

GENERAL SCIENCE & ABILITY

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①

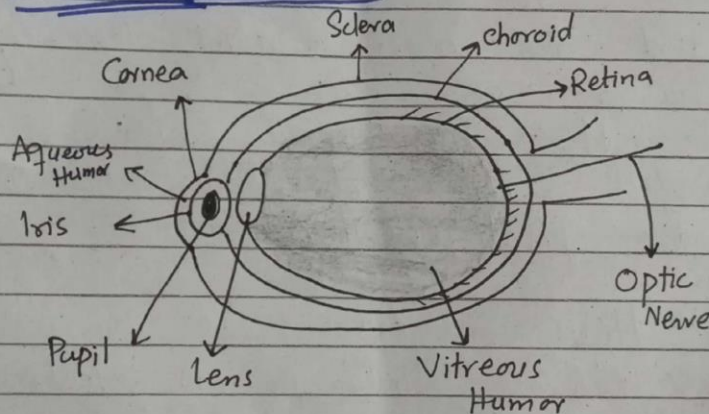
SECTION-I

Question #3 (1a)

HUMAN EYE:

Human eye is a sensory organ that is responsible for provision of sensory information, images or visuals and is used to visualize the objects.

Structure & Function:



① Cornea:

Cornea is a transparent frontal and outermost layer that interacts with light first and bends it.

② Iris:

Iris is a pigmented muscle that controls movement of pupil i.e. closing and opening. When light hits cornea,

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iris opens the pupil.

③ Pupil:

It is a small hole from where light enters into eye.

④ Lens:

Lens is responsible for reception of light and focusing of light waves.

⑤ Retina:

It is an ~~ext~~ innermost ~~eye~~ and the most sensitive layer of human eye.

It has small extensions called rods and cones which are the photoreceptors.

Here, light wave is converted into action potential i.e. image.

⑥ Optic Nerve:

It transmits image towards the brain where brain's role is the recognition of image.

⑦ Choroid:

Choroid is a little thicker and reddish layer, which helps in nourishment of eye.

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⑧ Sclera:

It is an outermost layer from the backside of the eye.

⑨ Vitreous Humour & Aqueous Humour:

Both are fluid filled parts. Vitreous Humour lies on back side while Aqueous Humour lies on front side.

Aqueous Humour supplies nutrients where vessels cannot reach and filters the dust particles.

Far sightedness & short sightedness:-

Both are the disorders of human eye.

Short sightedness:

It is the condition where a person is unable to see distant objects clearly because of light's inability to focus on retina.

Treatment:

Short sightedness can be corrected by

→ concave lenses in glasses or contact lenses

→ Laser eye surgery

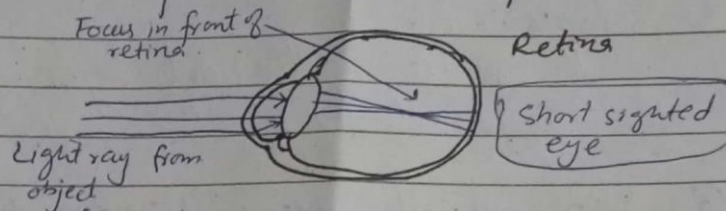
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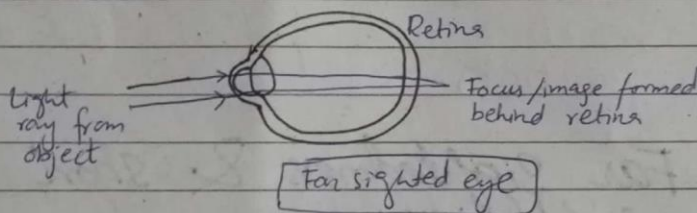
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→ Artificial lense implants.



Far sightedness:

It is a condition where a person is unable to see nearby objects clearly because of image forms behind the retina instead of at the retina.



Treatment:

Far sightedness can be corrected through

- Convex lenses as glasses or contact lenses
- Laser eye surgery
- Lens surgery etc.

