1. A car of mass m moves on a flat circular road of radius r with coefficient of friction μ. The maximum speed without slipping is:
   A. $\sqrt{(rg)}$ B. $\sqrt{(\mu rg)}$
   C. μrg D. rg/μ (D)

Explanation : B) $\sqrt{(\mu rg)}$

2. On a flat road, friction provides the centripetal force: $(mv^2/r = \mu mg) \Rightarrow v = \sqrt{(\mu rg)}$.
   A. $\sqrt{(rg\cot\theta)}$ B. $\sqrt{(rg\tan\theta)}$
   C. $\sqrt{(\mu rg)}$ D. $rg\tan\theta$ (D)

Explanation : At optimum speed, normal force components balance weight and centripetal force without friction.

3. A cyclist moves at 18 km/h on a curve of radius 3 m. If $\mu = 0.1$, will the cyclist slip?
   A. No, because v < vmax
   B. Yes, because v > vmax
   C. No, because friction is absent
   D. Cannot be determined (B)

Explanation : v = 5 m/s, vmax = $\sqrt{(\mu rg)}$ = 1.71 m/s. Since actual speed exceeds limit, slipping occurs.

4. For a vehicle on a banked road with friction helping motion, the expression for maximum speed is:
   A. $\sqrt{(rg(\tan\theta+\mu)/(1-\mu\tan\theta))}$
   B. $\sqrt{(rg\tan\theta)}$
   C. $\sqrt{(rg(\tan\theta-\mu)/(1+\mu\tan\theta))}$
   D. $\sqrt{(\mu rg)}$ (A)

Explanation : Friction in the direction of centripetal force increases the safe speed limit.

5. When is the minimum speed concept relevant on a banked curve?
   A. When friction is absent
   B. When friction acts outward, opposing motion
   C. When speed equals optimum speed
   D. Only on flat roads (B)

Explanation : At very low speeds, friction acts down the slope to provide centripetal force, giving a minimum speed limit.

6. The condition for no slipping of a vehicle on a flat circular road is:
   A. $v^2 < rg$ B. $v^2 < \mu rg$
   C. $v^2 > rg$ D. $v^2 = \mu g$ (B)

Explanation : If velocity exceeds this limit, required centripetal force surpasses maximum frictional force.

7. A race track has radius 300 m, bank angle 15°, $\mu = 0.2$. The optimum speed is closest to:
   A. 14.5 m/s B. 19.6 m/s
   C. 28.1 m/s D. 38.1 m/s (C)

Explanation : v = $\sqrt{(rg\tan\theta)}$ = $\sqrt{(300 \times 9.8 \times \tan15°)}$ ≈ 28.1 m/s.

8. On a banked road, if a vehicle moves exactly at optimum speed:
   A. Friction is maximum
   B. Friction is zero
   C. Friction balances centripetal force
   D. Friction opposes motion (B)

Explanation : At optimum speed, the banking angle alone provides required centripetal force.

9. Which force provides the necessary centripetal force for circular motion of a car on a level road?
   A. Normal reaction
   B. Gravitational force
   C. Frictional force
   D. Pseudo force (C)

Explanation : Horizontal component of static friction supplies centripetal force on level ground.

10. A cyclist moves at uniform speed of 7 m/s on a flat turn. If $\mu = 0.25$, the minimum radius of the turn for safety is:
    A. 9.8 m
    B. 19.6 m
    C. 4.9 m
    D. 0 m (B)

Explanation : Condition is $r = v^2/(\mu g) = 7^2/(0.25\times9.8) \approx 19.6$ m.