## SECTION A [40 MARKS]

ANSWER **ALL** QUESTION

**Question 1** **[25]**

a) **Directions: For each question, there are four alternatives A, B, C and D. Choose the correct alternative and circle it. Do not circle more than ONE alternative. If there are more than one choice circled, NO score will be awarded.**

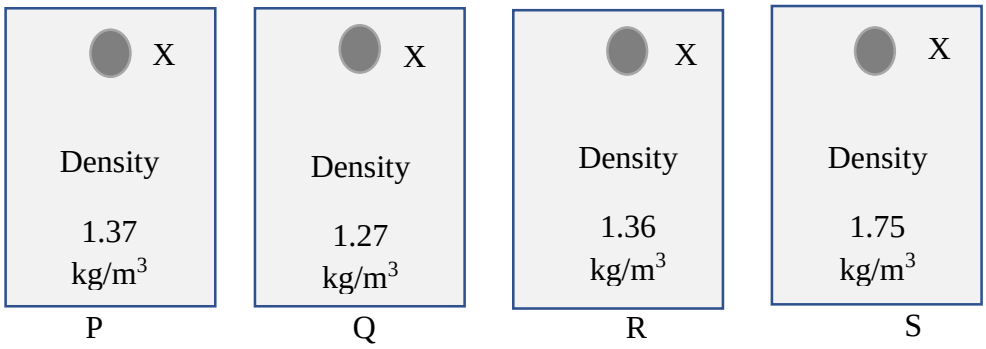
i. The total weight of a body acts downward as if located at a single point. The single point is called

A centre of body.
B centre of base.
C centre of gravity.
D centre of buoyancy.

ii. All of the following are examples of couple ***EXCEPT***

A opening a door.
B paddling a bicycle.
C opening a bottle cap.
D opening a lock with a key.

iii. An object X is made to fall through different air densities as shown in the figure. In which case would the object reach the ground first? (consider the height of object from the ground is same in each case)




A P
B Q
C R
D S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iv. The table below shows the input and output energy of four different brands of electric hair trimmers. Which brand is the most efficient?

| **Brand of trimmer** | **Energy input (J)** | **Energy output (J)** |
|---|---|---|
| Brand A | 120 | 110 |
| Brand B | 110 | 100 |
| Brand C | 112 | 105 |
| Brand D | 105 | 100 |

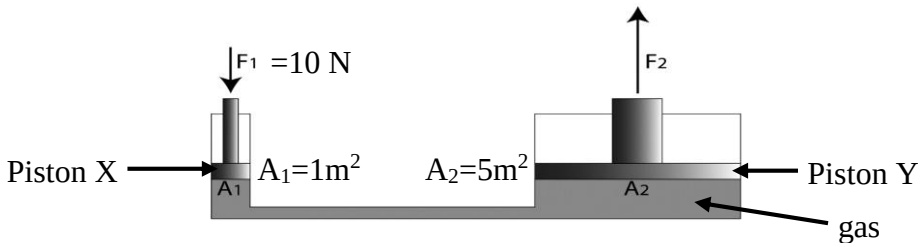
A Brand A
B Brand B
C Brand C
D Brand D

v. Sangay and Dema are best friends having different weights. One of them is thin and the other quite healthy. Sangay's school shoe is smaller in size than Dema's, however they exert the same magnitude of pressure on the ground while standing.

Choose the most correct statement from the following.

A Sangay is heavier than Dema.
B Dema is heavier than Sangay.
C Sangay and Dema have the same mass.
D Sangay and Dema have the same weight.

vi. Study the figure given. The hydraulic machine uses a gas instead of liquid. Choose the CORRECT statement.




A $F_2$ is 50 N.
B $F_2$ is more than 50 N.
C Pressure at piston X and Y are equal.
D Pressure at piston X and Y are unequal.

vii. What happens when a cold and a hot body are kept in contact?

A No heat flows
B Heat flows from cold body to hot body
C Heat flows from hot body to cold body
D Heat flows from one body to the other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viii. A mobile phone is capable of handling 5V of potential difference. Mobile phone chargers have inbuilt transformer to vary the voltage coming from main supply. Which statement best describes the type of transformer used in the charger.

