

Speed cameras and cricket

Question W10S: Short Answer

In an attempt to make cricket more interesting to the casual viewer, television companies are using technology to provide more information on how the game is played. A recent innovation has been the speed gun, giving the commentary team something new to talk about as the fast bowler walks slowly back the beginning of his run.

The speed guns are the same as those used by police to catch speeding motorists. They emit laser light in a narrow, intense beam that reflects off the car or cricket ball and is picked up by the gun which times how long it takes to return. The distance to the ball is then calculated. This is repeated several times a second and the speed is calculated from the changing distance measurements.

The laser uses light from just outside the visible range, with wavelengths between 700 and 1000 nanometres. The speed of light is $3.0 \times 10^8 \text{ m s}^{-1}$.

A cricket pitch is 22 yards (20.1 m) long but the bowler and batsman are each about 1 metre from the end so the distance between them is about 18 metres. The speed camera is at the edge of the pitch, about 50 metres from the wicket. A fast bowler bowls at about 85 mph. One mile is about 1600 metres.

1. Suggest why visible light is not used in speed guns.
2. What part of electromagnetic spectrum is used?
3. Convert the speed of the delivery into metres per second.
4. How long will it take the ball to travel from the bowler to the batsman?
5. How long will it take the radiation to travel from the gun to the players and back?
6. How many distance readings could the gun take while the ball is travelling from bowler to batsman?

When the bowler sends down a bouncer he seems to put maximum effort into the delivery but the speed reading is never the highest that he achieves. A normal delivery bounces about a metre in front of the batsman but a bouncer pitches about half way down.

7. Draw a side view diagram showing the flight of these two deliveries and also the direction of the light rays from the laser. Now explain why the speed readings for the bouncer will be smaller than those for the normal ball.
8. The speed gun cannot be placed directly in front of or behind the batsman or its line of sight would be blocked. Using this information and your answer to question 7, comment on the fact that many broadcasters quote the speed readings to 3 or more significant figures.