FIRST TERM EVALUATION 2026–27

PHYSICS • CLASS IX • SCORING KEY & SCHEME OF EVALUATION

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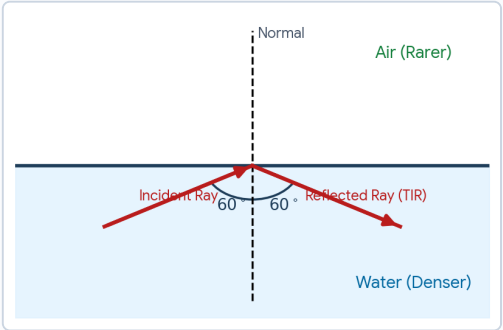
SECTION A : Objective Type Questions (Q. 1 to 4) — 4 × 1 = 4 Scores

Q. No	Value Points / Expected Answers	Score
1	**a** **Both Statement and Reason are correct, and the Reason explains the Statement.** (Light coming from point-sized stars passes through continuously moving atmospheric layers of varying optical densities, suffering continuous irregular refraction, causing apparent flickering/twinkling).	1
2	**b** **i – r – y , ii – p – z , iii – q – x** • i) Velocity = Displacement / Time (***r***) → Unit: m/s (***y***) • ii) Displacement = Velocity × Time (***p***) → Unit: m (***z***) • iii) Acceleration = Change in Velocity / Time (***q***) → Unit: m/s² (***x***)	1
3	**c** **Distance = 700 m, Displacement = 500 m** • Total path length (Distance) = 400 m + 300 m = ***700 m*** • Shortest straight-line vector (Displacement) = √(400² + 300²) = ***500 m***	1
4	**b** **X-Axis (1 cm = 2 s) , Y-Axis (1 cm = 10 m)** (From position-time graph: X-axis divisions increment by 2 s (0, 2, 4, 6...); Y-axis divisions increment by 10 m (0, 10, 20, 30...)).	1

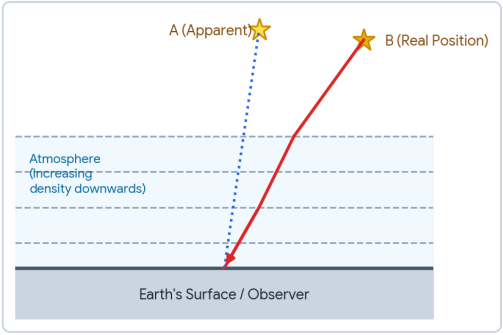
SECTION B : Short Answer Questions (Q. 5 to 11) — 7 × 2 = 14 Scores

Q. No	Value Points / Expected Answers	Score
5	• **Uniform Velocity:** — 1 Score **b)** A car moving at a constant speed in the same direction along a tarred road. **d)** Light travelling through vacuum. • **Non-Uniform Velocity:** — 1 Score **a)** A person walking around a circular stadium at a constant speed *(direction changes continuously)*. **c)** A train coming to a halt at a station *(speed changes)*.	2
6	**Precautions for pedestrians to avoid road accidents (Any two):** — 1 + 1 Score • Cross the road only through zebra crossings / pedestrian subways / foot overbridges. • Walk along footpaths / sidewalks; if unavailable, walk on the right side facing oncoming traffic. • Look to the right, then left, and right again before crossing. • Wear bright or reflective clothing when walking at night. • Avoid using mobile phones or earphones while walking/crossing the road.	2
7	**a) White broken lines on the road:** — 1 Score Indicates that vehicles are permitted to change lanes or overtake when safe to do so. **b) Continuous yellow lines on the road:** — 1 Score Strictly prohibits lane changing and overtaking; drivers must stay strictly within their lane.	2

Q. No	Value Points / Expected Answers		Score
8	**a) Angle of refraction:** $r = 90°$ (When incident at critical angle $c = 48.6°$ from water to air, the refracted ray grazes the surface). **b) Ray diagram for angle of incidence $i = 60°$:** Since $i = 60° > Critical\ Angle\ (48.6°)$, **Total Internal Reflection** occurs. The light ray reflects back into the water at an angle of reflection $r = 60°$. 	1 Score 1 Score	2
9	**a) Response to the child's statement:** **The child's statement is correct.** Displacement is defined as the shortest straight-line distance from the initial position to the final position. Since the child returned to the starting point (home), initial and final positions coincide, making the displacement $0\ m$. **b) Situation where Distance equals Displacement:** When an object moves along a straight line in a **single fixed direction** without turning back.	1 Score 1 Score	2
10 (A)	**a) Method to see the coin again:** Pour water (or any transparent liquid) into the vessel. **b) Scientific Concept:** **Refraction of light.** Light rays coming from the coin travel from an optically denser medium (water) into an optically rarer medium (air), bending *away from the normal* at the water surface. This bending causes a virtual image of the coin to appear elevated, entering the observer's line of sight.	1 Score 1 Score	2
	— OR —		
10 (B)	**Reason for aiming slightly below the perceived position:** Due to the **refraction of light**. Light rays reflecting off the fish travel from water (optically denser medium) to air (optically rarer medium) and bend *away from the normal*. This makes the fish appear at an **apparent depth** that is shallower (higher and closer to the surface) than its real position. Therefore, hunters must aim slightly below the apparent image to hit the actual fish.	2 Scores	2
11 (A)	**Reason Sun is visible after going below the horizon (Advanced sunrise / Delayed sunset):** Due to **Atmospheric Refraction**. The optical density of Earth's atmosphere increases gradually from space down to the surface. When light rays from the Sun below the horizon enter the atmosphere, they continuously refract and bend *towards the normal* (downwards towards the observer). This lifts the apparent position of the Sun above the horizon, allowing it to be seen for about 2 minutes after actual sunset.	2 Scores	2
	— OR —		
11 (B)	**a) Actual position of the star: B** (Letter A represents the apparent elevated position). **b) Scientific Reason:** Due to **atmospheric refraction**. As starlight enters the Earth's atmosphere from vacuum/	1 Score 1 Score	2