A Secondary and primary coil have the same number of turns
B Voltage in secondary coil is higher than in primary coil
C Primary coil has less number of turns compared to secondary coil
D Secondary coil has less number of turns compared to primary coil

ix. Infrared radiation is used for taking photographs at night. This is possible because the wave

A gets reflected.
B is not able to penetrate.
C produce heating effect.
D is not getting scattered easily.

x. A teacher can hear students talking in the adjacent classroom. The property of sound demonstrated is

A refraction.
B reflection.
C diffraction.
D diffusion.

xi. From the given equation, find the value of Z.

$$^{244}_{94}X \longrightarrow {}^{240}_{Z}Y + \alpha \text{ particle}$$

A 90
B 92
C 93
D 95

xii. You are a scientist in NASA and your team is assigned to collect soil samples and study the signs of life on Mars. Which of the following space mission will serve the purpose?

A Rovers
B Orbiter Spacecraft
C Flyby Space Mission
D Human Space Mission


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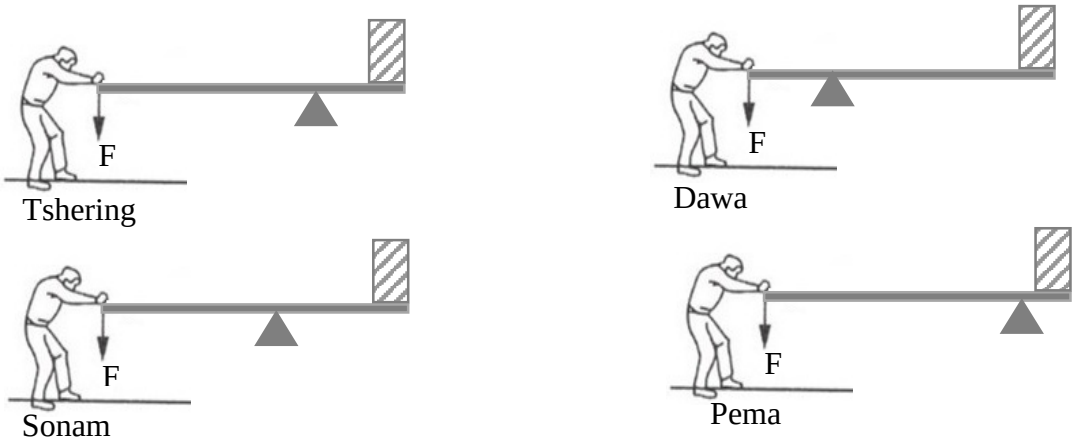
xiii. Four items are given below.

Identify the item with the **least** stability.

A ball
B umbrella
C hour glass
D flower vase

xiv. The figure below shows four friends lifting a heavy box using a wooden plank with the pivot position of their choice. Who would achieve equilibrium with least force F?




A Pema
B Dawa
C Sonam
D Tshering

xv. A ball of mass 1 kg is dropped from a height of 10 m. Which quantity given below would be maximum just before the ball hits the ground?

A weight
B aceleration
C kinetic energy
D potential energy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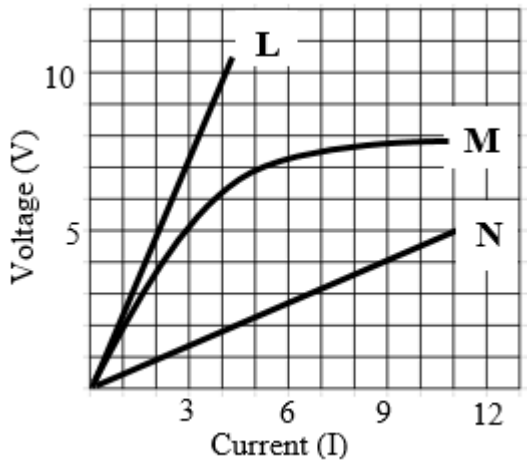
xvi. 2kg of water was heated for 15 minutes. The temperature rises from 20°C to 80°C. How much heat was gained by the water? (Specific heat capacity of water = 1Cal $g^{-1}°C^{-1}$/ 4.2J $g^{-1}°C^{-1}$/4200J $kg^{-1}°C^{-1}$)

A 504 J
B 504 Cal
C 504,000 J
D 504,000 Cal

xvii. A student plotted the following graph for three conductors L, M and N. What did the student conclude from the graph regarding resistance of the conductors? Choose the CORRECT statement.




