David Alciatore ("Dr. Dave") ILLUSTRATED PRINCIPLES

The 30° rule

Part I – The Basics

***Note**: Supporting narrated video (NV) demonstrations, high-speed video (HSV) clips, and technical proofs (TP) can be accessed and viewed online at www.engr.colostate.edu/pool. The reference numbers used in the article (e.g., **NV 3.8**) help you locate the resources on the website.*

If you don't know the 30º rule yet, learning it can truly transform your game. Like the 90º rule, presented in my previous series of three articles, the 30º rule helps you predict the path of the cue ball after impact with an object ball. This is a very important skill to have for helping you prevent scratches, plan break-up and avoidance shots, and execute carom and billiards shots. It is also critical in being able to play position (the skill that separates the great players from the good ones). It always surprises me how few people know this rule. Also, it is shocking to me that few books on pool and billiards give adequate (or any) coverage of this principle.

As shown in my previous three articles, the tangent line and the 90° rule are useful for predicting the path of the cue ball when it strikes an object ball with no topspin or bottom spin (i.e., for stun shots). However, with many shots the cue ball is rolling (with topspin) by the time it strikes the object ball. So for many shots, the angle between the cue ball and the object ball will be less than 90°. A useful rule for predicting the path of the cue ball when it is rolling is the **30° rule** presented in **Principle 2** and **Diagram 1**. It states that if the cue ball hits approximately half of the object ball (see **Diagram 2**), the cue ball will deflect off at very close to 30° from its original path. Note that, unlike with the 90° rule, the 30° angle is measured between the original cue ball path and the deflected cue ball path. The deflected object ball direction is not involved. With the 90° rule, the angle is measured between the deflected cue ball and object ball paths. An exact **half-ball hit**, where the center of cue ball is aimed at the edge of the object ball, is illustrated in **Diagram 2**.

Principle 2 30° rule

When the cue ball hits an object ball with normal roll close to a half-ball hit (see Diagram 2), the cue ball will deflect approximately 30° away from its initial aiming line (see Diagram 1).

- The 30° rule applies only when the cue ball is rolling without skidding at object ball impact. **Diagram 6** shows the type of shots where the 30° rule applies.
- The 30° rule is useful for planning carom and billiard shots (examples will be shown in a future article).
- There is a fairly large margin of error (see **Diagram 3**). In other words, for a fairly large range of ball-hit fractions (see **Diagram 4**), the cue ball path will still deflect by approximately 30°.
- The largest cue ball deflection (about 34°) occurs for an exact half-ball hit (see **Diagram 3**).
- The 90° rule (see my previous three articles) serves as another point of reference when shooting shots in between stun and normal roll.
- As with the 90° rule, the exact path of the cue ball depends on the speed of the shot (this will be discussed in detail in a future article).