Q. No	Value Points / Expected Answers	Score

outer space (rarer) into atmospheric layers of increasing optical density, the light rays bend progressively towards the normal, making the star appear higher in the sky (at position A).



SECTION C : Descriptive & Numerical Questions (Q. 12 to 17) — 6 × 3 = 18 Scores

Q. No	Value Points / Expected Answers	Score

12

Given Data for interval between 4th s and 10th s:
Initial velocity at 4th second, $u = 5\ m/s$
Final velocity at 10th second, $v = 35\ m/s$
Time interval, $t = 10\ s - 4\ s = 6\ s$

Step 1: Calculate Acceleration (a): — 1 Score

$$a = (v - u) / t = (35 - 5) / 6 = 30 / 6 = 5\ m/s^2$$

Step 2: Calculate Displacement (S): — 2 Scores

$$S = u\,t + \tfrac{1}{2}\,a\,t^2$$
$$S = (5 \times 6) + \tfrac{1}{2} \times 5 \times (6)^2$$
$$S = 30 + (\tfrac{1}{2} \times 5 \times 36) = 30 + 90 = 120\ m$$

(Alternative formula: $v^2 - u^2 = 2aS \Rightarrow S = (35^2 - 5^2) / (2 \times 5) = 1200 / 10 = 120\ m$)

Score: 3

13

Formula: *Refractive Index (n) = Speed of light in vacuum or air (c) / Speed of light in medium (v)* [$c = 3 \times 10^8\ m/s$]

- **Refractive index of Air:** $n_{air} = (3 \times 10^8) / (3 \times 10^8) = 1.00$ — ½ Score
- **Refractive index of Water:** $n_{water} = (3 \times 10^8) / (2.25 \times 10^8) = 1.33$ — 1 Score
- **Refractive index of Glass:** $n_{glass} = (3 \times 10^8) / (2.0 \times 10^8) = 1.50$ — 1 Score

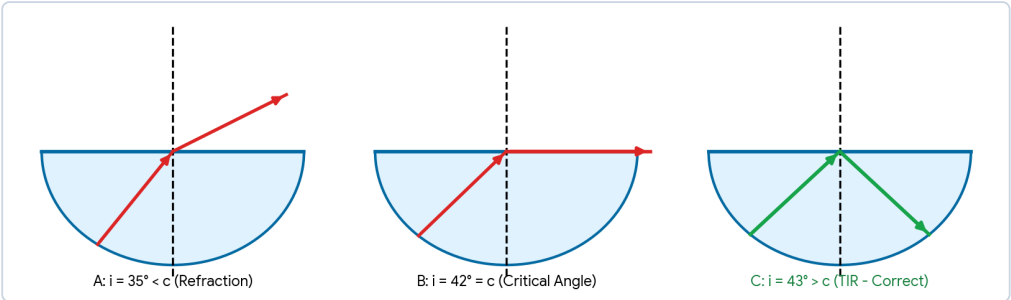
Ascending Order of Refractive Index: — ½ Score

Air (1.00) < Water (1.33) < Glass (1.50)

Score: 3

14

a) Diagram representing Total Internal Reflection: Diagram C — 1 Score



b) Two practical applications of Total Internal Reflection (Any two): — 1 Score

- Optical fibre cables (high-speed telecommunication & medical endoscopes).
- Prism binoculars / Periscopes.

