Physicsaholics

DPP – 9 (Kinematics)

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Q 1. A glass wind screen whose inclination with the vertical can be changed is mourned on a car. The car moves horizontally with a speed of 2 m/s. At what angle a with the vertical should the wind screen be placed so that the rain drops falling vertically downwards with velocity 6 m/s strike the wind screen perpendicularly?

(a) $\tan^{-1}\left(\frac{1}{3}\right)$ (b) $\tan^{-1}(3)$ (c) $\cos^{-1}(3)$ (d) $\sin^{-1}\left(\frac{1}{3}\right)$

Q 2. A stationary person observes that rain is falling vertically down at 30 km/hr. A cyclist is moving on the level road, at 10 km/hr. In which direction the cyclist should hold his umbrella to prevent himself from rain.

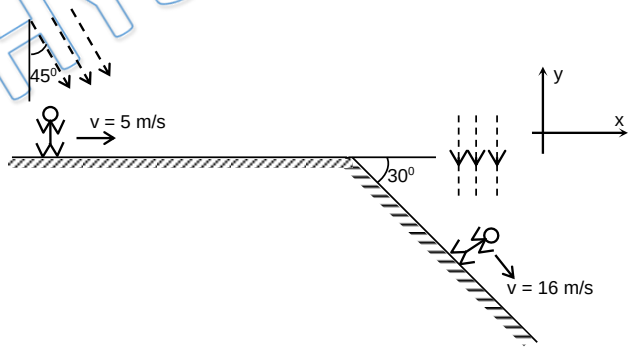
(a) $\tan^{-1}\frac{1}{3}$ from horizontal

(b) $\tan^{-1}3$ from vertical

(c) $\tan^{-1}\frac{1}{3}$ from vertical

(d) $\tan^{-1}3$ from horizontal

Q 3. A man moving with a velocity of 5 m/s on a horizontal road observes that raindrops fall at an angle of 45^0 with the vertical. When he moves with a velocity of 16 m/s along an inclined plane, which is inclined at 30^0 with the horizontal, he observes raindrops falling vertically downward as shown in the figure. Find the actual velocity of the raindrops.



(a) $8\sqrt{3}\hat{\imath} + (8\sqrt{3} - 5)\hat{\jmath}$

(b) $8\sqrt{3}\hat{\imath} - (8\sqrt{3} - 5)\hat{\jmath}$

(c) $(8\sqrt{3} - 5)\hat{\imath} + 8\sqrt{3}\hat{\jmath}$

(d) $(8\sqrt{3} + 5)\hat{\imath} - 8\sqrt{3}\hat{\jmath}$

Q 4. A man is walking at a speed 3 m/s rain drops are falling vertically with a speed 3 m/s –
(i) What is the velocity of rain drop with respect to the man ?
(ii) At what angle from vertical, the man should hold his umbrella ?
(a) 2.42 m/s, 30º in forward direction
(b) 4.24 m/s, 45º in forward direction
(c) 1.24 m/s, 60º in forward direction
(d) None of these

Q 5. Rain is falling vertically with a speed of 20 m/s relative to air. A person is running in the rain with a velocity of 5 m/s and a wind is also blowing with a speed of 15 m/s (both towards east). Find the angle with the vertical at which the person should hold his umbrella so that he may not get drenched.
(a) $\tan^{-1} 2$ (b) $\tan^{-1} \frac{1}{\sqrt{2}}$ (c) $\tan^{-1} \frac{1}{2}$ (d) $\tan^{-1} 3$

Q 6. Wind is blowing in the north direction at speed of 2 m/s which causes the rain to fall at some angle with the vertical. With what velocity should a cyclist drive so that the rain appears vertical to him :
(a) 2 m/s south (b) 2 m/s north
(c) 4 m/s west (d) 4 m/s south

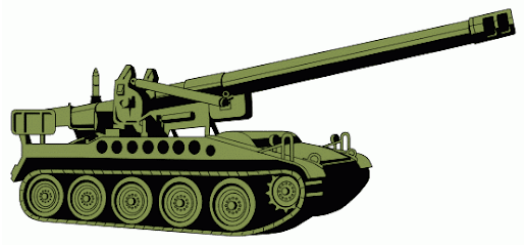
Q 7. Raindrops are falling vertically with a velocity 10m/s. To a cyclist moving on a straight road the rain drops appear to be coming with a velocity of 20m/s. The velocity of cyclist is :-
(a) 10m/s (b) $10\sqrt{3}$ m/s (c) 20 m/s (d) 20 3 m/s

Q 8. To man running at a speed of 5 m/sec, the rain drops appear to be falling at an angle of 45° from the vertical. If the rain drops are actually falling vertically downwards , then velocity in m/sec is
(a) 5 (b) $5\sqrt{3}$ (c) $5\sqrt{2}$ (d) 4

Q 9. A stationary man observes that the rain strikes him at an angle 60° to the horizontal. When he begins to move with a velocity of 25 m/s then the drops appear to strike him at an angle of 30° from horizontal. The velocity of the rain drops is :
(a) 25 m/s (b) 50 m/s (c) 12.5 m/s (d) $24\sqrt{2}$ m/s

Q 10. Rain is falling with speed 10 m/s at angle 37° with vertical. To a moving man raindrops appear to fall with $8\sqrt{2}$ m/s. Possible speed(s) of man is(are)?
(a) 1 m/s (b) 6 m/s (c) 11 m/s (d) 15 m/s

Q 11. Barrel of an Indian Army tank is at angle 53^o with vertical as shown in figure. Rain is falling at angle 45° with vertical with speed $10\sqrt{2}$ m/s. What can be the speed of tank in order to prevent the surface of barrel from being wet?



(a) 10 m/s (b) 6.66 m/s
(c) 3.33 m/s (d) 0.33 m/s

Answer Key

Q.1 b	**Q.2 c**	**Q.3 b**	**Q.4 b**	**Q.5 c**
Q.6 b	**Q.7 b**	**Q.8 a**	**Q.9 a**	**Q.10 b,c**
Q.11 c				