To conclude, short and far sightedness are common eye conditions that can be treated using concave and convex lenses. However, their permanent treatment is not available.

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(b)

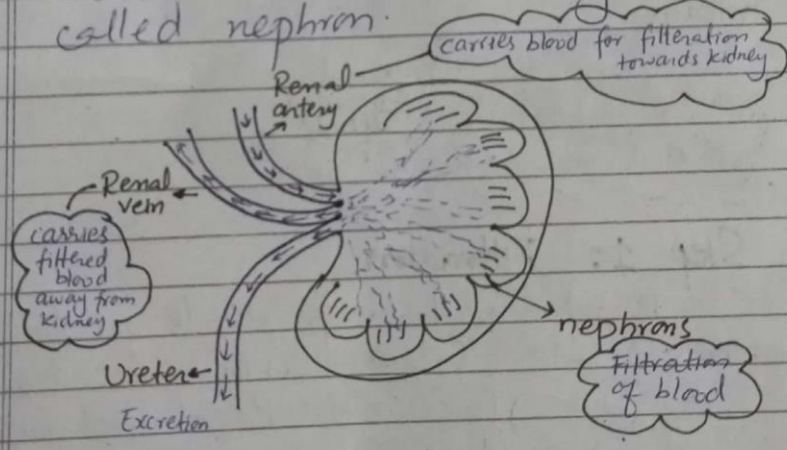
Kidney

Kidneys are present in human body for the excretion of metabolic waste products.

Structure:

Each kidney is bean shaped with an outer layer called ~~medulla~~ cortex and an inner layer called medulla.

It is kidney is composed of about 2 million tiny tubes called nephron.



Function:

Kidneys are responsible for regulation of blood volume, blood pressure, acid-base balance and synthesis of vitamin.

But the main function of

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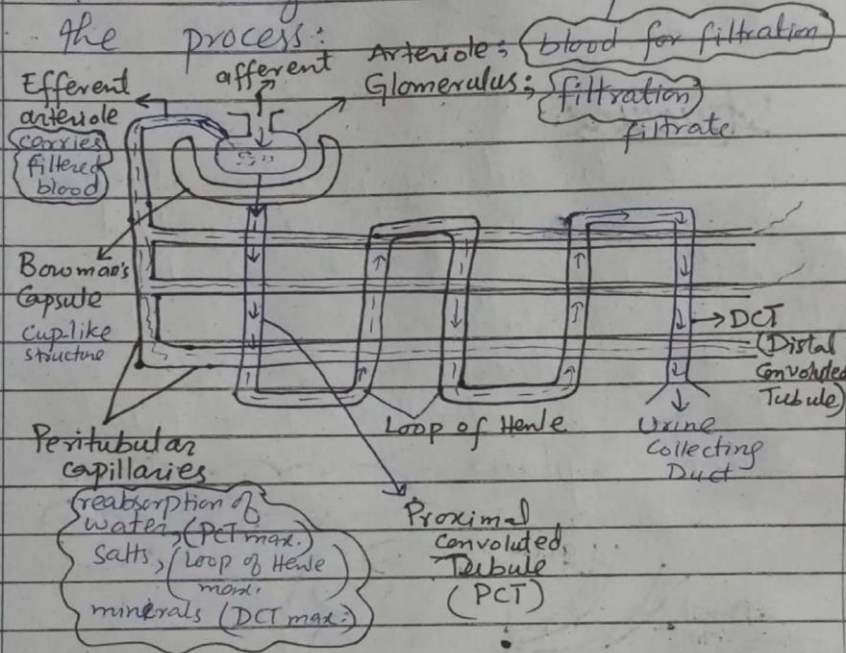
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Kidney, especially nephron, is is to massage filtration of the materials.

