CLOCKS

A normal clock shows 12 hours on the dial. It has two hands namely, the minute hand (m.h) and the hour hand (h.h). In 1 hour the minute hand passes over 60 minute spaces, i.e., one full rotation of 360°. Hour hand takes 12 hours to complete one full rotation of 360°.

Angle covered by hour hand and minute hand for various time intervals is as follows:

Minute hand - 1 hour = 360°, 1 minute = $\frac{360^\circ}{60}$ = 6°

Hour hand - 12 hours = 360°, 1 hour = 30°, 1 minute = ½°

In one minute the minute hand gains $5\frac{1}{2}^\circ$ over hour hand (relative speed)

In 1 hour the minute hand passes over 60 minute spaces. The hour hand traverses 5 minute spaces in the same time.The minute hand takes 60 minutes to gain 55 minute spaces over the hour hand. Therefore to gain 1 minute space over the hour hand, the minute hand takes 60/55 minutes or 12/11 minutes.

Remember that in every hour:

1. The hands coincide once.
2. The hands are straight (point in opposite directions) once.
3. The hands are twice at right angles

In 24 hours:

1. The hands coincide 11 times in every 12 hours or 22 times in 24 hours. Between 11 and 1 O'clock there is a common position 12 O'clock when the hands coincide
2. The hands of a clock are at right angles twice every hour. In 12 hours, they are at right angles 22 times and thus 44 times in a day. Two positions common in every 12 hours, are at 3 O'clock and 9 O'clock.
3. The hands of a clock point in opposite directions (in the same straight line, making an angle 180° between them) 11 times in every 12 hours because between 5 and 7 they point in opposite directions at 6 'o clock only and hence 22 times in 24 hours.

Types of problems:

Angle based problems – a) To find the angle between the two hands, first find the angle traced by minute hand from 12 O'clock and by the hour hand from 12 O'clock. The difference of the angles is the answer.

b) To find out after how many minutes the two hands of the clock form a particular angle, find the angle the minute hand has to gain over the hour hand and divide it by $5\frac{1}{2}^\circ$.

Gain/ Loss problems – If a clock, gains/loses time, calculate the gain/loss of time in minutes per hour and multiply it with the total time for which the clock is running to arrive at the total gain/loss of time in minutes.

PROBLEMS

1. An accurate clock shows 8 o'clock in the morning. Through how may degrees will the hour hand rotate when the clock shows 2 o'clock in the afternoon?

A. 154° B. 180° C. 170° D. 160°

2. A clock is started at noon. By 10 minutes past 5, the hour hand has turned through

A. 155° B. 145° C. 152° D. 140°

3. At what time between 7 and 8 o'clock will the hands of a clock be in the same straight line but, not together?

A. 5 minutes past 7 B. 5 3/11 miinutes past 7 C. 5 1/11 minutes past 7 D. 5 5/11 minutes past 7

4. At what time between 5.30 and 6 will the hands of a clock be at right angles?

A. 44 minutes past 5 B. 44 7/11 minutes past 5 C. 43 7/11 minutes past 5 D. 43 minutes past 5

5. At what angle the hands of a clock are inclined at 15 minutes past 5?

A. 67 1/2° B. 62 1/2° C. 70° D. 63 3/4°

6. At 3.40, the hour hand and the minute hand of a clock form an angle of

A. 135° B. 130° C. 120° D. 125°

7. The angle between the minute hand and the hour hand of a clock when the time is 8.30, is

A. 75° B. 85° C. 80° D. 70°

8. How many times in a day, are the hands of a clock in straight line but opposite in direction?

A. 48 B. 22 C. 24 D. 12

9. At what time between 3 o'clock and 4 o'clock, both the needles of a clock will coincide each other?

A. 16 2/11 minutes past 3 B. 16 4/11 minutes past 3 C. 15 4/11 minutes past 3 D. 15 2/11 minutes past 3

10. How many times will the hands of a clock coincide in a day?

A. 24 B. 22 C. 20 D. 21

11. How many times in a day, the hands of a clock are straight

A. 22 B. 44 C. 48 D. 24

12. A watch which gains 5 seconds in 3 minutes was set right at 7 a.m. In the afternoon of the same day, when the watch indicated quarter past 4 o'clock, the true time is

A. 3 pm B. 3.45 pm C. 3.30 pm D. 4 pm

13. The angle between the minute hand and the hour hand of a clock when the time is 4.20 is

A. 10° B. 5° C. 0° D. 1°

14. A clock is set at 5 am. If the clock loses 16 minutes in 24 hours, what will be the true time when the clock indicates 10 pm on 4th day?

A. 9.30 pm B. 10 pm C. 10.30 pm D. 11 pm