Chapter 4

Percentage, Profit and Loss

CHAPTER HIGHLIGHTS

- *Percentage*
- *Percentage Points*
- *Profit and Loss*
- *Partnerships*
- *Stocks and Shares*

PERCENTAGE

'Percent' implies 'for every hundred'. This concept is developed to make the comparison of fractions easier by equalising the denominators of all fractions to hundred.

For example, 7/11 as percentage is represented as

$$\frac{7}{11}=\frac{7\times100}{11\times100}=\frac{(7\times100)/11}{100}=\frac{63.63}{100}=63.63\%$$

Percentages can also be represented as decimal fractions. In such a case it is effectively equivalent to the proportion of the original quantity.

For example, 20% is the same as $\frac{20}{100}$, i.e. 0.2.

Any percentage can be expressed as a decimal fraction by dividing the percentage figure by 100, and conversely, any decimal fraction can be converted to percentage by multiplying it by 100.

PERCENTAGE INCREASE or DECREASE of a quantity is the ratio expressed in percentage of the actual INCREASE or DECREASE of the quantity to the original amount of the quantity, i.e.,

$$\text{PERCENTAGE INCREASE} = \frac{\text{Actual increase}}{\text{Original quantity}}\times100$$

$$\text{PERCENTAGE DECREASE} = \frac{\text{Actual decrease}}{\text{Original quantity}}\times100$$

For example, if the production of rice went up from 225 MT in 1993 to 242 MT in 1994, then the percentage increase in rice production from 1993 to 1994 is calculated as follows:

Actual increase = 242 – 225 = 17 MT

Percentage increase

$$=\frac{\text{Quality increase from 1993 to 1994}}{\text{Actual production of rice in 1993}}\times100$$

$$=\frac{17}{225}\times100=7\frac{5}{9}\%$$

Ratio of any two quantities also can be expressed as percentage.

For example, if the ratio of A and B is 3 : 2, we can say the ratio of A : B is 60% : 40%.

Whenever there is any percentage increase or decrease on a quantity, we can directly calculate the new value of the quantity instead of calculating the actual increase/decrease and then adding to/subtracting from the original quantity.

For example, if the increase on a value of 350 is 15%, the new quantity is $1.15 \times 350 = 402.5$ (where $1.15 = 1 + 0.15$, 0.15 being the decimal equivalent of 15%).

If the production in 1994 is given as 400 MT and the increase from 1993 to 1994 is given to be 25%, then the production in 1993 will be equal to $400/1.25 = 320$ MT (where $1.25 = 1 + 0.25$, 0.25 being the decimal equivalent of 25%).

Similarly, if there is a decrease of 12% on a quantity of 225, then the new quantity will be equal to 225×0.88 (where $0.88 = 1 - 0.12$, 0.12 being the decimal equivalent of 12%).

If the production in 1994 is given as 400 MT and it is a decrease of 13% from 1993, then the production in 1993 will be equal to $400/0.87$ (where $0.87 = 1 - 0.13$, 0.13 being the decimal equivalent of 13%).

On the basis of percentage increase, we can write down how many times the old value gives the new value. For example, if the percentage increase is 100%, then we can conclude that the new value is 2 times the old value. If the percentage increase is 300%, the new value is 4 times the old value. If the percentage increase is 450%, then the new

value is 5.5 times the old value. In general, if the percentage increase is $p\%$, then the new value is $\left(\frac{p}{100}+1\right)$ times the old value.

Conversely, if we know how many times the old value gives the new value, we can find out the percentage increase in the old value to get the new value. For example, if the new value is 3 times the old value, the percentage increase in the old value to get the new value is 200%. If the new value is 4.25 times the old value, then the percentage increase is 325%. In general, if the new value is k times the old value, then the percentage increase is $(k-1)\times 100$.

Solved Examples

Example 1

Rice production in a country increased by 25% from 2000 to 2004. It increased by 20% from 2004 to 2008. Find the percentage increase in the rice production from 2000 to 2008.

Solution

Let the rice production in 2000 be 100 tonnes.
Rice production in 2004

$$= 100+\frac{25}{100}(100) = 125 \text{ tonnes}$$

Rice production in 2008

$$= 125+\frac{20}{100}(125) = 150 \text{ tonnes}$$

$\therefore$ Percentage increase in the rice production from 2000 to 2008 is $\frac{150-100}{100}\times 100$ i.e. 50%.

