Indian School Al Wadi Al Kabir

Unit test (2026-2027)

Class: XI | Subject: Physics (042) | Max. marks: 30

Date: 17/05/2026 | SET- 1 | Time: 1 hour

MARKING SCHEME

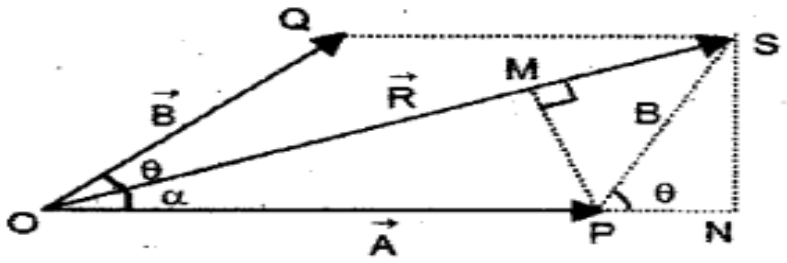
SECTION A

1	(A) 300 m [$v^2 - u^2 = 2as \rightarrow 80^2 - 20^2 = 2 \times 10 \times h \rightarrow h = 6000/20 = 300$ m]	
2	(A) Zero	
3	(A) 2R [140 s / 40 s = 3.5 rounds → returns to diametrically opposite point, displacement = 2R]	
4	(A) 90°	
5	(A) 10 m/s [From graph: x at t=2s = 10 m, x at t=4s = 30 m] [Avg velocity = $\Delta x/\Delta t = (30-10)/(4-2) = 20/2 = 10$ m/s]	
6	(A) $h = u^2/2g$	
7	(C) A is true, but R is false. A is true: In uniform motion, velocity is constant, so average velocity = instantaneous velocity. R is false: In uniform motion, velocity does not increase; it remains constant.	
8	(D) A is false and R is also false. A is false: Multiplying A by positive λ gives the same direction as A, not the opposite. R is false: Scalar × Vector = Vector (not scalar).	

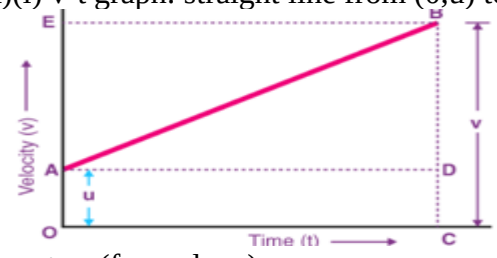
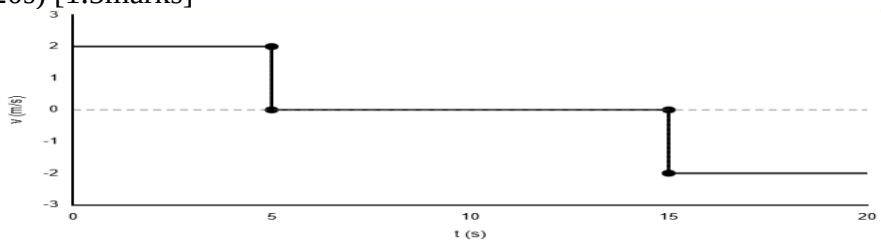
SECTION B

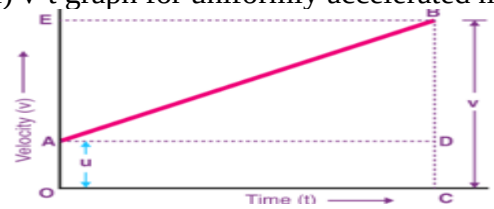
9	A. Unit vectors: Vectors of magnitude 1, used to indicate direction. $\hat{a} = A/\|A\|$ B. $\vec{A} = 2\hat{i} + 3\hat{j} + \hat{k}$ $\|\vec{A}\| = \sqrt{(4+9+1)} = \sqrt{14}$ Unit vector = $(2\hat{i} + 3\hat{j} + \hat{k})/\sqrt{14}$ OR $A_x = 10\cos60° = 5$ units $A_y = 10\sin60° = 5\sqrt{3}$ units $\vec{A} = 5\hat{i} + 5\sqrt{3}\hat{j}$	1+1 1+1
10	u = 10 m/s, v = 0, s = 0.2 m (½ mark) Using $v^2 = u^2 + 2as$: (½ mark) $0 = 100 + 2a(0.2)$ $0.4a = -100$ (½ mark) Retardation = 250 m/s² (½ mark)	2

