



# MATHEMATICS

## ***OPEN TEXT BASED ASSESSMENT***

### ***QUESTION BANK***

***for SA -II***

**CLASS – IX**

**2015 – 16**

**CBSE OPEN TEXT MATERIAL AND CBSE  
SAMPLE QUESTIONS INCLUDING SOME  
PROBABLE QUESTIONS THEME WISE**

*Prepared by*

***M. S. KUMARSWAMY, TGT(MATHS)***  
***M. Sc. Gold Medallist (Elect.), B. Ed.***  
**Kendriya Vidyalaya GaCHIBOWI i**



## PREFACE

It gives me great pleasure in presenting the Question Bank for Open Text Based Assessment (OTBA) for Class IX Mathematics for Summative Assessment (SA) - II. It is in strictly according to the latest guidelines issued by CBSE (Circular No. CBSE/ACAD./Addl Dir(I & R)/OTBA 2015, dated 23<sup>rd</sup> November, 2015) for OTBA to be held with SA-II in March 2016.

The CBSE has short listed text material for class IX in the subject areas of English, Hindi, Mathematics Science and Social Science. This short listed text is in the form of an article, a case study, a picture or a cartoon or a problem/situation. The question paper in each main subject will have a separate section of 10 marks for Open Text Based Assessment (OTBA). The OTBA aims to strengthen students' analytical and theoretical skills by moving away from the trend of rote learning.

I avail this opportunity to convey my sincere thanks to respected sir, Shri U. N. Khaware, Additional Commissioner(Acad), KVS Headquarter, New Delhi, respected sir, Shri S. Vijay Kumar, Joint Commissioner(Admn), KVS Headquarter, New Delhi, respected sir Shri P. V. Sairanga Rao, Deputy Commissioner(Acad), KVS Headquarter, New Delhi, respected sir Shri. D. Manivannan, Deputy Commissioner, KVS RO Hyderabad, respected sir Shri Isampal, Deputy Commissioner, KVS RO Bhopal, respected sir Shri Jagdish Mohan Rawat, Deputy Commissioner, KVS RO Chandigarh, respected sir Shri P. Deva Kumar, Deputy Commissioner, KVS RO Bangalore, respected sir Shri Nagendra Goyal, Deputy Commissioner, KVS RO Ranchi, respected sir Shri Y. Arun Kumar, Assistant Commissioner(Acad), KVS Headquarter, New Delhi, respected sir Shri Sirimala Sambanna, Assistant Commissioner, KVS RO Hyderabad, respected sir Shri. K. L. Nagaraju, Retd-AC, KVS RO Bangalore and respected sir Shri M.K. Kulshreshtha, Retd-AC, KVS RO Chandigarh for their blessings, motivation and encouragement in bringing out this project in such an excellent form.

I also extend my special thanks to respected sir Shri. P. S. Raju, Principal, KV Gachibowli, respected madam Smt. Nirmala Kumari M., Principal, KV Mysore & respected sir Shri. M. Vishwanatham, Principal, KV Raichur for their kind suggestions and motivation while preparing this Question Bank. I would like to place on record my thanks to respected sir Shri. P. K. Chandran, Principal, presently working in KV Bambolim. I have started my career in KVS under his guidance, suggestions and motivation.

Inspite of my best efforts to make this notes error free, some errors might have gone unnoticed. I shall be grateful to the students and teacher if the same are brought to my notice. You may send your valuable suggestions, feedback or queries through email to [kumarsir34@gmail.com](mailto:kumarsir34@gmail.com) that would be verified by me and the corrections would be incorporated in the next year Question Bank.