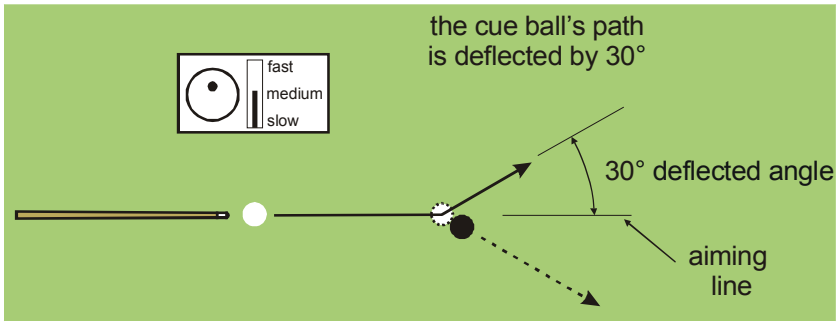


Diagram 1 30° rule

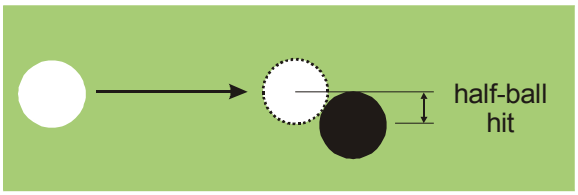


Diagram 2 Half-ball hit

You might be asking yourself: How often am I going to be shooting half-ball hits, and is the 30° rule so useful after all?" Fortunately, as illustrated in **Diagram 3**, the 30° rule applies over a wide range of ball-hit fractions (see **TP 3.3**). The center of the range is the half-ball hit, but the cue ball deflection is very close to 30° for ball-hit fractions as small as 1/4 and as large as 3/4. **Diagram 4** illustrates the ball-hit-fraction range, and corresponding cut angles, to illustrate the wide range of shots for which the 30° rule applies. With a 1/4-ball hit (see **Diagram 4a**), the center of the cue ball is aimed outside of the object-ball edge such that the projected cue-ball-path passes through 1/4 of the object ball. With a 1/2-ball hit (see **Diagram 4b**), the center of the cue ball is aimed directly at the edge of the object ball such that the projected cue-ball-path passes through 1/2 of the object ball. With a 3/4-ball hit (see **Diagram 4c**), the center of the cue ball is aimed inside of the object-ball edge such that the projected cue-ball-path passes through 3/4 of the object ball. These three cases cover a fairly large range of cut angles.