The diagram can help understand the process:



Step 1: Filtration:

- Blood containing waste products enters into Glomerulus through renal artery.
- Due to high Blood pressure and porous walls of the Glomerulus, blood is filtered here.
- Blood cells and proteins remain in the Glomerulus while glucose, urea, uric acid and important salts are filtered.
- The filtrate enters the proximal part of nephron

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Step 2: Reabsorption:

All the useful constituents of the filtrate like glucose, salts and water is reabsorbed in proximal, loop of Henle and distal part of the nephron by peritubular capillaries surrounding these parts.

Step 3: Secretion:

All waste products from the distal part enter into the collecting duct which interms open into pelvis. From

From pelvis, these enter into ureter, then stored into urinary bladder and later excreted outside through urethra.

Kidneys, in short, play the role of excretion in as a major contributor in the excretory system.

Part (c)

Black Holes:

A black hole is an object of extreme density and very strong gravitational pull, even light cannot escape from it.

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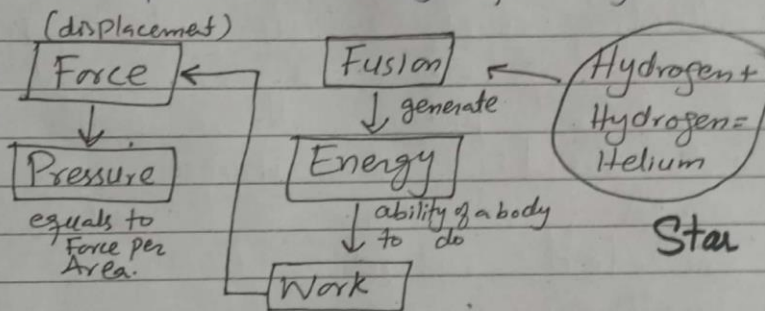
It is called black because of its maximum capturing density.

Formation of Black Holes:

Black holes are formed because of two reasons:

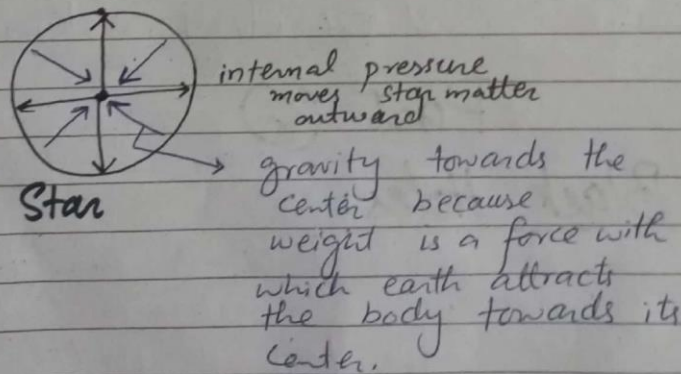
① Internal Pressure:

Fusion of Hydrogen forming Helium creates pressure through following process.



~~A result~~

② Gravity of Star:

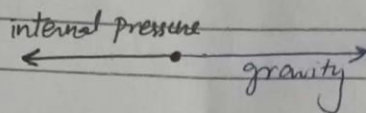


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Now, if internal pressure and gravity maintain a balance, the star is maintained. If not, the star collapses.



Since, Helium is stable but not the most stable, it converts into more heavier atoms e.g. Carbon, Oxygen, Iron etc.

As a result, the fusion reaction slows down, which decreases the internal pressure.

Lesser internal pressure means more gravity which in turn means that more density is acquired.

As a result, black hole is formed.

(d)

Isotopes:

Isotopes are the atoms of the same material having same atomic number

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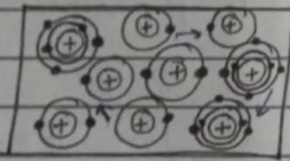
but different mass numbers.

Some isotopes are radioactive, meaning they radiate energy as they decay to a more stable form.

Their chemical properties are same but physical properties may differ.

Isotopes of Hydrogen:

For example Hydrogen atoms are tightly packed in a metal with other atoms.



It is possible that they keep sharing electrons with each other making or breaking their shells.