***M. S. KUMARSWAMY***



**DEDICATED  
TO  
MY FATHER**

**LATE SHRI. M. S. MALLAYYA**



# OPEN TEXT BASED ASSESSMENT

## MATHEMATICS CLASS-IX

### Theme-1: Childhood Obesity in India

#### Abstract

*The text given in this article will help teachers to sensitize the students about the importance of healthy food habits. They will be able to monitor and mentor the impact of the kind of food they intake. Now a day's being on diet is fad amongst adolescents. Sometimes to remain slim and trim they start following wrong practices. Using mathematical knowledge, they can analyse their diet programmes and the consequences. Youth today is also more inclined towards the junk food and electronic gadgets and is moving away from playing or taking regular exercises. This is resulting in growing childhood obesity and related health problems. All health professionals have a deep concern about the issue as the health of youth determines the health of a nation. Case study given below is based on use of linear equations. With the knowledge gained in class IX about linear equations, its graphical representation and its application; students can be made to understand the rising threat to children's health in the form of increasing childhood obesity cases in India.*

According to the Oxford Dictionary, 'Healthy' is defined as 'the state of being free from illness or injury'. Indian parents have a myth that the child who is chubby and cheeky is healthy. So they shower their love by over feeding the children. Child grows with understanding that over consumption is normal and it is a way of life.

Growing up years is the foundation of adult health. Children from age one onwards grows taller and heavier till they reach adolescence at a whopping rate of about 2-2.3 kg every year for weight and 2 to 3 inches for height.

During the growing up years the fat cells increase in number and size due to faulty eating practices. Once the extra fat cells have been formed, they stay. All efforts to reduce weight can only reduce the size of the fat cells but not the number. Overweight children generally grow as overweight adults.

**Rajat is studying in class IX. He feels hurt as well as confused when teased by his friends for being obese. He was admired as most cute and chubby guy of class. He decided to be on diet to control weight.**

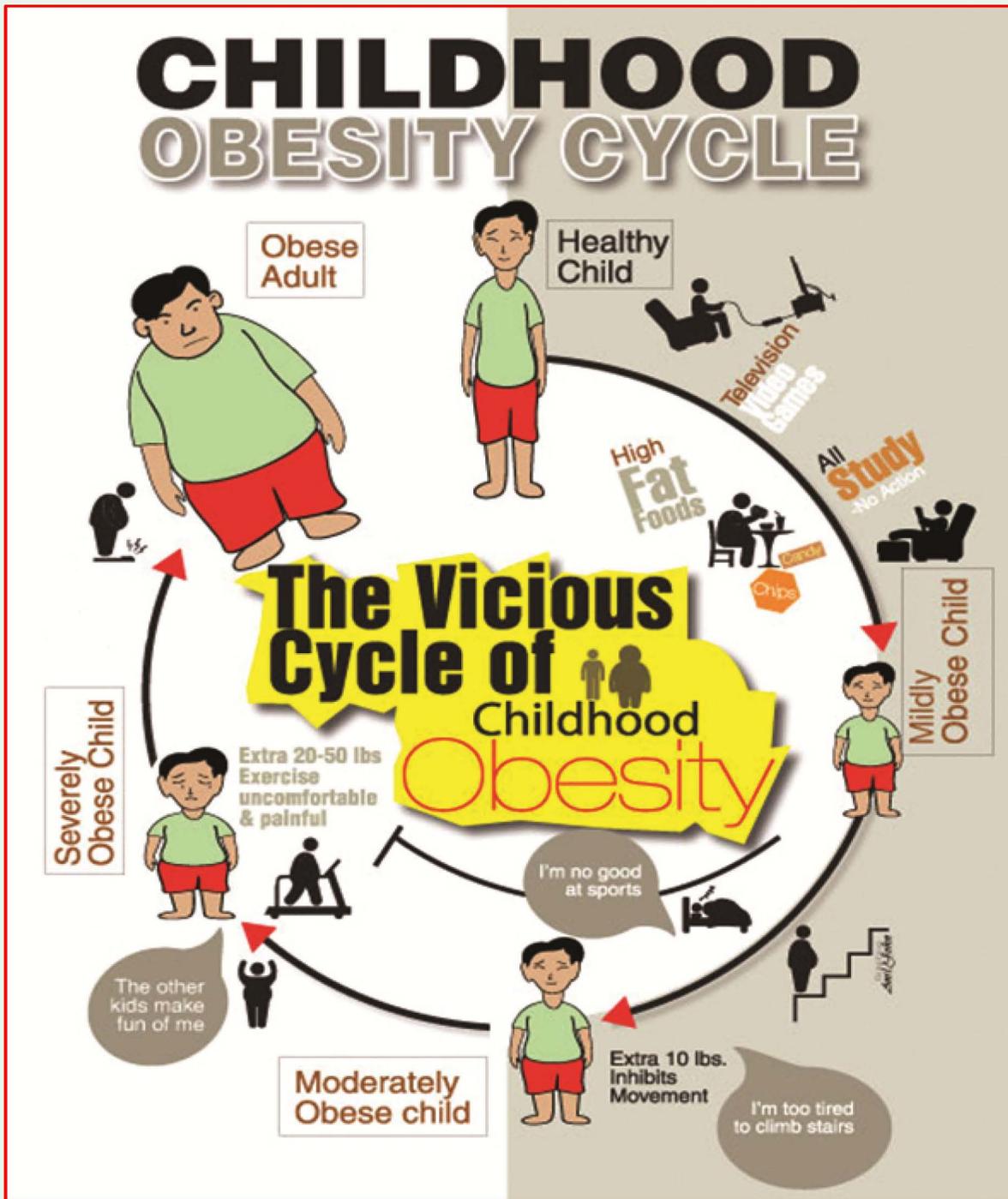
He started skipping meals and fasting. After some weeks he realized that instead of losing the weight he is running out of energy and is not able to focus on the studies. Rajat's parents discussed the issue with their family doctor. She calmed down them and told them that before starting any diet programme one must check his/her BMI in order to see the category in which the person falls – Normal or Overweight or Obese.