Score: 3

Q. No	Value Points / Expected Answers	Score
	• Retroreflectors on vehicles and bicycles. • Sparkling/Brilliance of cut diamonds. **c) Why TIR is not always possible (Necessary Conditions):** 1 Score 1. Light must travel from an **optically denser medium to an optically rarer medium**. 2. The angle of incidence in the denser medium must be **greater than the critical angle ($i > c$)**.	
15	**a) Calculate distance from A to B:** 2 Scores Let initial speed from A to B be u (in km/h). Time taken from A to B, $t_1 = 1\ h$. For journey after B: Speed = $u/2$, Time $t_2 = ½\ h = 0.5\ h$, Distance covered = $25\ km$. Using: $Distance = Speed \times Time$ $25 = (u/2) \times (1/2) \Rightarrow 25 = u/4 \Rightarrow u = 100\ km/h$ Therefore, **Distance from A to B:** $S = Speed \times Time = 100\ km/h \times 1\ h = 100\ km$. **b) Response to the opinion that the train has uniform acceleration:** 1 Score **Disagree / Incorrect.** The train is not moving with uniform acceleration. In the first hour it travelled at a constant speed of 100 km/h (acceleration = 0), and then reduced its speed to 50 km/h (retardation/non-uniform motion).	**3**
16 (A)	**a) Example of acceleration from daily life:** 1 Score A stone dropped freely from a height / A vehicle accelerating when the green light turns on / A ball rolling down an inclined plane. **b) Calculation of acceleration on Moon's surface:** 2 Scores Initial velocity, $u = 0\ m/s$ (dropped from rest) Distance, $S = 40\ m$, Time taken, $t = 7\ s$ Formula: $S = ut + ½ at^2$ $40 = (0 \times 7) + ½ \times a \times (7)^2$ $40 = ½ \times a \times 49$ $a = (40 \times 2)/49 = 80/49 \approx 1.63\ m/s^2$	**3**
	— OR —	
16 (B)	**a) Definition of Retardation:** 1 Score Retardation (or deceleration) is **negative acceleration**, defined as the rate of decrease in velocity with respect to time ($Retardation = -a$). **b) Calculation of retardation of the bullet:** 2 Scores Initial velocity, $u = 200\ m/s$ Final velocity, $v = 0\ m/s$ (comes to rest) Time taken, $t = 4\ s$ $Acceleration,\ a = (v - u)/t = (0 - 200)/4 = -50\ m/s^2$ **Retardation = 50 m/s²**	**3**
17 (A)	**a) Phenomenon responsible for broken pencil: Refraction of light** 1 Score **b) Another daily life situation (Any one):** 1 Score • Letters beneath a glass slab appear raised. • A lemon immersed in water appears enlarged. • Bottom of a pond/swimming pool appears elevated. **c) Reason pond bottom appears elevated:** 1 Score Light rays originating from the bottom of the pond travel from water (optically denser	**3**

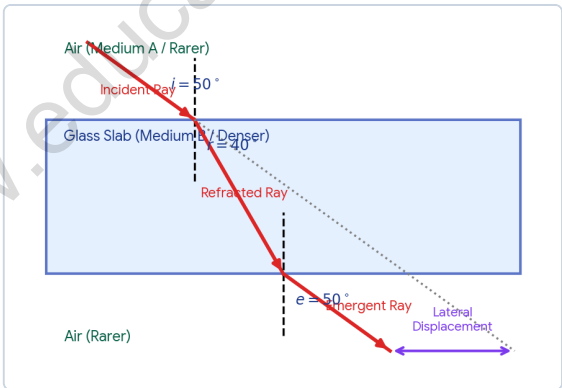
Q. No	Value Points / Expected Answers	Score
	medium) into air (optically rarer medium). At the boundary, they refract and bend *away from the normal*. When these rays enter the viewer's eyes, they appear to diverge from a higher virtual level, making the pond bottom seem elevated.	

— OR —

17 (B)	**a) Phenomenon: Refraction of light**	1 Score	**3**
	b) Justification regarding reflectors and plane mirrors:	2 Scores	
	Yes / Correct. Both vehicle reflectors and plane mirrors work on the principle of **Reflection of light** (bouncing back of light into the same medium).		
	(Note: Plane mirrors use regular specular reflection, while retroreflectors in vehicles use total internal reflection with prisms or micro-mirrors to reflect light back in the incident direction).		

SECTION D : Essay / Long Answer Questions (Q. 18) — 1 × 4 = 4 Scores

Q. No	Value Points / Expected Answers		Score
18 (A)	**a) Identification of Angles:**	1 Score	**4**
	• **Angle of incidence (*i*):** $90° - 40° = 50°$ *(angle between incident ray and normal)*		
	• **Angle of refraction (*r*):** $40°$ *(angle between refracted ray and normal)*		
	b) Comparison of Optical Densities:	1 Score	
	Since the angle of refraction ($40°$) is less than the angle of incidence ($50°$), the ray bends **towards the normal**. Therefore, **Medium B has higher optical density than Medium A** (Medium B is denser; Medium A is rarer).		
	c) Ray diagram for light emerging out of a glass slab:	2 Scores	
	Neat diagram showing: (i) Refraction bending towards normal at first boundary; (ii) Refraction bending away from normal at second boundary; (iii) Emergent ray parallel to original incident ray ($i = e$) with lateral displacement.		



— OR —

18 (B)	**a) Necessary conditions for light to change direction (Refraction):**	2 Scores	**4**
	1. The light ray must enter the interface **obliquely** (angle of incidence $i \neq 0°$).		
	2. The two transparent media must have **different optical densities** (different speeds of light).		
	b) Ray diagram: Laser torch light travelling through Air → Water → Glass slab:	2 Scores	
	• **Air → Water:** Ray passes from rarer (air) to denser (water) → bends *towards the normal*.		
	• **Water → Glass:** Ray passes from water ($n = 1.33$) to glass ($n = 1.50$, higher optical density) → bends *further towards the normal*.		

Q. No	Value Points / Expected Answers	Score