ILLAWARRA TUTORING

This worksheet focuses on the multiplication rule of probability. In this unit you will master how to calculate the probability of two or more events occurring together. You will practise with problems involving both independent events (where the outcome of one event does not affect the other) and dependent events (where outcomes affect subsequent probabilities). Read each instruction carefully and show your workings.

Easy Questions

1. Calculate the probability of two independent events occurring together. Calculate the probability of rolling a 3 on a fair die and obtaining heads on a fair coin toss.
2. If a card is drawn from a well-shuffled deck, replaced, and then a second card is drawn, find the probability that the first card is an Ace and the second card is a King.
3. Write the formula for calculating the probability of two independent events A and B both happening.
4. Given $P(A) = \frac{1}{4}$ and $P(B) = \frac{1}{2}$ for two independent events, calculate $P(A \text{ and } B)$.
5. Two independent events have probabilities 0.3 and 0.5, respectively. Determine the probability that both events occur.

Intermediate Questions

6. A bag contains 4 red and 6 blue balls. Two balls are drawn one after the other without replacement. Calculate the probability that both drawn balls are red.
7. Using the same bag as in question 6, if instead both balls are drawn with replacement, what is the probability that both drawn balls are red?
8. Suppose event A has probability 0.4. If event B occurs with probability 0.3 after A has occurred, find the joint probability that A and then B occur.
9. A spinner is divided into 5 equal sections and a fair coin is tossed. Find the probability that the spinner lands on section 2 and the coin shows tails.
10. Two six-sided dice are rolled. Find the probability that the first die shows a 2 and the second die shows a 5.
11. A fair coin is tossed twice. What is the probability of obtaining heads both times?

12. Find the probability that a fair die shows an even number twice in a row when rolled twice.

13. In a production line, the probability that a product passes the first inspection is 0.9. If it passes, the probability of passing the second inspection is 0.8. Find the probability that a product passes both inspections.

14. At a snack bar, the probability of buying chips is 0.4 and the probability of buying a soda is 0.5, independently. What is the probability that a customer buys both?

15. A box contains 8 light bulbs, 2 of which are defective. If you randomly pick two bulbs without replacement, determine the probability that both are defective.

16. Consider a scenario where you spin a spinner with 5 equal sections and toss a coin. Find the probability that the spinner lands on section 4 and the coin lands on heads.

17. In a survey, 0.6 of respondents like tea and 0.5 like coffee. If these preferences are independent, what is the probability that a respondent likes both tea and coffee?

18. A fair die is rolled and a random card is drawn from a standard deck (with replacement between actions so they are independent). Determine the probability that the die shows a 6 and the card drawn is a Queen.

19. Two people are selected at random. If the probability that an individual has a rare trait is 0.1, find the probability that both individuals have the trait.

20. Event A has a probability of $\frac{1}{3}$. Given that event A occurs, event B occurs with probability $\frac{1}{2}$. Find the probability that both A and B occur.

Hard Questions

21. A bag contains 5 red, 4 blue, and 3 green balls. Two balls are drawn sequentially without replacement. Calculate the probability that the first ball drawn is red and the second ball drawn is blue.

22. From a standard 52-card deck, two cards are drawn consecutively without replacement. Find the probability that the first card is a King and the second card is a heart.

23. In a game, a player spins a wheel and then rolls a die. If the events are independent, and $P(\text{spin lands on winning section}) = \frac{2}{7}$ and $P(\text{die shows 4}) = \frac{1}{6}$, find the overall probability that both occur.

24. In a three-stage experiment, the probability that event A occurs is $\frac{1}{2}$. If A occurs, then the probability that event B occurs is $\frac{2}{3}$; if both A and B occur, the probability that event C occurs is $\frac{1}{4}$. Determine the probability that all three events occur in sequence.

25. A jar contains 5 red marbles, 7 blue marbles, and 8 yellow marbles. Two marbles are drawn one after the other without replacement. What is the probability that the first marble is yellow and the second marble is blue?

26. A box contains 10 bulbs, of which 3 are defective. Two bulbs are drawn at random without replacement. Using the multiplication rule in a complementary probability approach, find the probability that at least one bulb is defective.

27. A student performs three actions: draws a coloured token from a bag, rolls a die, and flips a coin. If the probability of drawing a red token is $\frac{2}{5}$, the probability of rolling a 3 is $\frac{1}{6}$, and the chance of flipping heads is $\frac{1}{2}$, calculate the probability of all three events occurring.

28. In a raffle, there are 100 tickets and you hold 2 tickets. Two winning tickets are drawn consecutively without replacement. Find the probability that both drawn tickets are yours.

29. A bag contains 3 red, 7 blue, and 5 green balls. Three balls are drawn without replacement. What is the probability that the balls are drawn in the following order: red, blue, then green?

30. In a lottery game, a participant must progress through three rounds. The probability of success in Round 1 is 0.8. If a participant succeeds in Round 1, the probability of success in Round 2 is 0.7. Given success in Rounds 1 and 2, the probability of success in Round 3 is 0.6. Calculate the overall probability of a participant passing all three rounds.