إجابات النموذج الهيكلي ومخرجاته





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التواصل الاجتماعي بحسب الصف التاسع المتقدم					
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المزيد من الملفات بحسب الصف التاسع المتقدم والمادة فيزياء في الفصل الأول	
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Grade 9 Advanced Physics — Academic Year 2026–2027

اجابات النموذج الهيكلي الاولي للصف التاسع المتقدم

SECTION 1: MULTIPLE CHOICE QUESTIONS (MCQs) — ANSWER KEY & EXPLANATIONS

Question 1

- **Correct Answer: [A] Formulate a testable hypothesis based on research and observation.**
- **Detailed Explanation:** According to the standard scientific method, after observing a natural event and stating the problem (questioning "why" or "how"), the scientist conducts initial research and formulates a testable hypothesis before executing a controlled experiment.

Question 2

- **Correct Answer: [B] Incorrect; models simplify complex systems and must be continually tested and refined against real-world observations.**
- **Detailed Explanation:** Models (including computational simulations) are representations of ideas, events, structures, or objects used to help study complex or inaccessible phenomena. However, they are always subject to ongoing empirical validation against real-world observations and do not replace physical testing or represent absolute unalterable facts.

Question 3

- **Correct Answer: [B] Statement X is a Law; Statement Y is a Theory.**
- **Detailed Explanation:**
  - Statement X describes a universal rule about *what* happens in nature without explaining why (Law of Conservation of Mass).
  - Statement Y provides a comprehensive explanation of *why* and *how* gases behave based on particle motion (Kinetic Molecular Theory). Theories explain mechanisms; laws describe observed patterns.

Question 4

- **Correct Answer: [A] 4.2×10^{4} pm**
- **Detailed Explanation:**
  - Given: 0.042 μm = 0.042×10^{-6} m = 4.2×10^{-8} m.
  - Since 1 pm = 10^{-12} m: Value in pm = $(4.2 \times 10^{-8}\ \text{m})/(10^{-12}\ \text{m/pm}) = 4.2 \times 10^{4}$ pm

Question 5

- **Correct Answer: [C] 4**
- **Detailed Explanation:**
  - The leading zeros (0.0) serve only as decimal placeholders and are non-significant.
  - The digits 2, 0, and 5 are significant.
  - The trailing zero (0) after the decimal point is estimated/measured and is therefore significant.
  - Total significant figures = 4 (2, 0, 5, 0).

Question 6

- **Correct Answer: [B] Perimeter = 31.3 cm; Area = 40 cm^2**
- **Detailed Explanation:**
  - Addition Rule (Perimeter): P = 12.45 + 12.45 + 3.2 + 3.2 = 31.30 cm. The least precise measurement (3.2 cm) is precise to the tenths place. Rounding to one decimal place yields 31.3 cm.
  - Multiplication Rule (Area): A = 12.45 cm × 3.2 cm = 39.84 cm^2. The factor with the fewest significant figures is 3.2 cm (2 sig. figs.). Rounding 39.84 to 2 sig. figs. gives 40 cm^2 (or 4.0×10^{1} cm^2).

Question 7

- **Correct Answer: [C] Quadratic relationship; $d = av^2$**
- Detailed Explanation: When doubling the independent variable (v) causes the dependent variable (d) to quadruple ($2^2 = 4$), the variables exhibit a quadratic relationship where d depends on the square of v ($d \propto v^2$). Graphically, this forms a parabola.

Question 8

- **Correct Answer: [B] Car A is moving at constant velocity; Car B is accelerating.**

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- **Detailed Explanation:**
    - Car A displays equal dot spacing across equal time intervals, representing constant (uniform) velocity.
    - Car B displays progressively increasing dot spacing across equal time intervals, indicating that its displacement per unit time is increasing, which signifies positive forward acceleration.

Question 9

- **Correct Answer: [A] Distance, Mass, Speed, Work, Energy**
- **Detailed Explanation:** All items in option [A] are scalars, possessing magnitude only without directional specification. Options [B], [C], and [D] contain vector quantities (e.g., displacement, velocity, acceleration, force).

Question 10

- **Correct Answer: [C] A curve starting at the origin and bending upwards with an increasing positive slope.**
- Detailed Explanation: Increasing dot spacing over equal time intervals indicates increasing speed over time. On a position-time (x–t) graph, speed corresponds to the slope. Therefore, increasing speed manifests as a curve whose slope steepens upwards over time.