Being overweight means having more body weight than is considered normal or healthy for one's age or build. On the other hand, Obesity is the condition of being obese, i.e., excess amount of body



fat. While an overweight person will carry excess weight, he/she may or may not have excess accumulation of fat.

Doctor shared with them that child obesity is a major concern among all health professionals nowadays and appreciated the parent's concern about their child's sentiments and weight issues.



*"It is easier to build strong children than to repair broken man."*



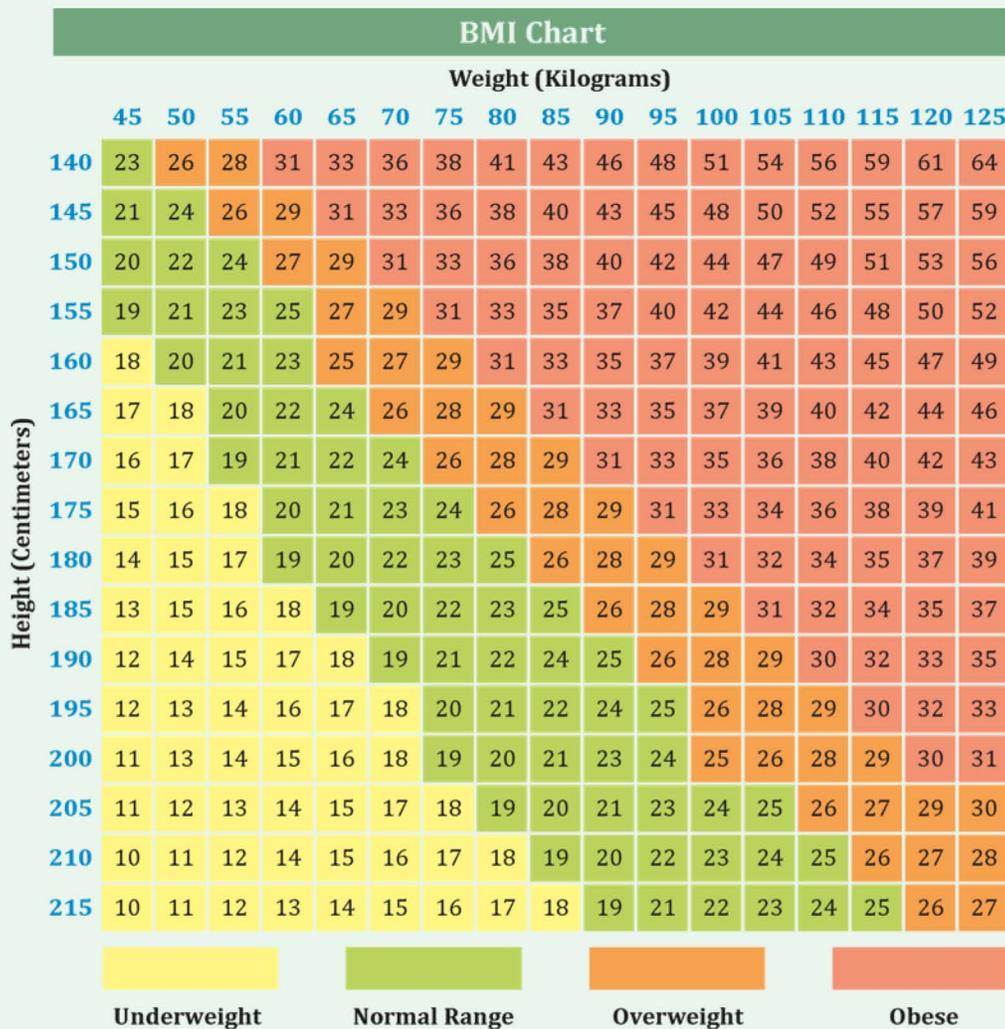
But to fight against it, one should have the clear idea of factors controlling the weight and shall adopt just the right combination of physical activity and balanced diet.