Question #.4

Earth quakes

Earthquake is a temporary trembling and shaking of ground due to release of energy stored inside the Earth.

Causes of Earthquake:

According to Plate Tectonics

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Theory, there are seven major plates in the internal structure of Earth.

- | | |
|------------------------|-------------------------|
| ① Atlantic plate | ⑤ African Plate |
| ② Pacific Plate. | ⑥ Indo-Australian Plate |
| ③ North American Plate | ⑦ Eurasian Plate |
| ④ South American Plate | |

Movement of these plates triggers earthquake.

Why the tectonic plates move?

Main driving force responsible for the movement of tectonic plates is gravity. When a plate in Oceanic Lithosphere meets another plate, then the denser plate drags the rest of the plates. The process is called subduction.

Furthermore, currents of magma also contribute in the movement of these tectonic plates.

Difference from Tsunami:

Earthquake is different from Tsunami because Earthquake is the movement

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of tectonic plates under the earth while Tsunami is the movement of tectonic plates under the sea.

Although both possess the same property of tectonic plates' movement but the medium in both cases is different.

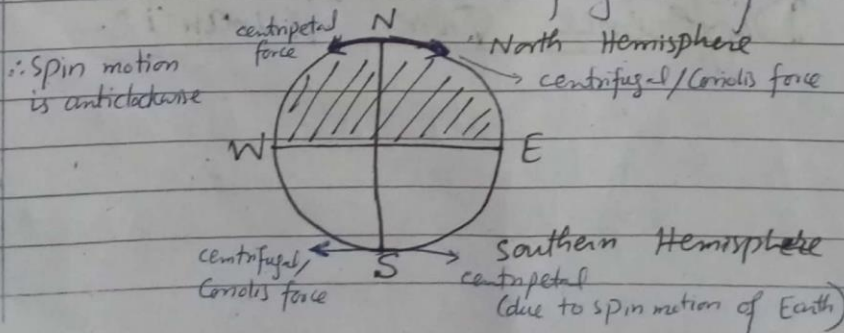
(b)

Coriolis Force:

It is a force that tends to move the objects to the right in Northern Hemisphere and to the left in Southern Hemisphere due to spin motion of the Earth.

origin of Coriolis force: 2 steps involved.
① when a fast moving object is in the moving frame of Earth.

② Coriolis force is analogous to the centrifugal force.



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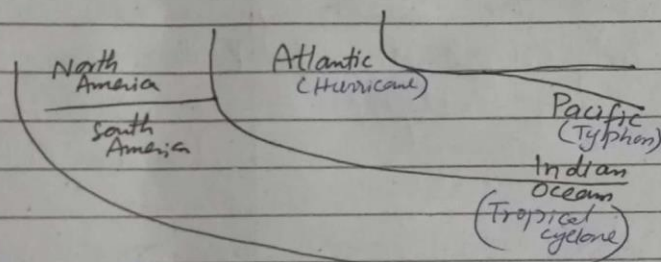
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When this Coriolis spin effect of spin motion of Earth is combined with pressure gradient, then the resulting phenomena is called cyclone.

Hurricanes:

These are the cyclones in the West Atlantic Ocean.

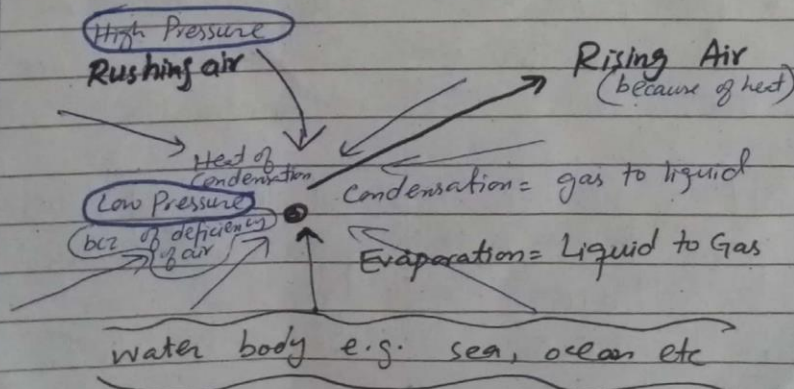


Formation:

Hurricanes are formed because of two factors

① Coriolis force - as discussed in previous part.