A conductor M has least resistance
B conductor L has the least resistance
C conductor N has the maximum resistance
D conductor L has the maximum resistance

xviii. A transformer decreases the input voltage from 220V to 50 V. If an input current of 0.5A is flowing through the primary coil, what would be the output current?

A 0.12 A
B 0.23 A
C 2.2 A
D 4.4 A

xix. Which of the following is an example of zero work done?

A A player kicking a ball.
B Children playing on a slide.
C A man moving a box across the table.
D An athlete completing the race on a circular track.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xx. Using the table given below, identify the correct sequence of waves in increasing order of frequency?

| Waves | Wavelength |
|---|---|
| W | $2 \times 10^{-5} m$ |
| X | $2 \times 10^{-3} m$ |
| Y | $5 \times 10^{-5} m$ |
| Z | $5 \times 10^{-3} m$ |

A wave W < wave Y < wave X < wave Z
B wave Z < wave X < wave Y < wave W
C wave X < wave Z < wave W < wave Y
D wave Y < wave Z < wave W < wave X

xxi. Read the following statements:

I. Digital signal uses 0 and 1 to represent information
II. Digital signal bandwidth is high
III. Digital signal is denoted by sine waves

Which of the statements are correct?

A I and II
B I and III
C II and III
D All I, II and III

xxii. Study the table given below. Atom A and atom B are radioative elements emitting two different types of radiation. Choose the correct atom with the type of ray emitted.

| Property | Atom A | Atom B |
|---|---|---|
| **Ionizing power** | Highest | Lowest |
| **Penetrating power** | Lowest | Highest |

A Atom B and beta ray
B Atom A and alpha rays
C Atom B and alpha rays
D Atom A and gamma rays


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xxiii. According to Newtons law of gravitation, if the mass of two objects is doubled, the gravitational force between them

A increases by a factor of two.
B increases by a factor of four.
C decreases by a factor of two.
D decreases by a factor of four.

xxiv. Following are the implications of space exploration.

I. Economy is diverted leading to poverty
II. Finding essential minerals and elements in space
III. Increase knowledge about outer space
IV. Space travelling is expensive
V. Risk to astronauts

What are the **disadvantages** of space exploration?

A I, II and V
B I, IV and V
C II, III and IV
D IV and V

xxv. Study the table given below.

| **Substances (50g)** | **Specific heat Capacity (J/g°c)** |
|---|---|
| Copper | 0.38 |
| Silver | 0.24 |
| Iron | 0.46 |
| Lead | 0.13 |

If all the substances given in the table are supplied with the same amount of heat for 20 minutes, the substance that has minimum change in temperature is

A lead.
B iron.
C silver.
D copper.

a) Fill in the blanks by writing **suitable word/s.** **[5]**

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| i. | Force that balances the unbalanced forces is called _____. | |
| ii. | The pressure exerted at equal depth in sea water is _____ than in a river. | |


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| iii. | When two bodies in contact attain the same temperature, it is said to be in_____equilibrium. | |
| iv. | Electric current is the rate of flow of _____ in a circuit. | |
| v. | Wireless communication used to transfer data within the range of 10 metres is called _____. | |

b) State whether the following statements are **TRUE** or **FALSE**. **[5]**

| | | | |
|---|---|---|---|
| i. | The acceleration of a falling body when it attains terminal velocity is zero. | | |
| ii. | Energy efficiency leads to the increase in energy imports from other countries. | | |
| iii. | The resistance of a conductor will double if its thickness is doubled. | | |
| iv. | The mass number of an element remains same in beta decay since number of protons increases and number of neutrons decreases. | | |
| v. | Expansion of universe is evident from cosmological blue shift. | | |

c) Match each item under **Column A** with the most approriate item in **Column B.** **[5]**
Write the correct alphabet in the space provided under the **'ANSWER'** column.