Question 11

- **Correct Answer: [C] Both objects move with identical average velocities, but Object 1 started earlier.**
- Detailed Explanation: The slope of a line on an x–t graph represents average velocity. Since the lines for Object 1 and Object 2 are parallel, they have equal slopes and thus identical velocities. Object 1's graph originates at a smaller time t_1, meaning it began moving earlier than Object 2.

Question 12

- **Correct Answer: [B] Uniform motion with zero acceleration.**
- Detailed Explanation: By definition, uniform motion occurs when an object covers equal displacements in equal intervals of time along a straight path. Because velocity is constant ($\Delta v = 0$), the acceleration is zero.

Question 13

- **Correct Answer: [B] It is moving in the negative direction and speeding up.**
- **Detailed Explanation:** When velocity and acceleration share the same sign/direction (here both are negative, $v < 0$ and $a < 0$), the object speeds up in that direction. The object moves in the negative direction and its magnitude of speed increases.

Question 14

- **Correct Answer: [A] 24.0 m/s**
- **Detailed Explanation:**
    - Formula: $v_f = v_i + at$
    - Substitution: $v_f = 15.0 \text{ m/s} + (1.50 \text{ m/s}^2)(6.00 \text{ s}) = 15.0 + 9.00 = 24.0 \text{ m/s}$.

Question 15

- **Correct Answer: [A] -25.0 m/s²**
- **Detailed Explanation:**
    - Given: $v_i = 70.0$ m/s, $v_f = 0$ m/s, $\Delta x = 98.0$ m.
    - Formula: $v_f^2 = v_i^2 + 2a\Delta x \Rightarrow 0^2 = (70.0)^2 + 2a(98.0)$
    - Solve for a: $0 = 4900 + 196\,a \Rightarrow 196\,a = -4900 \Rightarrow a = (-4900)/(196) = -25.0 \text{ m/s}^2$

Question 16

- **Correct Answer: [B] Upward: v upward, a downward | Downward: v downward, a downward**
- Detailed Explanation: During upward flight, the velocity vector points upward while gravity accelerates the object downward ($g = 9.8 \text{ m/s}^2$ downward). During downward flight, the object moves downward (velocity vector downward) while gravitational acceleration remains directed downward toward Earth's center.

SECTION 2: FREE-RESPONSE QUESTIONS (FRQs) — DETAILED SOLUTIONS & RUBRICS

Question 17 (10 Marks Total)

1. Independent & Dependent Variables [2 Marks]

- **Independent Variable:** Block Volume (or side length of the cubes) [1 Mark].
- **Dependent Variable:** Total Mass [1 Mark].

2. Significant Figures & Uncertainty [3 Marks]

- Scientific Significance: 2.50 cm indicates precision to the nearest hundredth of a centimeter (0.01 cm), possessing 3 significant figures. 2.5 cm indicates precision only to the nearest tenth (0.1 cm), possessing 2 significant figures [1.5 Marks].
- Uncertainty & Measurement Reporting: Precision is one-half of the smallest division ((0.01 cm)/(2) = ± 0.005

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cm or ± 0.01 cm depending on instrument convention). Correctly reported measurement: (2.50 ± 0.01) cm [1.5 Marks].

3. Classification Table [3 Marks]

Quantity	Classification (Base or Derived)	SI Unit
Length	**Base Quantity** [0.5 Mark]	\text{meter} (\text{m}) [0.5 Mark]
Mass	**Base Quantity** [0.5 Mark]	\text{kilogram} (\text{kg}) [0.5 Mark]
Density	**Derived Quantity** [0.5 Mark]	\text{kilogram per cubic meter} (\text{kg/m}^3) [0.5 Mark]

4. Precision vs. Accuracy Evaluation [2 Marks]

- Student B is more precise: Student B has a smaller uncertainty margin (± 0.02 g/cm³ vs ± 0.40 g/cm³), representing higher measurement repeatability/exactness [1 Mark].
- Student A is more accurate: Student A's average measured value (8.95 g/cm³) is much closer to the accepted value of pure copper (8.96 g/cm³) compared to Student B (8.42 g/cm³) [1 Mark].