SECTION C

11	A. d = 2 km; v1 = 4 km/h; v2 = 6 km/h (a) t = 30 min = 0.5 h: Dist = 4 × 0.5 = 2 km (reaches market exactly) Displacement = 2 km Avg velocity = 2/0.5 = 4 km/h; Avg speed = 4 km/h (b) t = 40 min = 2/3 h: Time to market = 30 min; Remaining = 10 min = 1/6 h Return dist = 6 × 1/6 = 1 km Net displacement = 2 - 1 = 1 km Total distance = 3 km Avg velocity = 1 ÷ (2/3) = 1.5 km/h Avg speed = 3 ÷ (2/3) = 4.5 km/h OR B. Find displacement from areas under v-t graph: (i) 0-4s, (ii) 0-8s, (iii) 0-12s (using signed areas) From graph: 0–2s: v=+15 m/s; 2–4s: v=+15 m/s; 4–8s: v=−10 m/s; 8–12s: v=+10 m/s (i) Displacement 0–4s = 15 × 4 = +60 m (ii) Displacement 0–8s = 60 + (−10 × 4) = 60 − 40 = +20 m (iii) Displacement 0–12s = 20 + (10 × 4) = 20 + 40 = +60 m	3 1+1+1
12	A.. The v-t graph shows a straight line with a negative slope starting from a positive velocity, crossing zero and going negative (reaching point A below the x-axis). ∴ Object A is in uniformly retarded motion (uniform deceleration / negative uniform acceleration). [1 mark] B. Position-time (x-t) graphs: (i) Positive acceleration: x-t graph is an upward curving parabola (concave upward — slope increases with time). [1 mark] (ii) Negative acceleration: x-t graph is a downward curving parabola (concave downward — slope decreases with time). [1 mark]	3
13	A. Parallelogram Law: If two vectors are represented by two adjacent sides of a parallelogram, their resultant is the diagonal from the same vertex. B.  From the diagram, A and B are at an angle θ: R = OS drop perpendicular SN to OP extended PN = A cosθ, SN = B sinθ, ON = A + B cosθ	1+2

	$R^2 = ON^2 + SN^2$ $= (A + B\cos\theta)^2 + B^2\sin^2\theta$ $= A^2 + B^2 + 2AB\cos\theta$ $R = \sqrt{(A^2 + B^2 + 2AB\cos\theta)}$	

	SECTION D	
14 (i)	(A) $4\hat{i} + 4\hat{j}$ m $\Delta r = (6-2)\hat{i} + (7-3)\hat{j} = 4\hat{i} + 4\hat{j}$	1
(ii)	(B) $4\sqrt{2}$ m $\lvert\Delta r\rvert = \sqrt{(16+16)} = \sqrt{32} = 4\sqrt{2}$ m	1
(iii)	(B) Path length > magnitude of displacement Path = 10 m > |displacement| = $4\sqrt{2} \approx 5.66$ m	1
(iv)	(C) x = 2 m, y = 3 m From $r = 2\hat{i} + 3\hat{j}$: x-coordinate = 2, y-coordinate = 3 OR Net displacement (P→Q→P) = Zero	1
	SECTION E	
15	(A)(i) v-t graph: straight line from (0,u) to (t,v); slope = a  v = u + at (from slope) Displacement s = area under v-t = ½(u+v)t Substitute t=(v-u)/a: $s = \frac{1}{2}(v+u)(v-u)/a = (v^2-u^2)/2a$ $\therefore v^2 = u^2 + 2as$ (a)(ii) Net displacement = 0 (returns to O) Average velocity = 0 Total path = OP + arc(PQ) + QO = $1 + \pi/2 + 1 = (2 + \pi/2)$ km Avg speed = $(2+\pi/2) \div (1/6) \approx 21.4$ km/h OR (B)From x-t graph: 0–5s: slope=+2 m/s | 5–15s: slope=0 m/s | 15–20s: slope=−2 m/s (i) v-t graph: horizontal line at v=+2 m/s (0–5s), then v=0 (5–15s), then v=−2 m/s (15–20s) [1.5marks]  (ii) Displacement in 20s = area under v-t graph (signed): = (2×5) + (0×10) + (−2×5) = 10 + 0 − 10 = 0 m [1.5 marks] (The body returns to its starting position)	5 5

	(iii) v-t graph for uniformly accelerated motion is a straight line with positive slope.  [1 mark] Derivation of $s = ut + \frac{1}{2}at^2$: Area under v-t graph = area of rectangle + area of triangle $s = u \times t + \frac{1}{2} \times (v - u) \times t$ Since $v - u = at \rightarrow s = ut + \frac{1}{2}at^2$ [1 mark]	