| **Answer** | **Column A** | **Column B** | |
|---|---|---|---|
| i. | i. Five star rated appliance | a. latent heat of vaporization | |
| ii. | ii. Explains the magnitude of pressure in a confined liquid | b. infrared waves | |
| iii. | iii. The temperature of boiling water remains at $100^0$C till the last drop evaporates | c. Pascal's law | |
| iv. | iv. Principle of electromagnetic induction | d. latent heat of fusion | |
| v. | v. Waves with minimum obstruction by large structures | e. energy effiency | |
| | | f. radiowaves | |
| | | g. Ohm's law | |


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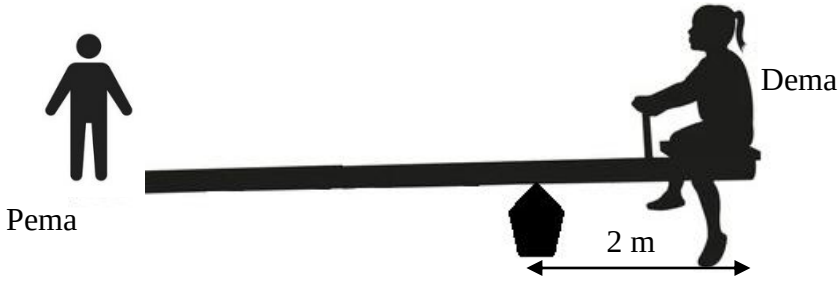
**SECTION B [60 MARKS]**

ATTEMPT **ANY SIX** QUESTIONS

**Question 2**

a) Two children were playing on a 6 m long see-saw plank pivoted at 2m as shown in the figure. Dema weighing 450 N sits on one end of the plank. Where should Pema weighing 250 N sit to balance the see-saw? **[2]**





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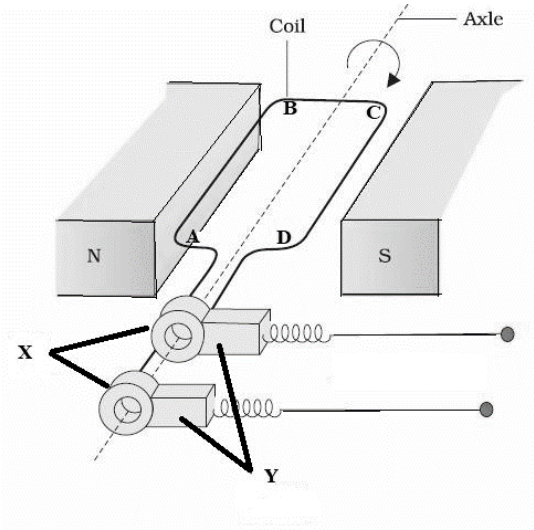
b) Study the diagram and answer the questions that follow:




i. Using Fleming's Right Hand rule, state the direction of induced current. **[1]**

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ii. Name the parts denoted by X and Y. **[1]**

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c) A radiation X is focused by a device on the bulb of a clinical thermometer and the mercury rises rapidly.

i. Name the radiation X **[1]**

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ii. Write **ONE** property demonstrated by it in the above statement. **[1]**

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d) Why is digital signal preferred over analogue signal in telecommunication? **[1]**

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e) Give **TWO** safety precautions while handling a radio active substance. **[1]**

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f) Many cosmologists believe that the universe started with a big bang. However, some of them oppose this idea. What could be the possible reasons for their disagreement? **[2]**

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**Question 3**

a) Complete the following table. **[2]**

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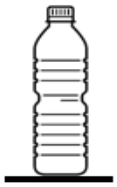
| Picture |  | | |
| Types of Equilibrium | | | |
| Definition | | | |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b) A mother lifts her baby having mass 15kg to a height of 2m in 2s. Calculate the power developed in lifting the baby. **[2]**

c) Principle of calorimetry and the law of conservation of energy are similar. Do you agree? Justify? **[2]**


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d) State **TWO** factors on which the heat produced depends on the heating effect of current. **[1]**