Rajat asked the doctor to explain BMI in detail.

### What is BMI?

Body Mass Index (BMI) is a person's weight in kilograms divided by the square of height in meters. For children and adolescent, BMI is age- and sex-specific and is often referred to as BMI-for-age.

BMI	Health Status
18.5-25	Healthy
25-30	Overweight
30-35	Obese
Above 35	Severely Obese





After explaining BMI, doctor asked Rajat to calculate his BMI. Rajat quickly used the weighing machine and height chart at clinic and found that his weight is 60 kg and height is 150 cm. As per the chart shown above his BMI is 27, so he lies in overweight category.

Doctor took a sigh of relief and said. "Thank God. You are not in obese category." Rajat asked "Why obesity is such a serious issue."



### Child obesity: A major concern

Doctor replied, "The World Health Organization (WHO) has labelled childhood obesity as the most serious public health problem of the twenty first century as it contributes towards 44% of diabetes, 23% of heart disease and 7-41 % of certain cancers. WHO estimates that world wide 2.8 million people die each year as a result of being overweight and obese".

Risks of heart disease, stroke, type 2 diabetes and cancer increase steadily with increasing body mass index (BMI).

Obesity is defined as a 20% excess of calculated ideal weight for age, sex and height of a child. A child is said to be obese when there is an excess of accumulated fat in the subcutaneous tissue (below the skin) and other areas of the body.

Today, childhood obesity is on the rise and is considered as a major public health problem. Globally, in 2010 there were estimated to be over 42 million overweight children below the age of 5.

Studies show that in India, nearly 15% to 20% of children are overweight and 30% are in the risk of falling in this category. It is these statistics that ring major alarm bells in India.

## Prevalence of Childhood Obesity in India

- Do you know the number of children who are obese in India?
- **One in four** school children in Indian metros is overweight.
- **One in six in non-metro cities is overweight.**
- Around 20% of children show signs of obesity.





## Factors responsible for obesity

- Consumption of energy-dense, nutrient-poor foods and lack of physical activity contributes to an increase in calories as compared to the requirement. Calorie is a measure of the energy derived from a food source. The calories derived from fruits and vegetables are superior to the calories derived from fast foods and soda, even though the number of calories may be same in both foods.
- A diet low on nutrients and high in salt, sugar and fat is commonly referred to as junk food. It is dangerous for health, as it lacks nutrition and is loaded with only calories. Children eat nearly twice as many calories (770) at restaurants as they do during a meal at home (420).
- Watching television and consuming junk foods are associated with a higher prevalence of being overweight.
- Unavailability of open spaces leave the children not much of a choice but to be home and spend hours watching television or be with the gadgets. On an average a city child is spending 4-5 hours in front of media machines.

