

SECTION - II

Question # 6

a) Rate of three pipes:

$$\text{Pipe A} = \frac{1}{10}$$

$$\text{Pipe B} = \frac{1}{15}$$

$$\text{Pipe C} = -\frac{1}{30}$$

Total: $A + B + C$

$$\frac{1}{10} + \frac{1}{15} + \left(-\frac{1}{30}\right)$$

$$\frac{3+2-1}{30}$$

$$\frac{4}{30} \Rightarrow \frac{2}{15}$$

$$\text{Time} = \frac{\text{Total work}}{\text{rate}}$$

$$= 1 \div \frac{2}{15}$$

$$= 1 \times \frac{15}{2}$$

$$\boxed{\text{Time} = 7.5 \text{ hours}}$$

b)

Ratio of their salaries

$$X : Y : Z$$

$$4x : 5x : 7x$$

$$Y's \text{ salary} = \frac{5x}{16} \Rightarrow \frac{5x}{16} + \frac{10}{100} \left(\frac{5x}{16} \right)$$

$$X's \text{ salary} = \frac{4x}{16} \Rightarrow \frac{4x}{16}$$

$$Z's \text{ salary} = \frac{7x}{16} \Rightarrow \frac{7x}{16} + \frac{25}{100} \left(\frac{7x}{16} \right)$$

New sum of salaries:

$$\frac{4x}{16} + \left(\frac{5x}{16} + \frac{5x}{160} \right) + \left(\frac{7x}{16} + \frac{175x}{1600} \right) = 169500$$

$$\frac{4x}{16} + \left(\frac{50x+5x}{160} \right) + \left(\frac{700x+175x}{1600} \right) = 169500$$

$$\frac{4x}{16} + \frac{55x}{160} + \frac{525x}{1600} = 169500$$

$$\frac{x}{4} + \frac{11x}{32} + \frac{21x}{64} = 169500$$

$$\frac{16x+22x+21x}{64} = 169500$$

$$\frac{59x}{64} = 169500$$

$$59x = 169500 \times 64$$

$$59x = 10848000$$

$$\therefore x = \frac{10848000}{59}$$

$$x = 183864$$

Salary of employee X

$$X = \frac{4x}{16}$$

$$X = \frac{4(183864)}{16}$$

$$X = \frac{735457}{16}$$

$$X = 45966$$

c)

Workers	Work	Days
$\uparrow$ x	$\uparrow$ $\frac{3}{5}$	60
$\downarrow$ $x+10$	$\downarrow$ $\frac{2}{5}$	20

$$\frac{x+10}{x} = \frac{\frac{2}{5}}{\frac{3}{5}} \times \frac{60}{20}$$

$$\frac{x+10}{x} = \frac{2 \times 8}{8 \times 3} \times \frac{x}{x}$$

$$x+10 = 2x$$

$$10 = 2x - x$$

$$10 = x$$

$$x = 10$$

The contractor originally have 10 workers.

d)

Average score of students = 78

$$\frac{78x}{x} = 78$$

Score after excluding top 5 scores

Sum of 5 scores:

$$98 + 95 + 92 + 90 + 85 = 460$$

$$\frac{78x - 460}{x - 5} = 75$$

$$78x - 460 = 75(x - 5)$$

$$78x - 460 = 75x - 375$$

$$78x - 75x = -375 + 460$$

$$3x = 85$$

$$x = \frac{85}{3}$$

$$x = 28.3$$

Question # 8

a)

ROAD $\rightarrow$ UQDG

LAKE $\rightarrow$ OCNQ

In this coding first alphabet is two step forward, second alphabet is one step forward, third alphabet is two step forward and the last alphabet is two step forward.

b)

A man tells a woman that the son of my sister's husband is the father of your son.

Son of his sister's husband = Man's Nephew
Father of woman's son = woman's husband
Hence, that woman is the wife of his nephew. So she ~~called~~ can be called man's daughter-in-law in relation.

c) i) 4, 12, 6, 18, 9, 27

$$\underbrace{4, 12}_{\times 3}, \underbrace{6, 18}_{\div 2}, \underbrace{9, 27}_{\times 3}, \underline{13.5}_{\div 2}$$

In this series, The number is first multiplied by 3 and the answer is divided by ~~two~~ 2 to get the second and third number. The same rule will be used further. Hence, the number series is 4, 12, 6, 18, 9, 27, 13.5

ii) 1, 2, 6, 24, 120, _____

1, 2, 6, 24, 120, 720
x2 x3 x4 x5 x6

In the given series each number will be multiplied by the consecutive numbers starting from 2. Hence, the number series will be 1, 2, 6, 24, 120, 720.

- d)
- P is shorter than Q = $P < Q$
 - P is taller than R = $P > R$
 - S is shorter than T = $S < T$
 - S is taller than Q = $S > Q$

According to the given information,

$$R < P < Q < S < T$$

So,

the tallest is T with 180 cm tall
and the shortest is R with 150 cm.

- The Third tallest is the Q among five friends

- Maximum possible range of heights

$$\text{Range} = \text{tallest} - \text{smallest}$$

$$\text{Range} = 180 - 150$$

SECTION - I

Question # 2

A-

Difference between star
and Planet-

Star:

Stars are massive shining sphere of hot gases, that revolve around galactic center. Stars are extremely hot and possess strong gravity due to which heavily bodies such as planets revolve around it.

Example of stars:

Sun, Alpha centauri
Betelgeuse

Planet

Planets are round bodies present in space that orbit around stars. Stars planets are neither hot nor they shine. Objects which revolve around planets are called satellites

Examples of planets

Venus, Mercury, Earth.

