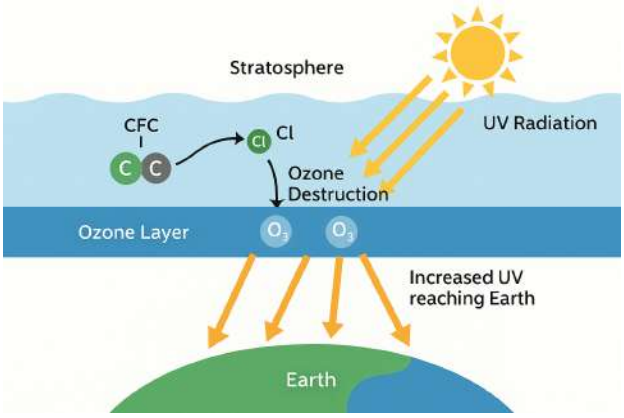
(B) $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$; Chlorophyll reflects light energy, and stomata take in oxygen for the breakdown of glucose.

(C) $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$; Chlorophyll traps solar energy to drive the synthesis of glucose, and stomata regulate gaseous exchange (CO_2 intake and O_2 release).

(D) $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$; Chlorophyll participates in respiration, and stomata absorb atmospheric water vapor.

(E) $6CO_2 + 12H_2O \rightarrow C_6H_{12}O_6 + 6O_2 + 6H_2O$; Chlorophyll converts carbon dioxide directly into glucose, and stomata release heat energy to maintain equilibrium.

25. A scientist studied atmospheric data from regions with high chlorofluorocarbon (CFC) emissions during the 1980s. Over the next decade, these regions reported a significant increase in skin cancer cases, reduced crop yield, and damage to aquatic phytoplankton. Further analysis of stratospheric samples showed the presence of reactive chlorine radicals and a sharp decline in ozone concentration, particularly during springtime.



Which conclusion best explains the role of CFCs and their long-term environmental impact?

(A) CFCs directly cause cancer and crop failure by heating the Earth's surface.

(B) CFCs act as greenhouse gases, trapping excess heat and increasing global temperature.

(C) CFCs decompose ozone molecules in the stratosphere, leading to enhanced UV radiation reaching the Earth's surface.

(D) CFCs combine with oxygen to form stable compounds that block sunlight, reducing temperature.

(E) CFCs react with sulfur compounds to produce acid rain that harms crops and aquatic life.

26. A scientist is analyzing an unknown diatomic gas, labeled element Z, found in an atmospheric sample. During experimentation, she records the following observations:

- It exists as diatomic molecules under normal conditions.
- When reacted with hydrogen, it forms a compound ZH_3 that acts as a weak base in water.
- It is a vital component of amino acids and proteins, forming part of living tissues.
- Despite being chemically inert at room temperature, it dominates the composition of Earth's atmosphere.

Based on these clues, which option correctly identifies element Z, the type of bond formed with hydrogen, and its approximate proportion in the atmosphere?

(A) Oxygen; ionic bond; 21%

(B) Carbon; covalent bond; 0.04%

(C) Nitrogen; covalent bond; 78%

(D) Phosphorus; ionic bond; trace

(E) Sulfur; covalent bond; 1%

27. Two monochromatic point sources X and Y are fixed 50 cm apart on the principal axis. A thin convex lens of focal length 12 cm is placed somewhere between them. The lens is positioned so that:

(a) The images of X and Y are formed at the same physical point and

(b) The magnitude of the linear magnification of X is k times that of Y, with $k > 1$. If $k = (25 + \sqrt{661})/6$, what is the distance (in cm) of Y from the lens?

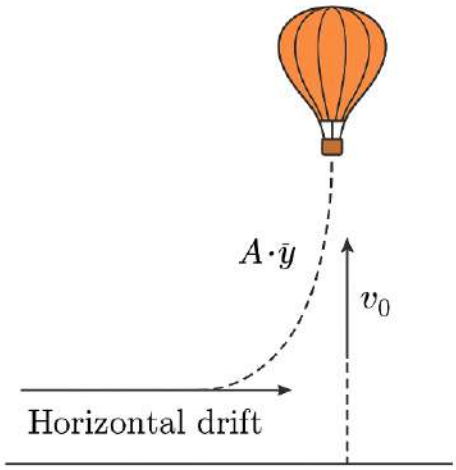
(A) 42.0 (B) 44.7 (C) 45.0 (D) 47.0 (E) 48.0

28. A block of mass m is gently lowered onto a massive horizontal platform moving with a constant velocity of 4 m/s. The coefficient of kinetic friction between the block and the platform is 0.2, and g = 10 m/s². The block is initially at rest (relative to the ground). As soon as the block touches the platform, it begins to accelerate due to friction until it moves with the same velocity as the platform. Neglect air resistance and assume uniform friction during motion.

Through what distance will the block slide relative to the platform before coming to rest relative to it?

(A) 4 m (B) 8 m (C) 16 m (D) 20 m (E) 10 m

29. A balloon rises vertically from the ground with constant upward speed v_o. At the same time, a steady wind gives it a horizontal speed that increases in proportion to its height, that is, at any height y, the horizontal speed is $v_x = A \cdot y$, where A is a constant. When the balloon has reached a height H, what is its horizontal drift?



(A) $(A \cdot H^2) / (2 \cdot v_o)$ (B) $(A \cdot H^2) / v_o$ (C) $(A \cdot H) / v_o$ (D) $(A \cdot v_o \cdot H) / 2$ (E) $(A \cdot H^3) / (3 \cdot v_o)$

30. A body of mass 6 kg moves in a straight line with a uniform velocity of 3 m/s. At a certain instant, it explodes into two equal fragments due to an internal explosion, releasing 54 J of energy. Both fragments continue to move along the same straight line as the original motion.

Which of the following statements correctly describes the motion of the two fragments immediately after the explosion?

(A) Both fragments continue in the same direction as the original body.

(B) One fragment comes to rest while the other continues in the same direction.

(C) One fragment comes to rest while the other moves in the opposite direction.

(D) One fragment moves forward and the other backward relative to the original motion.

(E) Both fragments move in opposite directions with equal speeds relative to the ground.

❑❑❑

ANSWER KEY

1. (C)	2. (C)	3. (B)	4. (E)	5. (C)	6. (B)	7. (C)
8. (C)	9. (C)	10. (D)	11. (A)	12. (C)	13. (B)	14. (B)
15. (C)	16. (C)	17. (D)	18. (B)	19. (B)	20. (C)	21. (C)
22. (D)	23. (B)	24. (C)	25. (C)	26. (C)	27. (B)	28. (B)
29. (A)	30. (D)					