## Controlling Obesity

To control obesity in children it is essential to

- **Keep them physically active** in order to burn extra calories and to keep metabolism geared towards using food for energy instead of storing it for fat.

Nature of Physical Activity	Calorie Burnt (k. cal/min)
Home activities	3
Walking	4
Jogging	6
Running	8
Running up stairs	10

You can make linear equations to plan your workout schedule.

For example

You want to burn 150 kilo calories in a day and you can work out at the most for 30 minutes. Also you feel that walking and jogging are most convenient ways to carry out your plan.

From above table you can observe that walking burns 3 kilo calories per minute and jogging burns 6 kilo calories per minute.



Suppose you walk for  $x$  minutes and jog for  $y$  minutes.

To burn 150 kilo calories, fitness schedule can be followed according to linear equation

$$3x + 6y = 150$$

You can draw graph of this linear equation and identify suitable time to invest in walking and jogging.

- **Take balance food intake**

Recommended calorie intake for boys and girls per day is as follows:

For children, boys, girls	2200 calories
For active boys and girls	2800 calories

Recommended calorie intake from different nutrients is as given below:

Nutrient	Recommended Calorie intake from nutrients/Amount per day
Fat	15%-30%
Carbohydrate	55%-75%
Protein	10%-15%
Salt	5-6gm/day
Sugar	20-25gm/day

- During the growing up phase, children are able to burn calories due to their high metabolism and activity levels. However, the taste for salty and sugary food, once developed, continues well into adult life. The result is that these kids grow into obese adults.

- **Be cautious of deceiving labels**

Sometimes the labels like cholesterol-free food, sugar free, multigrain, diet food etc. used as marketing tactics are very deceiving as such products may have low fat but excess salt and sugar which simply means intake of high calories. Decoding food labels is an essential exercise. For instance a bag of masala peanuts states that 100 gm of the product contain 610 calories. And the 50 gm fat in the packet of same product claims to provide 450 calories. Thus 450 calories out of 610 calories comes from fat, which is whopping 73%. Although the dietary recommendation is that only 30% of calories should come from fat.

- Avoid eating fast food as you can end up taking 47% more calories than traditional Indian food.



Have a look at the following chart showing the effort required to burn the specific amount of calorie obtained after eating junk food.

Junk food	Calorie value	How to burn it.
1 Slice pizza	250	Bicycling for 90 minutes
1 Cheese burger	330	Swimming for 60 minutes
1 Medium French fries	300	Jogging for 30 minutes
1 Pastry	500	Tennis for 90 minutes
1 Samosa	150	Dancing for 30 minutes
200 ml cola	110	Jumping rope for 15 minutes

### Why Fasting is not good for weight loss?

Fasting is popular because it can provide dramatic weight- loss but it is primarily water loss rather than fat. Lost water is regained quickly when eating is resumed.

After getting this information Rajat understood how to reduce the weight and he charted his diet plans with the help of his parents which of course was right blend of physical exercises, control over excess technology hours and vigilant intake of food with nutrients, salt and sugar in appropriate proportions.

You too can make one for yourself.

### REFERENCES

- <http://www.cseindia.org>

### SAMPLE QUESTIONS

Q1. It is stated that

“Children from age one onwards grows taller and heavier till they reach adolescence at a whopping rate of about 2 kg every year for weight and 3 inches for height.” 3 Marks

Assuming weight as variable ‘w’ and height as ‘h’, and ‘a’ as age in years, if weight at age 1 is 5 kg and height is 24 inch, establish a linear relationship between