Example 2

The population of a country increased by 10% from 2001 to 2002. It increased by 20% from 2002 to 2003. It increased by 30% from 2003 to 2004. Find the simple average yearly percentage increase in the population from 2001 to 2004.

Solution

Let the population of the country in 2001 be 100 million.
Population in 2002 = 110 million.
Population in 2003 = $110\times 1.2 = 132$ million.
Population in 2004 = 132×1.3

$$= 171\times 6 \text{ million.}$$

Simple average percentage increase

$$= \frac{171.6-100}{\frac{100}{3}}(100) = 23\frac{13}{15}$$

Example 3

The price of a Swiss watch was ₹10000 in 2001. Due to devaluation of the rupee, it becomes ₹12000 in 2002. Find the percentage increase in its price from 2001 to 2002.

Solution

Percentage increase

$$= \frac{\text{Final price} - \text{Initial price}}{\text{Initial price}}(100)$$

$$= \frac{12000-10000}{10000}(100) = 20\% .$$

Example 4

64% of a number is 416. Find 85% of that number.

Solution

Let the number be x

$$\frac{64}{100}x = 416$$

$$x = 650$$

$$\frac{85}{100}x = 552.5 .$$

Alternative method:

$$64\% = 416$$

$$85\% = \frac{85}{64}(416) = 552.5 .$$

Example 5

The ratio of the salaries of A and B is $2:2\frac{1}{7}$. By what percentage is B's salary greater than A's salary?

Solution

Let the salary of A be $2x$

$$\Rightarrow \quad \text{Salary of } B = ₹2\frac{1}{7}x$$

$\therefore$ The salary of B is more than the salary of A by $\frac{\frac{1}{7}x}{2x}(100) = 7\frac{1}{7}\%$.

Example 6

The height of a triangle as well as its base are increased by 30%. Find the percentage increase in its area.

Solution

Let the original height as well as the base be 100 cm. Original area

$$= \frac{(100)(100)}{2} = \frac{100^2}{2}$$

New height = New base = 130 cm

$$\text{New area} = \frac{(130)(130)}{2}$$

$$= \frac{1}{2}\left((1{\cdot}3)(100)^2\right) = \frac{1{\cdot}69\left(100^2\right)}{2}$$

$$= 1{\cdot}69 \text{ (original area)}$$

$\therefore$ the area increased by 69%.

Example 7

If the price of tea goes up by $33\frac{1}{3}\%$, what should be the percentage by which its consumption must be reduced so that the expenditure on it remains unchanged?

Solution

Let the original price be ₹300 per kg and the original consumption be 100 kg. Original expenditure = New expenditure = ₹30000.

$$\text{New price} = 300\left(1+\frac{1}{3}\right) = ₹400.$$

$$\text{New consumption} = \frac{30000}{400} \text{ i.e., 75 kg.}$$

Percentage reduction in consumption

$$= \frac{25}{100}(100) = 25\%$$

In the above three examples, if the percentage given initially is x, what is asked to be found is $\frac{100x}{(100 + x)}$.

We can generalize each of the three cases as below:

If the value of an item goes up/down by x%, the percentage reduction/increment to be now made to bring it back to the original level is $\frac{100x}{(100 \pm x)}$ *%.*

If A is x% more/less than B, then B is $\frac{100x}{(100 \pm x)}$ *% less/more than A.*

If the price of an item goes up/down by x%, then the quantity consumed should be reduced/increased by $\frac{100x}{(100 \pm x)}$ *% so that the total expenditure remains the same.*

Percentage Points

The concept of 'percentage points' is important in the usage of percentages. Percentage points is the difference of two percentage figures.

Let us understand this with an example.

Suppose that rice forms 20% of total food grain production in Year I and 30% of total food grain production in Year II.

If we are asked to find out the percentage increase in the production of rice, calculating percentage increase from 20 to 30 as $\frac{30-20}{20}\times 100$ and saying it is 50% increase is NOT correct. With the available data, we cannot find out the percentage increase in the production of rice from Year I to Year II. We can only say that the production of rice as a percentage of total food grain production went up by 10 PERCENTAGE POINTS (the 10 being the increase from 20 to 30—both percentage figures).

We can see by taking the following figures that the percentage increase in rice production need not be 50%.