② Pressure Gradient



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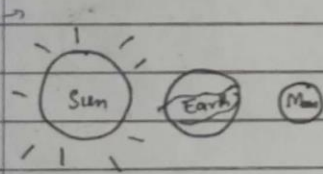
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Change of air pressure results
in Hurricanes.

(C) Difference

Lunar Solar Eclipse

→ When ~~Earth~~ ^{moon} is in between the sun and the ~~Earth~~ ^{moon}, such an eclipse is called solar eclipse.



→ Lunar Eclipse is classified into

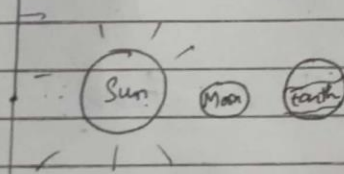
- Total lunar Eclipse
- Partial lunar Eclipse

→ Here, Earth casts shadow on the Moon.

→ It is visible from the whole nighttime hemisphere.

Lunar Eclipse

→ When ~~Earth~~ ^{moon} is in between the Sun and the ~~Earth~~ ^{moon}, such an eclipse is called lunar eclipse.



→ Solar Eclipse is classified into

- Total Solar Eclipse
- Partial Solar Eclipse
- Annular Solar Eclipse

→ Here, Moon casts shadow on the Earth.

→ It is only visible from a narrow strip of land over which

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Lunar Eclipse

Solar Eclipse

the moon shadow passes.

→ Lunar eclipses happen at full moon.

→ Solar eclipses happen at new moon.

→ Moon's surface can be seen during a lunar eclipse.

→ Moon's surface cannot be seen during a solar eclipse.

→ Can always be safely viewed with naked eye.

→ Can only be safely viewed with naked eye during totality.

(d)

Semiconductors:

Semiconductors are the materials which allow electricity to pass through them only partially, that conduct electricity less than conductors but more greater than insulators.

Examples include, Silicon, germanium etc

Doping in semiconductors:

Doping is a process in which impurities are added into

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the semiconductors to boost up their conducting properties.

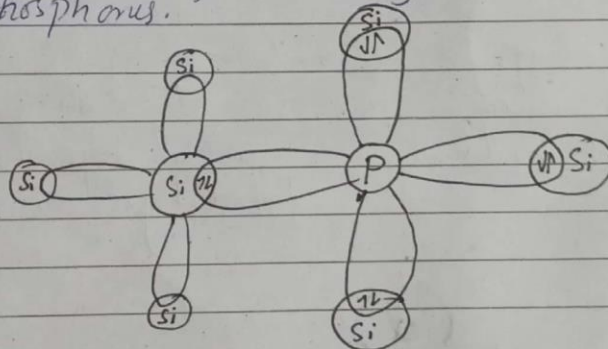
On the basis of impurities, there are two types of semiconductors i.e. N-type and P-type.

N-Type Semiconductors:

These are formed when impurity is added to a pure semiconductor from fifth group of the periodic Table.

N - because electron carries negative charge.

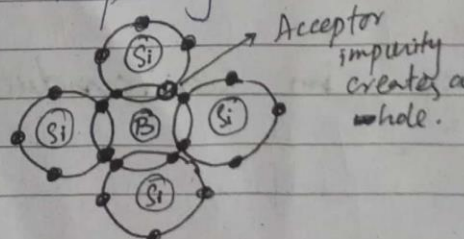
For example, doping Silicon with Phosphorus.



P-Type Semiconductors:

These are formed when impurity is added to a pure semiconductor from the III group of the Periodic Table.

For example, Boron is added as an impurity.