- a) a and w
- b) a and h

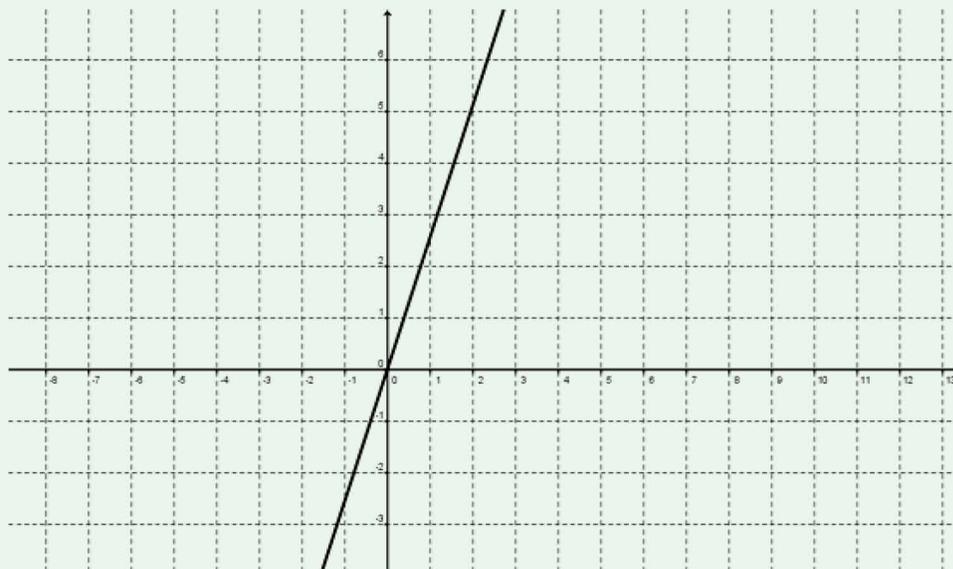
Q2. Atul wants to burn 250 calories in a day by doing physical activity. He chooses walking and running stairs for the same and plans to spend ‘t’ hours in walking and ‘s’ hours in running stairs. Write a linear equation for the same and draw the graph. 4 Marks



- Q3. Body mass Index (BMI) is a person's weight in kilograms divided by the square of height in meters. Taking the height as 160cm, form a linear equation in two variables taking BMI as  $x$  and weight as  $y$  kg. Draw its graph also. 3 Marks

### MARKING SCHEME

- Sol.1.** a)  $w = 5 + (a-1)2$  3  
 $\therefore w = 3 + 2a$
- b)  $h = 24 + (a-1)3$   
 $= 19 + 3a$
- Sol 2.**  $4t + 10s = 250$  & Graph 4
- Sol 3.**  $x = \frac{y}{1.6^2}$  3  
 $2.56x - y = 0$