	Year I	Year II
Rice	1000	960
Total foodgrains	5000	3200
Rice as percent of Total foodgrains	20%	30%

Here, while rice is 20% of total food grains in Year I and 30% of total food grains in Year II, we find that the actual production of rice has not even increased—it decreased from 1000 in Year I to 960 in Year II.

Profit and Loss

In any business/commercial environment the most important concern is about the profit/loss of the transaction conducted.

The SELLING PRICE (SP) and the COST PRICE (CP) of an article determine the profit or loss made on the particular transaction.

The computation is done as follows:

$$\text{Profit} = \text{Sale Price} - \text{Cost Price} = \text{SP} - \text{CP}$$

$$\text{Percentage Profit} = \frac{\text{SP} - \text{CP}}{\text{CP}} \times 100$$

$$= \frac{\text{Profit}}{\text{CP}} \times 100$$

$$\text{Loss} = \text{CP} - \text{SP}$$

$$\text{Percentage Loss} = \frac{\text{Loss}}{\text{CP}} \times 100 .$$

It is customary to express profit/loss as percentage of cost price. However, in some problems, it may specifically be given that profit/loss percentage has been calculated on the selling price or the student may be asked to calculate the profit/loss percentage on the selling price. Unless such specific directions are given, the profit/loss percentage is always to be calculated on the cost price.

Given profit/loss percentage along with SP, CP can be found out, and similarly, given profit/loss percentage along with CP, SP can be found out by using the concepts discussed

at the beginning of this chapter (where, if percentage increase or decrease is given, we can find out the new value from the old value or the old value from the new value).

The following simple rules can be remembered for this purpose.

Given the cost price (CP) and profit percentage p%, the selling price will be given by $SP = CP \times \frac{(100+p)}{100}$

Given the cost price (CP) and loss percentage p%, the selling price will be given by $SP = CP \times \frac{(100-p)}{100}$

Given the selling price (SP) and profit percentage p%, the cost price will be given by $CP = SP \times \frac{100}{(100+p)}$

Given the selling price (SP) and loss percentage p%, the cost price will be given by $CP = SP \times \frac{100}{(100-p)}$

When two articles are SOLD at the same price (i.e., their SP is the same) such that there is a PROFIT of $p\%$ on one article and a LOSS of $p\%$ on the other (i.e. common profit or loss percentage), then, irrespective of what the SP actually is, the net result of the transaction is LOSS. This percentage loss is given by

$$\text{Loss percentage} = \frac{(\text{Common profit or loss})^2}{100} = \frac{p^2}{100}$$

MARKED PRICE or LIST PRICE is the price that is indicated or marked on the product or it is the price which is given in the price list. This is the price at which the product is intended to be sold. However, there can be some DISCOUNT given on this price, and consequently, the actual SELLING PRICE of the product may be less than the MARKED PRICE.

SELLING PRICE = MARKED PRICE – DISCOUNT

The amount of discount given can also be expressed as a percentage. DISCOUNT is always expressed as a percentage of the MARKED PRICE or the LIST PRICE.

DISCOUNT percent

$$= \frac{\text{Marked price} - \text{Selling price}}{\text{Marked price}} \times 100$$

$$= \frac{\text{Discount}}{\text{Marked price}} \times 100$$

Certain discount is given on an article whose selling price is SP. If further discounts are given on this discounted price, such discounts are referred to as successive discounts.

If the successive discounts are $p\%$, $q\%$, and $r\%$, on a product whose selling price is SP, then the effective price after all the discounts is given by

$$\text{Discounted price} = SP \times \frac{(100-p)(100-q)(100-r)}{100 \times 100 \times 100}$$

Example 8

Alok bought a watch for ₹250 and sold it for ₹300. Find his profit percentage.

Solution

Given that

$$SP = ₹300 \quad CP = ₹250$$

$$\Rightarrow \quad \text{Profit} = SP - CP = ₹300 - ₹250 = ₹50$$

$$\text{Profit } \% = \frac{50}{250}(100) = 20\%.$$

Example 9

Anand gained 20% by selling a book at ₹30. Find his gain percentage if he sells it for ₹36.