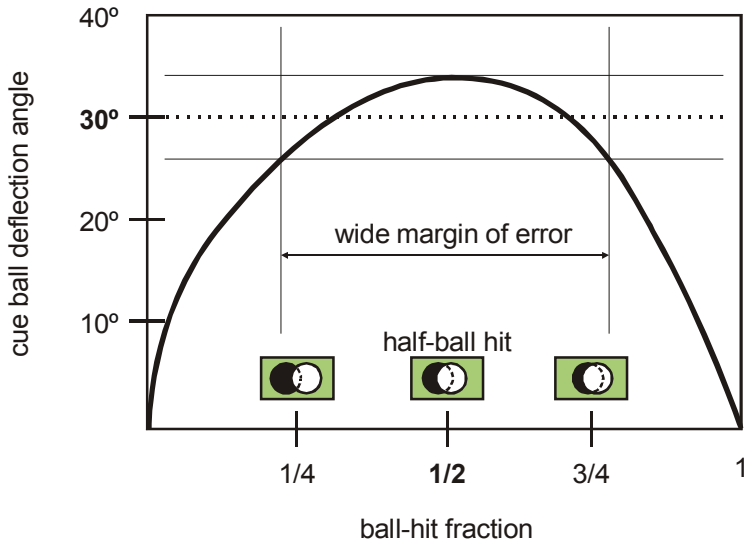


Diagram 3 **Large margin of error for 30° rule**

technical proof

TP 3.3 – 30° rule

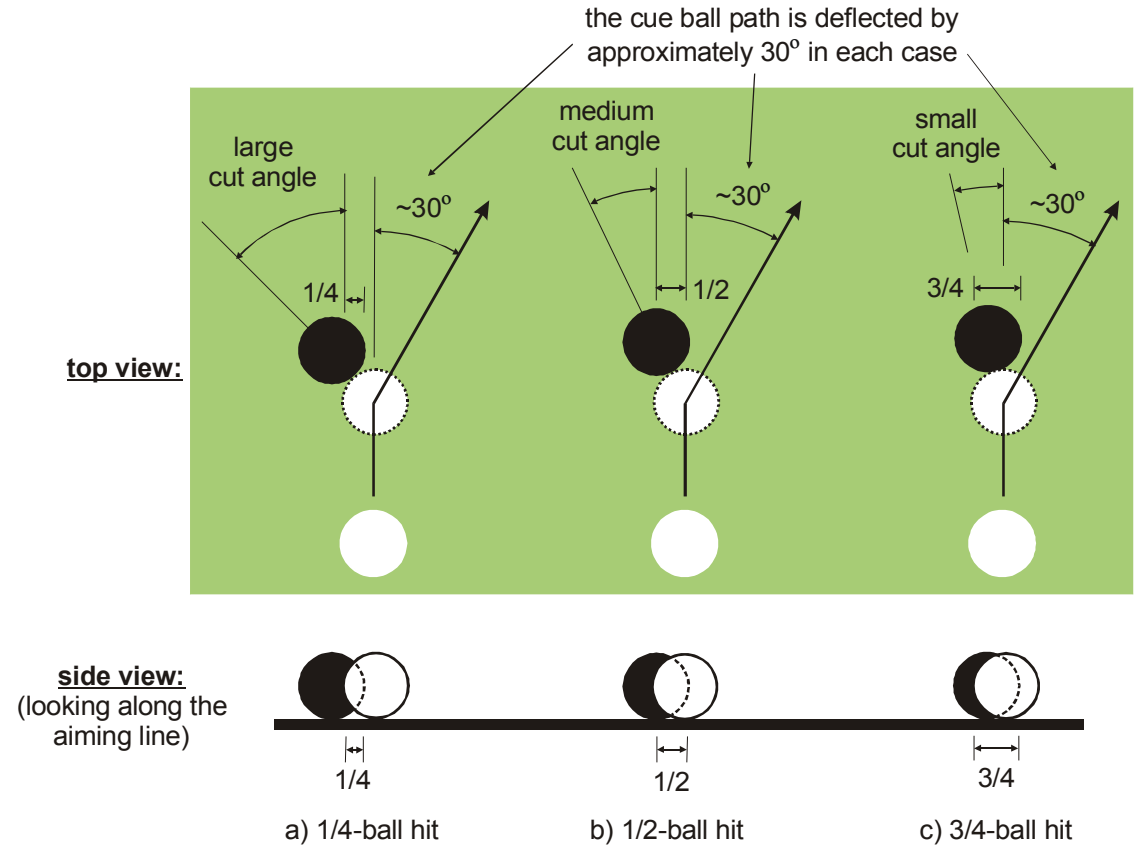


Diagram 4 **Various ball-hit fractions**

When using follow and draw, it is important to understand how the spin changes as the cue ball slides on the table cloth. The spin associated with follow and draw shots degrades as the cue ball travels. The harder you hit the shot the longer the spin will persist, but most soft to medium shots eventually end up with pure **normal roll,** where there is no longer any over-rotation or sliding between the cue ball and the cloth (see **TP 4.1**). **Diagram 5** illustrates how the vertical spin from stun, draw, and follow shots eventually transforms into normal roll (see **Principle 3**). With a center ball hit (**Diagram 5a**) the cue ball is initially sliding without rolling, but the sliding on the cloth gradually builds up topspin to the point of normal roll. The increasing topspin is illustrated in the diagram by the lengthening of the curved arrows. The speed of the cue ball slows as the cue ball slides. This is illustrated in the diagram by the shortening of the straight arrows. Once the cue ball reaches normal roll, the roll persists until the ball slows to a stop. With a draw shot (**Diagram 5b**) it takes a little longer for roll to develop; but eventually, all of the bottom spin is lost (see **HSV 3.1**), creating stun, which then degrades to normal roll. With a follow shot (**Diagram 5c**) the topspin degrades to normal roll; however, unlike with stun and draw, the speed actually increases because the topspin is turning and sliding in the direction to create the normal roll. The draw shot takes the longest to reach normal roll because its spin first degrades to stun and then to roll.