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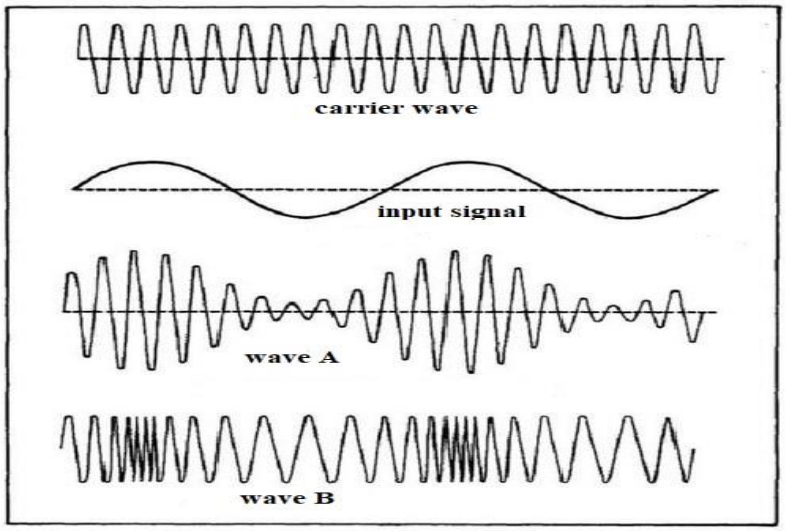
e) The waves A and B have undergone modulation. Identify the wave that has undergone amplitude modulation and justify your answer. **[2]**

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f) Astronauts are not able to write with a normal pen in space. Why? **[1]**

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**Question 4**

a) State the principle of moments. **[1]**

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b) The engineers of a motorcycle company developed two new models of a racing motorcycle. Motorcycle A has an engine force greater than that of motor cycle B but both can achieve the same velocity. Which motorcycle has more power? **[1]**

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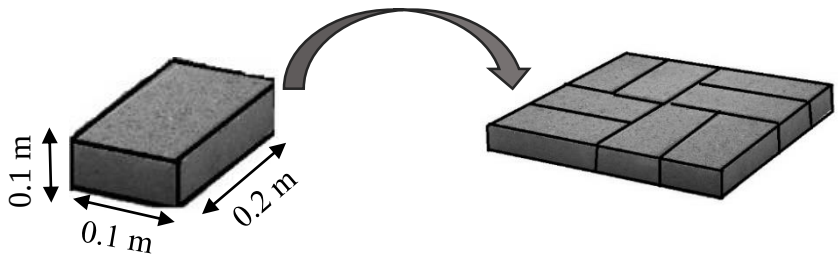
c) A brick with dimensions of 0.2 m x 0.1 m x 0.1 m weighs 60 N. What would be the minimum pressure exerted by 8 such bricks lying on the ground in a single layer uniformly? **[2]**

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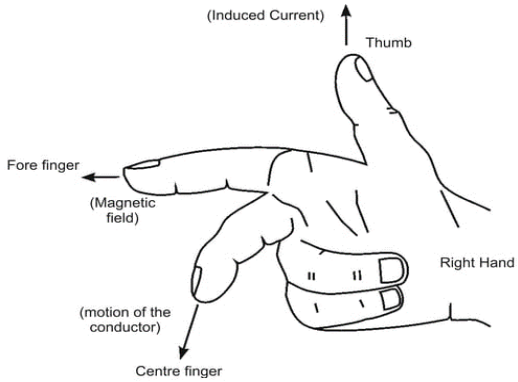
d) The picture given below shows one important rule used in electromagnetic induction.




i. Identify the error in the diagram. **[1]**

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ii. Name the rule. **[1]**

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e) A radioactive substance P having a mass number of 226 and atomic number of 88 underwent alpha decay followed by two beta decay.

i. Represent the final element S with nuclide notation. **[1]**

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ii. Compare the atomic number and mass number of the mother element P and the daughter element S. **[1]**

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f) Differentiate between orbiter and flyby space exploration. **[2]**

| Orbitar Spacecraft | Flyby Spacecraft | |
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**Question 5**

a) A cat falling from a building does not get injured. Why? **[2]**

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b) About 11% of the world's electrical energy is generated from nuclear power plants. Should Bhutan also generate nuclear energy? Justify your answer. **[2]**

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c) A hydraulic lift having a piston of area $0.6m^2$ was exerted with a force of 40N in order to lift a load of 1000N. What will be the area of the other piston? **[2]**