Solution

Let his cost price be ₹x

Given, $$\left(1 + \frac{20}{100}\right)x = 30$$

$$\Rightarrow \quad x = 25$$

Gain percent when sold at ₹36

$$= \frac{36-25}{25}(100) = 44\%.$$

Example 10

Ajay calculated his profit/loss percentage on his selling prices. Find his actual profit/loss percentage if he calculated

(i) his profit percentage to be 25%

(ii) his loss percentage to be 25%

Solution

Let his selling price be ₹100

(i) Profit = ₹25 ⇒ CP = SP – Profit
= ₹75

Actual profit percentage

$$= \frac{25}{75}(100) = 33\frac{1}{3}\%$$

(ii) Loss = ₹25
⇒ CP = SP + Loss
= ₹125

Actual loss percentage

$$= \frac{25}{125}(100) = 20\%.$$

Example 11

The profit made by selling 5 m of a cloth equals the selling price of 2 m of that cloth. Find the profit percentage made.

Solution

SP (5 m) = CP (5 m) + Profit (5 m)
As Profit (5 m) = SP (2 m),

$$\text{SP (5 m)} = \text{CP (5 m)} + \text{SP (2 m)}$$

$$\Rightarrow \quad \text{SP (3 m)} = \text{CP (5 m)}$$

$$\Rightarrow \quad \frac{\text{S.P.}}{\text{C.P.}} = \frac{5}{3}$$

$$\therefore \quad \text{Profit \%} = \frac{5-3}{3} \times 100 = 66\frac{2}{3}\%.$$

Example 12

A trader promised his customers to sell at cost price. But he cheats his customers by giving 100 g less for every kg that he sells. Find his profit percentage.

Solution

Let the cost of each gram to the trader be ₹1. Cost price of 1000 g = Selling price of 900 g.
Cost of 900 g = ₹900
Selling price of 900 g = ₹1000

$$\text{Profit percentage} = \frac{1000-900}{900}(100)$$

$$= 11\frac{1}{9}\%.$$

Partnerships

Two or more people can get together to do business by pooling their resources. The money put in by each of the partners is called his 'INVESTMENT' or 'CAPITAL'.

All the people who have invested money in the partnership are called PARTNERS.

While two or more partners would have invested money, it is not necessary that all of them should be involved in the day-to-day running of the business. The partners involved in the day-to-day activities of the business are called 'working partners', and the others are called 'sleeping partners' or 'dormant partners'.

The profits left after paying the working partners' remuneration/commission are shared amongst all the partners.

Sometimes, the partners also take interest on their investments, and only the remaining profits are shared by the partners.

Sharing of profits among the partners also depends on the understanding between the partners. However, if no special scheme of sharing the profits is specified (in a problem), then the profits are shared based on the investments of the partners. There are three different possibilities that exist here.

1. If the partners invest DIFFERENT amounts each for the SAME period of time, then the profits at the end of the year are shared in the ratio of their investments.
2. If the partners invest the SAME amounts for DIFFERENT periods of time, then the profits at the end of the year are shared in the ratio of the time periods for which their respective investments have been in business.
3. If the partners invest DIFFERENT amounts and the time periods for which their investments are in the business are also DIFFERENT, then the profits at the end of the year are shared in the ratio of the products of (investment x time period) calculated for each partner.

There can be problems that are modelled along the sharing of profits in partnerships. An example of this type is where a particular facility (like renting a tractor for ploughing their fields by three different people) is used by more than one party and the rent has to be shared by all the concerned parties—similar to sharing of profits in a partnership.

Example 13

Sachin started a business with ₹20000, and after 4 months, Sunil joined him with ₹40000. Sachin received ₹39000 as his annual profit share that included a salary of 16% of the annual profit. Find the annual profit share of Sachin.

Solution

Let the total annual profit be ₹x
Ratio of the part of the total annual profit which is shared in the ratio of the (investments × time) = (20000) (12) : (40000) (8) = 3 : 4.

Hence, the share of Sachin

$$= \frac{3}{7}\left(\frac{84}{100}x\right) + \frac{16x}{100} = 39000$$

$$x = 75000$$

∴ Annual profit share of Sachin

= ₹75000 – ₹39000 = ₹36000.

Example 14

A started a business with ₹20000. After 3 months, *B* joined him with ₹40000. After some more months, *C* joined them with ₹100000. *B* received ₹18000 out of the total annual profit of ₹55000. How many months after *A* started the business did *C* join?