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Ceramics

A ceramic is an inorganic, nonmetallic, solid material comprising metal, nonmetal and/or metalloids atoms primarily held in ionic and covalent bonds.

Types of Ceramics:

There are two types of Ceramics

(a) Crystalline:

Crystalline ceramic materials are not amenable to a great range of processing.

Forming techniques include, shaping by hand, slip casting, tape casting, dry pressing etc.

(b) Non-Crystalline:

Non-crystalline ceramics, being glass, tend to be formed from melts.

The glass is shaped when either fully molten, by casting or when in state of toffee-like viscosity, by methods such as blowing into a mould.

When later heat treatments cause the glass turn partly crystalline, it is known as glass ceramic.

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SECTION-II

Question No. # 06

(a)

Sol: Current Age of father = x
Current Age of Son = y
Father's age 5 years ago = $x-5$
Son's age was thrice
5 years ago = $y-5$

As we know

Father's age was thrice the age of son:

$$\text{So, } x-5 = 3(y-5)$$

$$x-5 = 3y-15$$

$$3y-x = 15-5$$

$$3y-x = 10 \rightarrow \textcircled{1}$$

Since,

$$\text{Current age of son} = y = 30$$

Put $y=30$ in equation $\textcircled{1}$

$$3(30) - x = 10$$

$$90 - x = 10$$

$$x = 90 - 10$$

$$\boxed{x = 80}$$

Hence,

Father's current age is 80 years.

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Part (b)

Observations = 10, 30, Y, 50

Mean = 50

No. of observations = 4

Y = ?

As we know that

$$\text{Mean} = \frac{\text{Sum of Observations}}{\text{No. of Observations}}$$

Putting the values in formula

$$50 = \frac{10 + 30 + Y + 50}{4}$$

$$50 \times 4 = 10 + 30 + Y + 50$$

$$200 = 10 + 30 + Y + 50$$

$$200 = 90 + Y$$

$$Y = 200 - 90$$

$$Y = 110$$

So,

The missing observation is 110.

Check

$$\text{Mean} = \frac{\text{Sum of observations}}{\text{No. of observations}}$$

$$50 = \frac{10 + 30 + 110 + 50}{4}$$

$$50 = \frac{200}{4}$$

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$50 = 50$
Both the means are equal.
Hence, proved that the missing
number is $Y = 110$.

Part (c)

(i) 2, ~~36~~, 18, 54, 172

The numbers are ~~multi~~ a series multiplied by 3 starting from 2 multiplied by 3 and continuing with 6 multiplied by 3, 18 multiplied by 3 and the next number after multiplying 54 by 3 comes 172.

(ii) 3125, 256, 27, 4, 1

The numbers are multiples of their respective powers in a descending order i.e. 4 is the square of 2, 256 is 4 times of 4 and 3125 is 5 times of 5. Hence, 3 times (cube) of 3 will be 27.

$$2 \times 2 = 4$$

$$3 \times 3 \times 3 = 27$$

$$4 \times 4 \times 4 \times 4 = 256$$

$$5 \times 5 \times 5 \times 5 \times 5 = 3125$$

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Part (d)

Let Two number be = x, y

Product of the numbers = $x \times y = 320$

Their ratio = $x:y = 1:5$

Simplifying it

$$x = 1$$

$$y = 5x$$

So,

$$x \times y = x \times 5x$$

Therefore, we can say

$$(x \times 5x) = 320$$

$$5x^2 = 320$$

$$x^2 = \frac{320}{5}$$

$$x^2 = 64$$

Taking the square root

$$\sqrt{x^2} = \sqrt{64}$$

$$\boxed{x = 8} \rightarrow \textcircled{1}$$

Putting the value of x ,

$$y = 5x$$

$$y = 5(8)$$

$$y = 40$$

Now, we can get the difference between their squares.