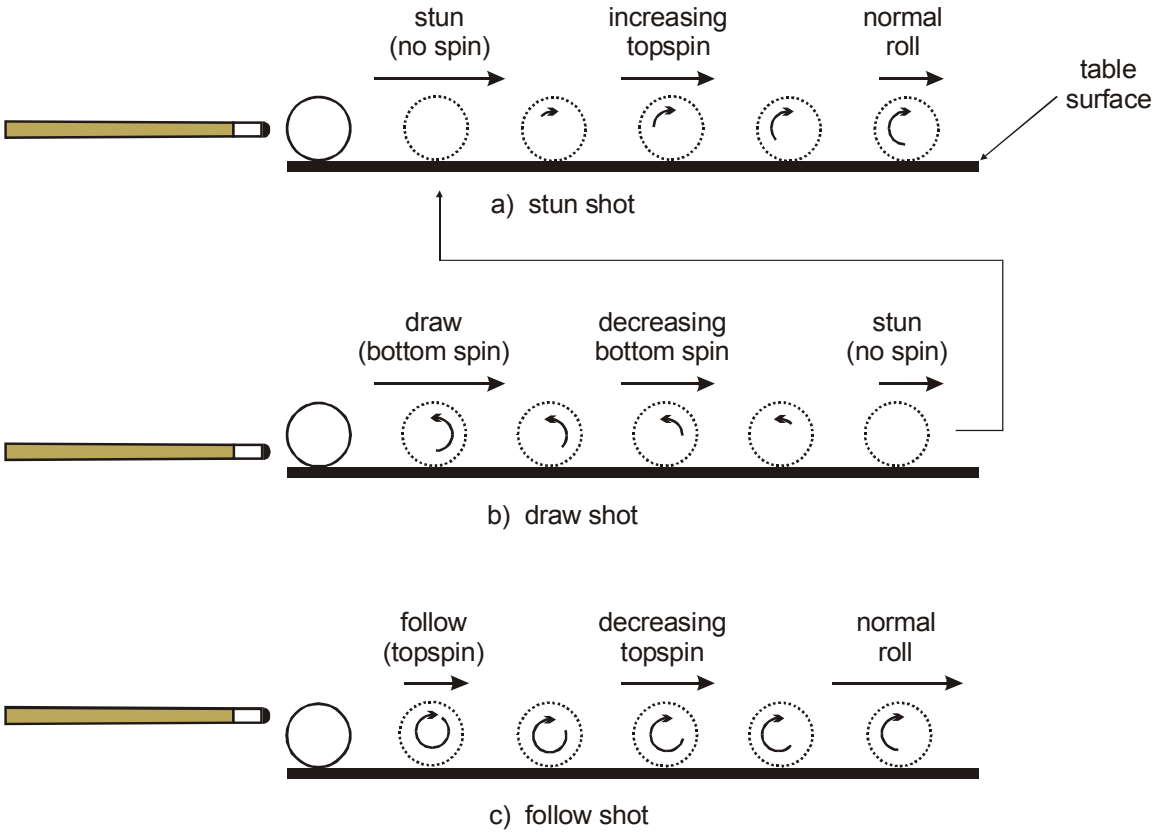


Diagram 5 Conversion of vertical-plane spin to normal roll (side view)

Principle 3 Normal roll

The cue ball gradually develops normal roll as it slides along the table cloth (see Diagram 5).

- This is true regardless of what type of vertical spin the ball has (draw, follow, or stun).
- Normal roll gives a ball the effects of a follow shot.

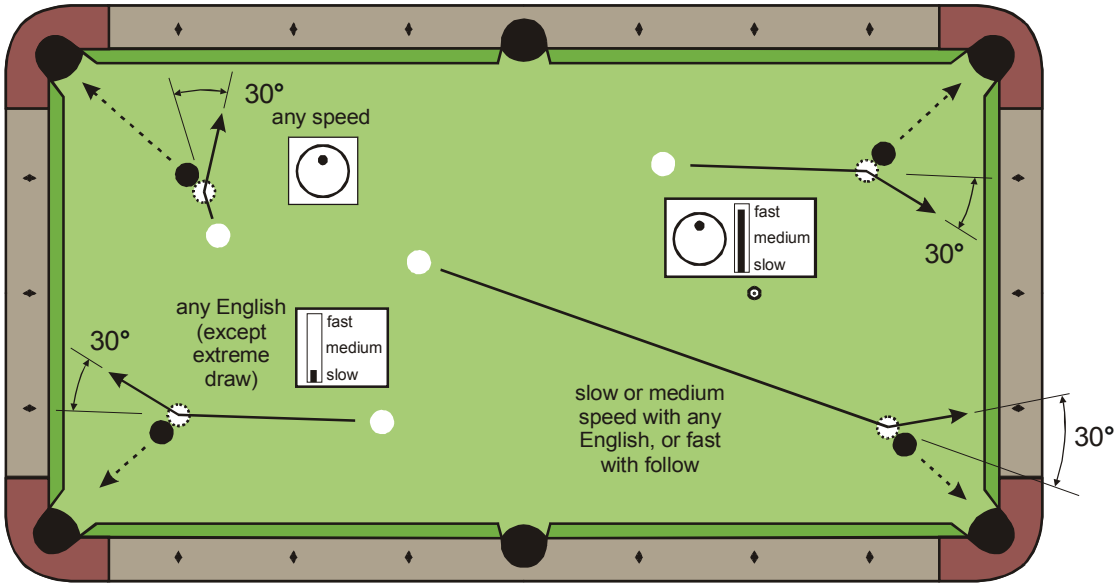
HSV 3.1 – Stop shot showing loss of bottom spin over distance

TP 4.1 – Time and distance required to develop normal roll

Diagram 6 illustrates some of the cases where the 30° rule applies. Remember, it applies only when the cue ball has developed complete forward roll by the time it reaches the object ball, and when the ball-hit fraction is in the approximate range 1/4 to 3/4. For shot "A" in **Diagram 6** (the top-left shot), the cue ball is close to the object ball, so follow (topspin) is required because the cue ball does not have enough distance and time to develop complete forward roll on its own. For shot "B" (the top-right shot), follow (topspin) is again required because the faster speed does not give the cue ball enough time to develop complete roll. In shot "C" (the bottom-left shot), because the cue ball is hit with slow speed, the cue ball will develop forward roll regardless of the English (except extreme draw). In shot "D" (the bottom-right shot), the large cue-ball distance provides enough time for roll to develop for most speeds and English (except fast draw shots).