Solution

Let us say *C* joined after x months.
Profit is shared in the ratio

$$(20000)\,(12) : (40000)\,(9) : 100000\,(12-x)$$

$$= 24 : 36 : 10\,(12-x)$$

Given $\frac{36}{180-10x} = \frac{18}{55} = \frac{36}{110}$

$$180 - 10x = 110$$

$$\therefore \quad x = 7.$$

Example 15

Mohan started a business with ₹20000. After 4 months, Sachin joined him with ₹30000. At the beginning of the fifth month, Mohan added ₹10000. Find the ratio in which the annual profit will be shared.

Solution

Ratio of the profit share

$= [(20000)(12) + (10000)(8)] : [30000(8)] = 4 : 3.$

Exercises

Direction for questions 1 to 30: Select the correct alternative from the given choices.

1. Ganesh owns $83\frac{1}{3}\%$ of a property. Three fourths of the part of it he owns is worth ₹5 lakhs. Find the value of the property (in ₹ lakhs).
(A) 7.2 (B) 8 (C) 6.4 (D) 8.8

2. The salaries of two persons are equal. If the salary of one of them is increased by 20% and the salary of the other is decreased by 20%, find the percentage change in the total salary of the two persons.
(A) 4% increase B) 4% decrease
(C) 0% (D) None of these

3. The price of a TV is decreased by 20%. By what percent must it be increased to bring it back to the original price?
(A) 25% (B) 20%
(C) $16\frac{2}{3}\%$ (D) 15%

4. The ratio of two numbers is 5/6 : 2/3. By what percentage is the second number more/less than the first number?
(A) 20% less (B) 25% more
(C) 25% less (D) 20% more

5. In a test, Mohan's mark was 25% more than Sohan's mark. Mohan got the minimum mark required to pass the test. The pass mark was 35. Find Sohan's mark.
(A) 21 (B) 26 (C) 27 (D) 28

6. In 2004, the price of a shampoo bottle increases by 10% with respect to that in 2003. By what percentage is its price in 2003 less than that in 2004?
(A) 10% (B) $9\frac{1}{11}\%$
(C) 11% (D) $10\frac{1}{11}\%$

7. Due to inflation the total cost of monthly household items has gone up by 20%, but the salary of the family increased by only 10%. Initially, the family used to spend 20% of the salary on household items. What percentage of the present salary should the family spend to buy the same quantities of household items?
(A) 10% (B) $20\frac{2}{11}\%$
(C) $22\frac{2}{11}\%$ (D) $21\frac{9}{11}\%$

8. If the area of a rectangle is increased by 32% and its breadth is increased by 10%, what is the percentage increase in its perimeter?
(A) 10%
(B) 12%
(C) 20%
(D) Cannot be determined

9. *A*'s salary is 20% less than *B*'s salary. If *C*'s salary is ₹10000 and it is 25% more than *B*'s salary, then what is *A*'s salary?
(A) ₹6000 (B) ₹9600
(C) ₹8000 (D) ₹6400

10. School *A* has 30% more students than school *B*. If 120 more students join school *B*, the two schools will have the same number of students. What is the sum of the number of students in school *A* and school *B* initially?
(A) 600 (B) 400 (C) 800 (D) 920

11. The price of petrol increased by 2% in a certain week and increased by 4% in the next week. Find the net percentage increase in the price of petrol over these two weeks.
(A) 6.12% (B) 6.08%
(C) 6.16% (D) 6.20%

12. Rahul got 150 marks in a test. He scored 25% more marks than the pass mark in it. Rajesh got 165 marks in it. By what percent did his mark exceed the pass mark?
(A) 40% (B) 37.5%
(C) 45% (D) 32.5%

13. In a college of total strength 1000, 30% of the students are girls. There are 600 PGs and 120 more male UGs than female UGs. What percent of the males are the female UGs?
(A) 20% (B) 15% (C) 25% (D) 10%

14. A machine costs ₹4,00,000. It depreciates by 18% in value in the first year, 16.5% in the second year, 15% in the third year and so on. Find the amount by which it depreciates in the seventh year (in ₹) (Assume all percentages apply to the original cost of the equipment).
(A) 32000 (B) 28000
(C) 36000 (D) 40000

15. The monthly income of Ram increased by 26%. His expenditure which is 70% of his monthly income increased by 20%. His savings must have increased by
(A) 40% (B) 30% (C) 50% (D) 25%

16. A shopkeeper sells an item for ₹60 at a profit of 20%. At what price (in ₹) should he sell it to gain 30%?
(A) 63 (B) 65 (C) 68 (D) 70