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d)

i. Define specific heat capacity. **[1]**

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ii. Ice cubes are found to cool a juice more effectively than cold water at $0^0$C. Give a reason. **[1]**

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e) Observe the pictures given below. Identify the type of transformers. **[1]**

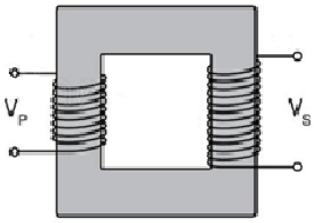


Figure A

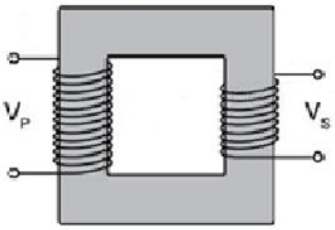


Figure B

| | |
|---|---|
| A | |
| B | |

f) In what ways are visible light and radio waves similar? Write **TWO** similarities **[1]**

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**Question 6**

a) Which truck has lesser stability? Give a reason for your choice. **[2]**

Truck A

Truck B

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b) State **TWO** factors which affect the magnitude of pressure due to solids. **[1]**

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c)

i. How much heat is required to raise the temperature of 10 kg of water by $1^0$C ? **[1]**

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ii. A bucket full of water weighing 5 kg is heated to a temperature of 80 $^0$C. The hot water is mixed with 10 kg of cold water. The final temperature of the mixture is 40$^0$C. Calculate the initial temperature of cold water considering no heat is lost to the surrounding. (Specific heat capacity of water is 4200 J/kg $^0$C) **[2]**

d) Explain the process of communication over long distances using the following key words and identify the wave used. **[2]**

Receiver's phone , satellites, transmitter, receiver, caller's phone


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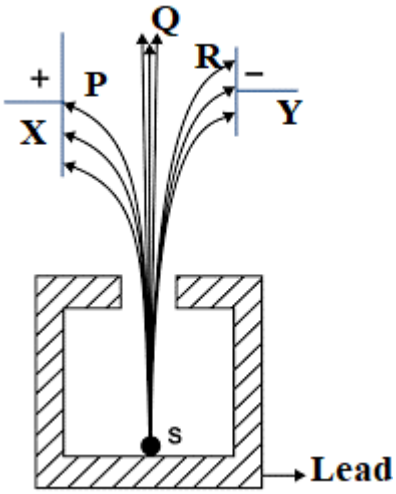
e) Study the diagram and answer the following questions.




i. Name the radiation P and R. **[1]**

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ii. Why does the ray Q not get deflected? **[1]**

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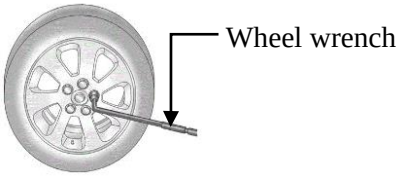
**Question 7**

a)

i. A mechanic is unsuccessfully changing the tyre of a car with a wheel wrench. How should he modify the wheel wrench to increase the torque? **[1]**

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ii. Steering wheels of heavy vehicles are usually larger. How does that help the drivers? **[1]**

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b) If an object is made to fall on the moon and the earth from the same height, compare the velocity of the falling object and give a reason. **[1]**

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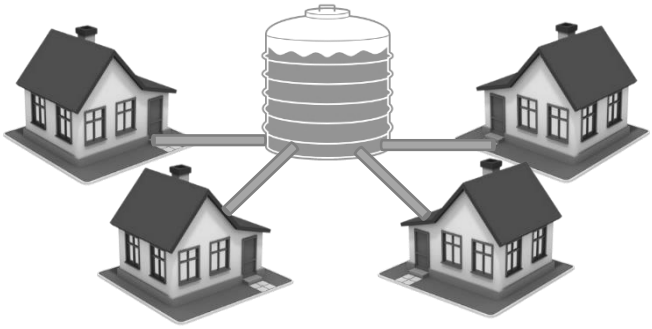
c) The water supply to four houses is from the same tank as shown in the figure. The four pipes are connected around the base of the tank at the same level. Is the pressure exerted by the water equal in all the four houses? Why? **[2]**