A: cue ball at a short distance

B: cue ball hit hard at a medium distance



C: cue ball hit soft at a medium distance

D: cue ball hit at a large distance

Diagram 6 Types of shots where the 30° rule applies

To be able to apply the 30° rule effectively, you need to be able to visualize a 30° angle. **Diagram 7** shows how to use you hand to help with this. For most people, if you form a relaxed but firm V-shape (peace sign or victory symbol) with your index and middle fingers, the angle

between your fingers will be very close to 30°. **Diagram 7**, **NV 3.8**, and **NV 3.9** show how this hand V-shape is used in practice. If you point one of the fingers in the aiming line direction, the other finger will indicate the direction the cue ball will travel after impact.

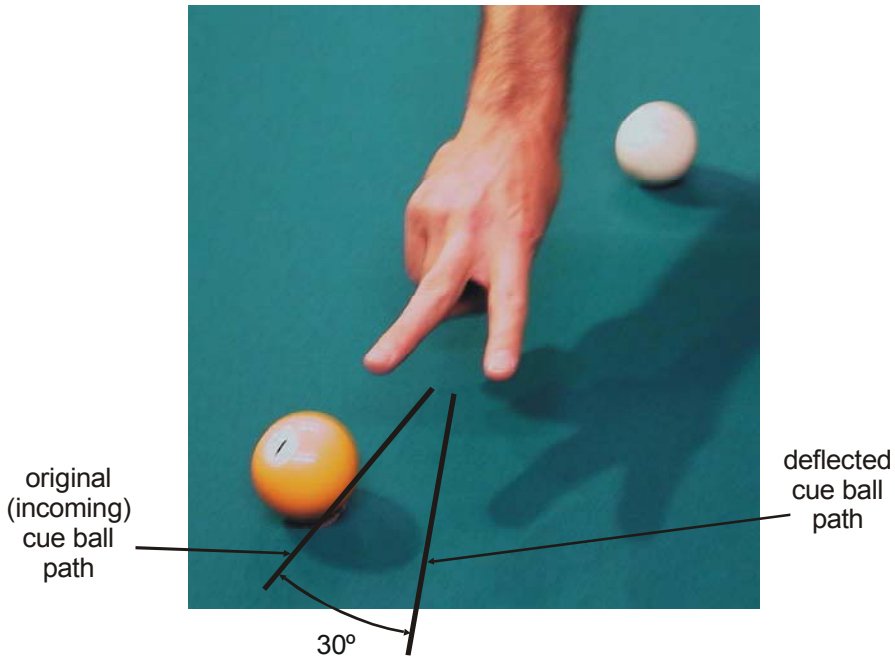
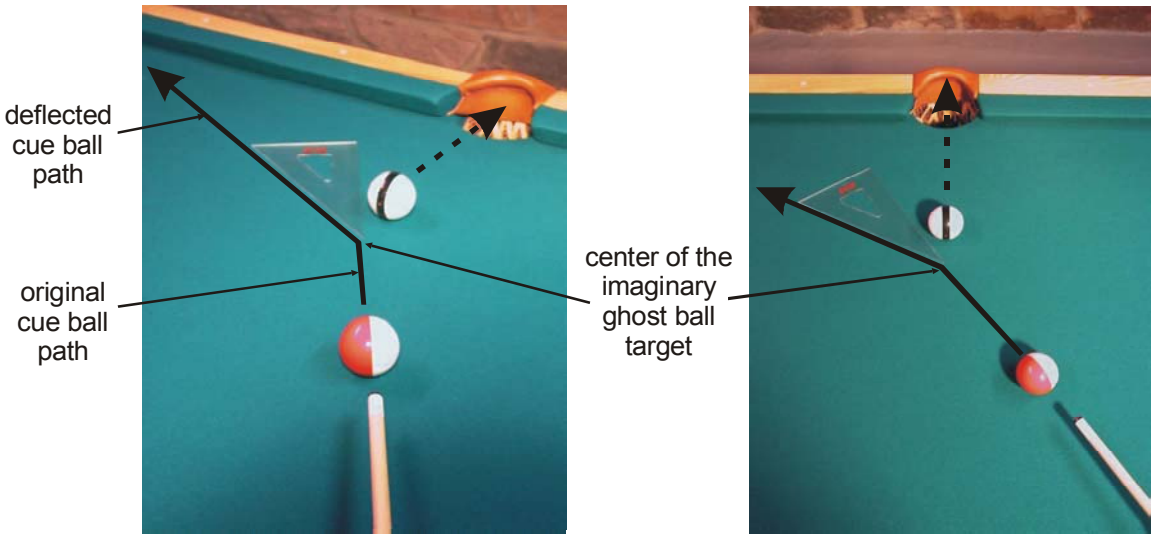