17. The profit made on selling 5 m of a cloth equals the cost price of 2 m of that cloth. Find the profit percentage in selling each m of the cloth.
(A) $66\frac{2}{3}\%$ (B) 50%
(C) 40% (D) $28\frac{4}{7}\%$

18. A company manufactures a product for ₹50. It sold it to a dealer for ₹60. The dealer sold it to a shopkeeper for ₹75. The shopkeeper sold it to a customer for ₹100. Find the profit percentage of the company.
(A) $16\frac{2}{3}\%$ (B) 25%
(C) 20% (D) $33\frac{1}{3}\%$

19. The cost price of 80 articles is ₹12.50 per article. Twenty of them were sold for ₹18 each. At what price should each of the remaining articles be sold so as to get an overall profit of ₹4.50 per article?
(A) ₹15 (B) $₹16\frac{2}{3}$
(C) $₹17\frac{1}{3}$ (D) ₹18

20. Rohit marked his goods 40% above his cost price. He sold it after a discount at 12% profit. Find his discount percentage.
(A) 20% (B) 25% (C) 15% (D) 30%

21. Two successive discounts of 30% and 10% are equal to a single discount of
(A) 33% (B) 35% (C) 37% (D) 36%

22. *P* and *Q* started a business in which *P* invested ₹10000 and *Q* invested ₹20000. They received a profit of ₹9600 at the end of a year. Find *Q*'s share in profit (in ₹).
(A) 8000 (B) 6400
(C) 4800 (D) 3200

23. Ramesh and Suresh started a business. Ramesh invested ₹9000 for ten months and Suresh invested ₹6000 for a year. If the profit at the end of a year was ₹4500, find Suresh's share.
(A) ₹3600 (B) ₹2700
(C) ₹2500 (D) ₹2000

24. Kanchan has bought 50 articles. He sells 20% of the articles and makes a profit of ₹1200, which is also equal to the cost of 5 articles. If the selling price for all 50 articles is the same, what is the value of the remaining articles at the selling price?
(A) ₹14400 (B) ₹9600
(C) ₹18000 (D) ₹15000

25. If the discount and profit percentage are both 20% by what percent is the marked price above the cost price?
(A) 40% (B) 50% (C) 60% (D) 70%

26. A car dealer sold a car at a discount of ₹100000. Even after the discount, he made a profit of 15%. What is the marked price of the car, if the marked price is 25% more than the cost price?
(A) ₹1000000 (B) ₹1115000
(C) ₹2500000 (D) ₹1250000

27. Simon gets a discount of 25% on purchasing 100 VCD's from Samuel. He sells them and makes a profit equal to the undiscounted price of 25 VCD's. What is the gain percentage?
(A) 25% (B) 30%
(C) 66.66% (D) 33.33%

28. Ashwin bought an article at ₹200 and marked it at ₹300. He offered a discount and then sold it his profit/loss percentage and discount percentage are in the ratio 3 : 2. Find his profit/loss percentage.
(A) 29% profit (B) 25% profit
(C) 20% loss (D) 25% loss

29. Feroze marks up an article by 30% and sells it at a discount of 20% to Sohail. Sohail marks up the price of the article to a certain amount which happens to be 20% more than Feroze's cost price. What is the maximum discount Sohail can offer without going into loss?
(A) 30% (B) 20%
(C) $16\frac{2}{3}\%$ (D) $13\frac{1}{3}\%$

30. Gopal, Hari, and Karthik started a business with investments of ₹8000, ₹12000, and ₹16000 respectively. Hari and Karthik left the business after *x* months. Out of the annual profit share, Gopal got more than Hari but less than Karthik. If *x* is an integer, find the ratio of Gopal's, Hari's and Karthik's shares.
(A) 27 : 21 : 28 (B) 24 : 21 : 28
(C) 30 : 27 : 36 (D) 32 : 30 : 40

Answer Keys

1. B	**2.** C	**3.** A	**4.** A	**5.** D	**6.** B	**7.** D	**8.** D	**9.** D	**10.** D
11. B	**12.** B	**13.** A	**14.** C	**15.** A	**16.** B	**17.** C	**18.** C	**19.** B	**20.** A
21. C	**22.** B	**23.** D	**24.** A	**25.** B	**26.** D	**27.** D	**28.** B	**29.** D	**30.** B