3.2   Mutually Exclusive

*Many of the questions in this exercise can be done directly by using a possibility space, Venn diagram or two-way table. Take care, however, to distinguish between P(A **or** B), P(A **and** B).*

1 An ordinary fair cubical die is thrown. Find the probability that the score on the die is

   (i) even,

   (ii) prime,

   (iii) even or prime,

   (iv) even and prime.

2 All the students in a class of 30 study at least one of the subjects, physics and biology. Of

these, 20 study physics and 21 study biology. Find the probability that a student chosen at random (i) studies both physics and biology, (ii) studies only physics.

3 From an ordinary pack of 52 playing cards the seven of diamonds has been lost. A card is dealt from the well-shuffled pack. Find the probability that the card is

   (i) a diamond,

   (ii) a Queen,

   (iii) a diamond or a Queen,

   (iv) a diamond or a seven,

   (v) a diamond and a seven.

4 In a quality control test, all the components produced by three machines on a particular day are tested. The results are summarised in the two-way table.

	Machine A	Machine B	Machine C
Faulty	2	3	1
Not faulty	80	72	42

A machine operator picks up one of these components at random. Find the probability that the component

   (i) is from Machine A,

   (ii) is a faulty component from Machine C,

   (iii) is not faulty or is from Machine A.

5 A class consists of 9 boys and 11 girls. Of these, 4 boys and 3 girls are in the athletics team. A pupil is chosen at random from the class to take part in the 'egg and spoon' race on Sports Day. Find the probability that the pupil is

   (i) in the athletics team,

   (ii) a girl,

   (iii) a girl in the athletics team,

   (iv) a girl or in the athletics team.

6 Events C and D are such that $P(C) = \frac{19}{30}$, $P(D) = \frac{2}{5}$ and $P(C \text{ or } D) = \frac{4}{5}$. Find $P(C \text{ and } D)$.

7 Events X and Y are such that $P(X) = 0.75$, $P(Y') = 0.45$ and $P(X \text{ and } Y) = 0.5$. Find $P(X \text{ or } Y)$.

8 Events A and B are such that $P(A) = P(B)$, $P(A \text{ and } B) = 0.1$ and $P(A \text{ or } B) = 0.7$. Find $P(A')$.

9 Events A and B are such that $P(A \text{ occurs}) = 0.6$, $P(B \text{ occurs}) = 0.7$, $P(\text{at least one of } A \text{ and } B \text{ occurs}) = 0.9$.

Find

   (i) P(both A and B occur),

   (ii) P(neither A nor B occurs),

   (iii) P(A occurs or B occurs but not both A and B occur).

10 X and Y are mutually exclusive events such that $P(X) = 0.5$ and $P(Y) = 0.25$. Find   (i) $P(X \text{ or } Y)$,   (ii) $P(X \text{ and } Y)$.

11 The probability that a randomly chosen boy in Class 2 is in the football team is 0.4, the probability that he is in the chess team is 0.5 and the probability that he is in both teams is 0.2.

Find the probability that a boy chosen at random from the class

(i) is in the football team, but not in the chess team,

(ii) is in the football team or the chess team,

(iii) is not in either team.

12 Two fair cubical dice are thrown. Find the probability that the sum of the scores is

(i) a multiple of 5,

(ii) greater than 9,

(iii) a multiple of 5 or greater than 9,

(iv) a multiple of 5 and greater than 9.

13 A fair cubical die is thrown. Events are defined as follows:
A: the score is at most 3
B: the score is at least 3
C: the score is lower than 3
D: the score is higher than 3

(i) Identify pairs of events that are mutually exclusive.

(ii) Find P(A or B).

(iii) Find P(A and C).

14 Two fair coins are tossed.

(i) Events A and B are mutually exclusive. A is the event 'at least one head is obtained'. Define event B.

(ii) X is the event 'one head is obtained'. Define an event Y such that X and Y are not mutually exclusive.

15 Two fair cubical dice are thrown.

Event A is 'the scores on the dice are the same'.

Event B is 'the product of the scores is a multiple of 3'.

Event C is 'the sum of the scores is 7'.

State, with a reason, whether the following pairs of events are mutually exclusive:

(i) A and B

(ii) A and C

(iii) B and C.