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d) A newly constructed house was installed with electrical bulbs. Incandescent bulbs of 100W were used in the toilet and kitchen while LED bulbs of 9W were used in other rooms. If an electric current of 220V was supplied to the house, how much current is drawn by each type of bulbs? **[2]**

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| | |

e) Compare and contrast the characteristics of gamma ray and hard X-ray. **[2]**

| **Rays** → | **Gamma rays** | **Hard X-rays** | |
|---|---|---|---|
| **Differences** | | | |
| **Similarities** | | | |


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f) Is there a possibility of life on other planets? Justify your answer. **[1]**

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**Question 8**

a) Two sheets of A4 size paper were used to study the nature of falling bodies. One paper was crumpled into a paper ball and the other was kept normal as given in the diagrams below. They were dropped from a height of 100 metres. **[2]**

Paper sheet

Paper ball

Complete the table given below using comparing words in each row.

| **Quantity** | **Paper** | **Comparing words** (equal, more than, less than) | **Paper** | |
|---|---|---|---|---|
| Mass | **Paper Sheet** | | **Paper Ball** | |
| Force exerted on the ground | | | | |
| Time taken to reach the ground | | | | |
| Drag force experienced | | | | |


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b) Using the different methods of energy efficiency, design an energy efficient house best suited for a cold place. **[2]**


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c) Hydraulic machines act as a force multiplier. Explain with the help of a mathematical expression. **[1]**

d) 1 g of ice at $0^0$C absorbs 360 J of heat energy to convert into water at $0^0$C. How much heat is required in bringing 1000 g of ice to boiling point? (Specific heat capacity of water is 4.2J/g$^0$C) **[2]**

e) How does high voltage drop in a circuit affect the efficiency of a machine? **[1]**


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f) Some schools use radioactive materials in their science laboratories to teach about radiation. Should such practices be promoted. Justify your answer. **[2]**

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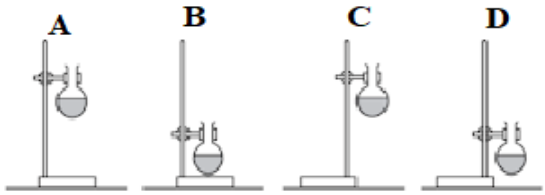
**Question 9**

a) Stand and clamp is used to hold a round bottom flask of liquid in four different ways in a practical class. **[1]**




Which set-up shows the most stable arrangement? Give a reason.

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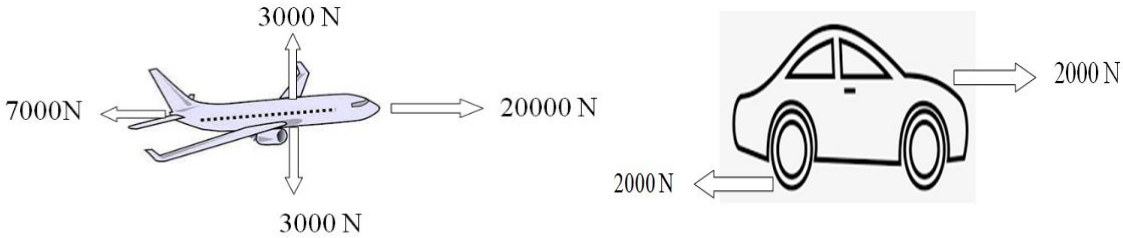
b) Study the diagram.




i. What is the resultant force on the plane and the car? **[1]**

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ii. Which body is at equilibrium? **[1]**

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c) Bhutan should not depend on hydropower as a single source of energy. Explain one alternative source of energy with **THREE** minimal impact on the environment. **[2]**

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d) Calculate Q and R to complete the table for transformers A and B. **[2]**

| **Transformer** | **$N_s$:$N_p$** | **$V_s$** | **$V_p$** |
|---|---|---|---|
| A | 10:1 | **Q** | 16 |
| B | 12:3 | 60 | **R** |

| | |
|---|---|
| | |


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e) Pregnant women are advised not to do X-rays unless it is required. Why? **[2]**

f) Optical fiber is better than copper cables for wired communication. Do you agree? Justify with **ONE** reason. **[1]**


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