Question 18 (10 Marks Total)

1. Total Distance [2 Marks]

- Formula: $d_{total} = d_1 + d_2 + d_3$
- Calculation: d_{total} = 600 m + 0 m + 900 m = 1500 m [2 Marks].

2. Net Displacement [3 Marks]

- Taking North as +y: Δ y = (+600 m) + 0 m + (-900 m) = -300 m
- Result: Magnitude = 300 m, Direction = South (or -300 m North) [3 Marks].

3. Average Speed [3 Marks]

- Formula: v_{avg}, speed = $(d_{total})/(\Delta t_{total})$
- Calculation: Δt_{total} = 40 s + 20 s + 60 s = 120 s v_{avg}, speed = (1500 m)/(120 s) = 12.5 m/s [3 Marks].

4. Average Velocity & Conceptual Explanation [2 Marks]

- Formula: $\vec{v}_{avg}$ = $(\Delta y)/(\Delta t_{total})$
- Calculation: $\vec{v}_{avg}$ = (-300 m)/(120 s) = -2.50 m/s (or 2.50 m/s South)
- Explanation: Average speed depends on total path length, which accumulates continuously regardless of direction. Average velocity depends only on net displacement (Δ y), where opposite directions cancel each other out [1 Mark].

Question 19 (10 Marks Total)

1. Physical Motion Description [3 Marks]

- Interval A (0-5 s): The robot moves forward in the positive direction with a constant positive velocity of +6 m/s [1 Mark].
- Interval B (5-15 s): The robot is stationary / at rest at position x = 30 m (v = 0 m/s) [1 Mark].
- Interval C (15-20 s): The robot moves backward toward the origin in the negative direction with a constant negative velocity of -6 m/s [1 Mark].

2. Velocity Calculation (Slope Analysis) [3 Marks]

- Interval A: $v_a = (x_f - x_i)/(t_f - t_i)$ = (30 m - 0 m)/(5 s - 0 s) = +6.0 m/s [1.5 Marks].
- Interval C: $v_c = (x_f - x_i)/(t_f - t_i)$ = (0 m - 30 m)/(20 s - 15 s) = (-30 m)/(5 s) = -6.0 m/s [1.5 Marks].

3. Velocity-Time Graph Construction [2 Marks]

- A graph plotted with v on the vertical axis and t on the horizontal axis showing:
  - Horizontal line at v = +6 m/s from t = 0 to t = 5 s.
  - Horizontal line at v = 0 m/s from t = 5 to t = 15 s.
  - Horizontal line at v = -6 m/s from t = 15 to t = 20 s.

4. Instantaneous Velocity at t = 10 s [2 Marks]

- At t = 10 s, the object is in Interval B where the position line is flat (zero slope).
- Instantaneous Velocity: 0.0 m/s (the robot is completely at rest).

Question 20 (10 Marks Total)

1. Acceleration Calculations [3 Marks]

- Engine Firing Period (0 - 4.0 s): $a_1 = (v_f - v_i)/(\Delta t)$ = (80.0 m/s - 0 m/s)/(4.0 s - 0 s) = +20.0 m/s² [1.5 Marks].
- Coasting Free-Fall Period (4.0 - 12.0 s): $a_2 = (v_f - v_i)/(\Delta t)$ = (0 m/s - 80.0 m/s)/(12.0 s - 4.0 s) = (-80.0 m/s)/(8.0 s) = -10.0 m/s² (≈ -g) [1.5 Marks].

2. Maximum Height Calculation (Area under v–t curve) [4 Marks]

- The total displacement equals the area of the triangle under the v–t curve from t = 0 to t = 12.0 s: Area = (1)/(2) × base × height Base = 12.0 s, Height = 80.0 m/s Δy_{max} = (1)/(2) × 12.0 s × 80.0 m/s = 480 m
- Maximum Height: 480 m above ground level [4 Marks].

3. Kinematic Reasoning [3 Marks]

- Between t = 4.0 s and t = 12.0 s, the rocket's velocity remains positive (v > 0), meaning it is still moving

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upward.

- Negative acceleration means the rocket is slowing down (decelerating), but it continues to gain altitude until its upward velocity decreases all the way to zero at t = 12.0 s [3 Marks].

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