Stars

↓
release own light
↓
high temperature
↓
shine
↓
have life cycle

Planets

↓
does not emit light
↓
lower temperature
↓
does not shine
↓
does not have life cycle

Life cycle of stars

Nebula: the birth place of stars

Nebula is a huge cloud of gas and dust floating in space. Due to gravity parts of this cloud start pulling together. Temperature and density rises. This central, hot mass marks the beginning of a star's birth.

protostar: The Embryo of a star

The gravity continues to squeeze the gas, the center becomes hotter and denser. This early form is called a protostar. It glows faintly because of heat but nuclear fission has not started yet.

Main sequence star - longest stage

When the core temperature reaches about 10 million °C, H atom start fusing into

helium. This fusion release enormous energy, making the star shine brightly.

Red Supergiant: The Expansion Phase

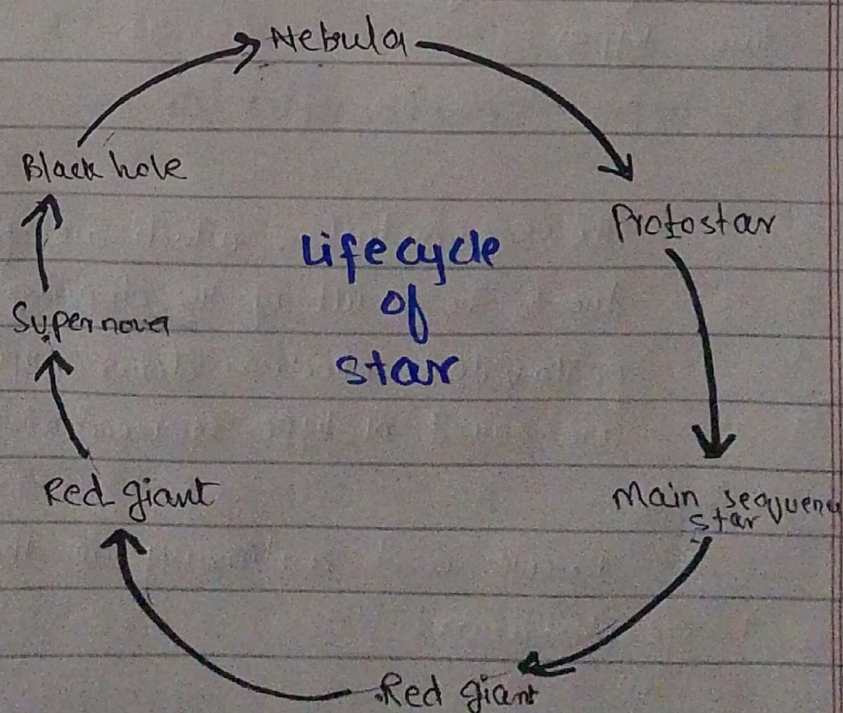
When hydrogen in the core is used up, the star begins to fuse heavier elements. Outer layers expand massively, and star become giant.

Supernova - explosion

When the core begins fusing elements up to iron, the star reaches a point where no more energy can be produced. Suddenly the core collapses violently and the outer layers explode into space called supernova.

Black Hole - The final fate

If the remaining core is extremely massive its gravity becomes so strong that nothing can escape, not even light. This forms a black hole.



b) Semiconductor

Semiconductors are essential elements in the modern era. These elements can be defined as:

"Materials which allow electricity to pass through them only partially, they conduct electricity less than conductors but greater than insulators, are called semiconductors."

Example:

Silicon, germanium, selenium

The process in which impurities are added into the semiconductors to boost up their conductivity is called doping. On the basis of doping, semiconductors are of two types

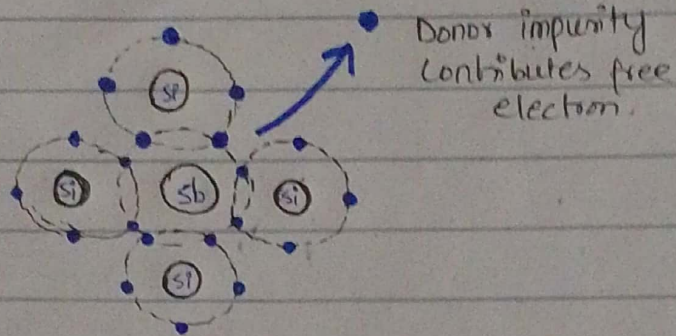
N-type semiconductor

"The semiconductors which are formed due to the result of the doping of pentavalent electron donor impurities are called N-type semiconductor."

Example:

Arsenic and antimony in the silicon and germanium.

N-Type

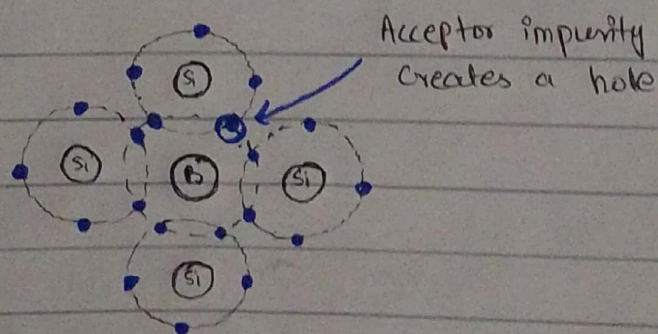


P-Type Semiconductors

“Semiconductors which are formed due to the result of the doping of trivalent electron deficient impurities are called p-type semiconductors”.

Example:

Boron and indium in the silicon and germanium semiconductors.



P-Type