$$\text{Difference} = \cancel{8} (40)^2 - (8)^2$$

$$= 1600 - 64$$

$$\boxed{= 1536}$$

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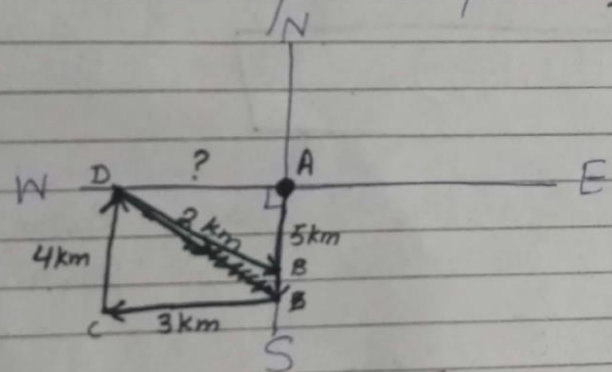
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Hence the difference between the squares is 1536.

Question #08 (a)

A crow travels south = 5 km
then west = 3 km
then North = 4 km
then South-East = 2 km
Distance from initial point = A = ?



Using Pythagorean Theorem formula:

$$\begin{aligned}(\text{Hypotenuse})^2 &= (\text{Base})^2 + (\text{Perpendicular})^2 \\(BD)^2 &= (AB)^2 + (AD)^2 \\(2)^2 &= (5)^2 + (AD)^2 \\4 &= 25 + (AD)^2 \\(AD)^2 &= -25 + 4 \\&= -21 \\ \sqrt{(AD)^2} &= \sqrt{21}\end{aligned}$$

$AD = 4.58 \text{ km}$

Hence crow is 4.58 km from the initial point.

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(b)

Total number of Slices = 8
Raisin containing slices = 3

Probability = ?

~~Part~~ Applying the formula:

Prob(Raisin in Slice) = $\frac{\text{No. of ways of occurrence of an event}}{\text{Total no. of outcomes}}$

$$\text{Prob(Raisin in slice)} = \frac{3}{8}$$

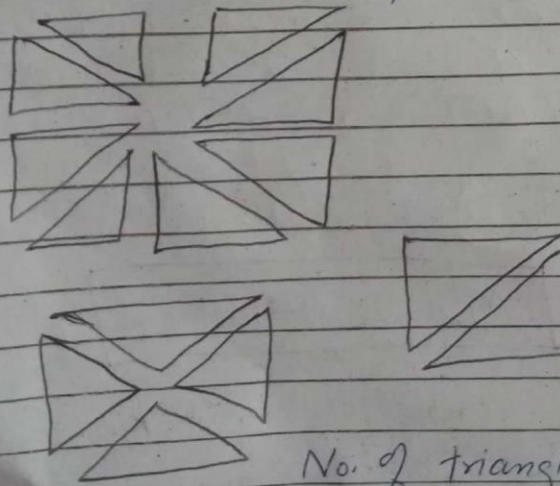
Hence,

Probability of having Raisin
in the slice of pizza
is $\frac{3}{8}$.

(c)

Number of triangles = ?

Let's draw the possible triangles



No. of triangles = 14

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Hence, there are 14 triangles in the given figure.

(d)

Intelligence Quotient (IQ):

Intelligence Quotient is a score derived from one of ~~different~~ several different tests designed to assess intelligence.

Factors affecting the IQ:-

IQ can be affected by different factors. Some are discussed below.

→ Parental IQ:

This factor affects the IQ to some degree or may be the other.

→ Parental Social Status

Parental social status may also affect the IQ of an individual.

→ Morbidity & Mortality:

These are also the factors associated with intelligence.

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quotient.

→ **Heritability:**

The IQ may be a result of genes of an individual.

These factors, to a higher or lesser extent, affect the IQ level of a person.

Applications of IQ scores:

It is used in many fields ~~the~~ as

- predictor of educational achievement or special needs
- predictor of job performance
- predictor of learning abilities etc.

In short, IQ is an effective way to find the intelligence level of an individual. But the factors affecting it, should also be taken in account while finding the scores.