Diagram 7 Using your hand to visualize the 30° rule cue ball paths


normal video

NV 3.8 – Using your hand to visualize the 30° rule

When first trying to develop an intuition for the 30° angle, it might be helpful to use a 30°/60°/90° drafting triangle which you can purchase at an art supply store (see **Diagram 8**) or a template you can cut out of paper (refer to **Diagram 9** for the proper proportions). Before shooting a shot, lay the triangle or template down on the table to help you learn to visualize the 30° angle, as shown in **Diagram 8** and **NV 3.9**. **Diagram 10** shows the example from **NV 3.9** graphically. The point of the triangle should be placed at the center of the imaginary ghost-ball target and one edge should be aligned with the original cue-ball path (i.e., the aiming line). The remaining edge then shows the direction of the deflected cue-ball path.



a) aiming line (cue ball path) view

b) impact line (target) view

Diagram 8 Using a drafting triangle to visualize the 30° rule cue ball paths

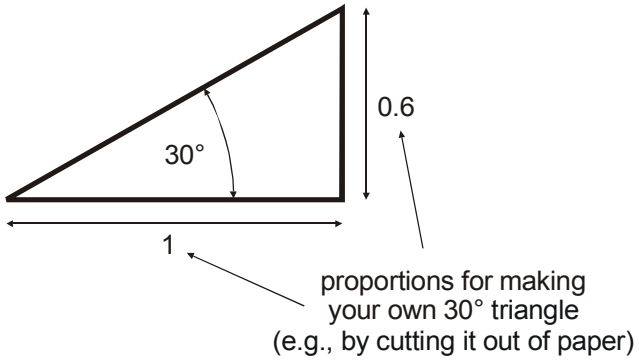


Diagram 9 30° angle proportions

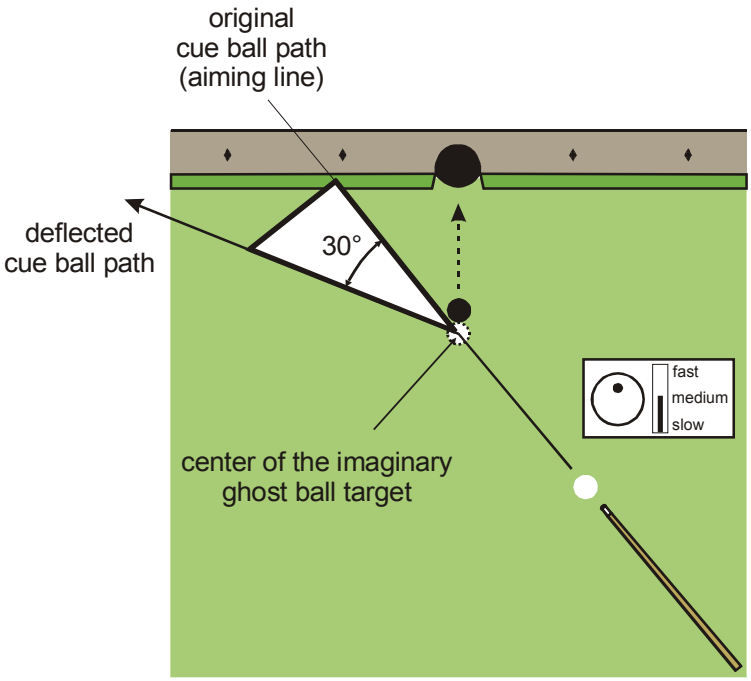


Diagram 10 Example shot illustrating the 30° rule


normal video

NV 3.9 – 30° rule example

As with the 90° rule, the 30° rule is very useful for helping you prevent scratches, break up ball clusters, avoid obstacle balls, and execute carom and billiard shots. Examples of these types of shots will be presented in my next two articles. Hopefully, after this series of articles, you will appreciate the importance of the 30° rule and be able to use it in your game. As was shown in **Diagrams 3, 4, and 6**, the 30° rule applies for a wide variety of shots, and you will have many opportunities to use it to your advantage.

Good luck with your game,
Dr. Dave