## THEME – 1: CHILDHOOD OBESITY IN INDIA

### SOME PROBABLE QUESTIONS

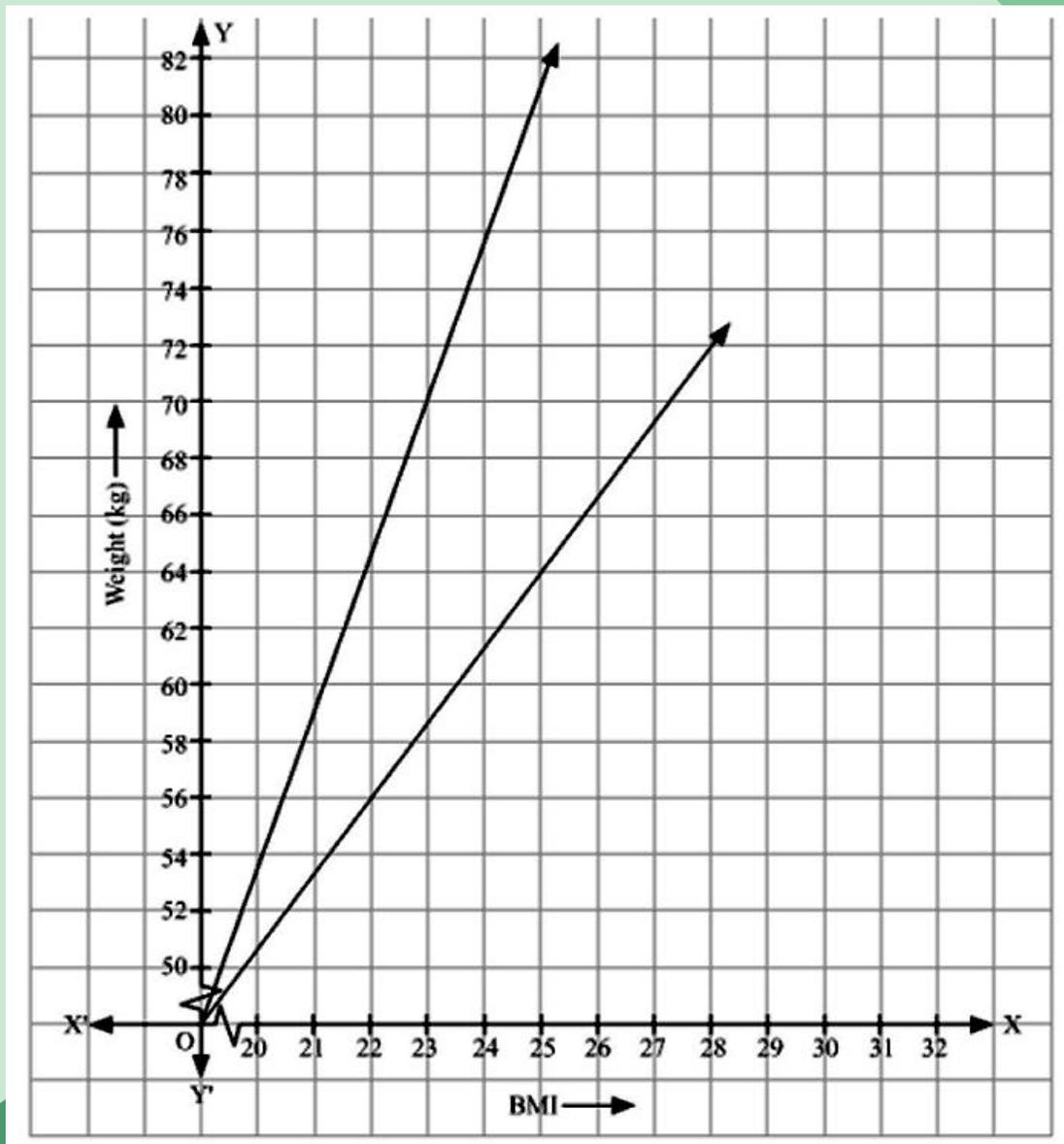
1. It is stated that “Children from age one onwards grows taller and heavier till they reach adolescence at a whopping rate of about 4 kg every year for weight and 5 inches for height.”  
Assuming weight as variable ‘w’ and height as ‘h’ and ‘a’ as age in years, if weight at the age 1 weighs 6 kg and its height is 25 inches, establish a linear relationship between  
(a) a and w (b) a and h. **(3 marks)**
2. Ajay wants to burn 300 calories in a day by doing physical activity. He chooses walking and running up stairs for the same and plans to spend ‘t’ hours in walking and ‘s’ hours in running up stairs. Write a linear equation for the same and draw the graph. **(4 marks)**
3. Body mass Index (BMI) is a person’s weight in kilograms divided by the square of height in meters. Taking the height as 210 cm, form a linear equation in two variables, taking BMI as x and weight as y kg. Draw the graph also. **(3 marks)**
4. Aman took one Cheese burger, one Pastry, one samosa, 2 Medium French fries and 200ml cola. If she wants to burn extra calories by doing three physical activities; jumping rope, dancing and swimming. Establish a linear relationship between  
(i) jumping rope and dancing  
(ii) dancing and swimming. **(3 marks)**
5. Body mass Index (BMI) is a person’s weight in kilograms divided by the square of height in meters. Taking the height as 150 cm, form a linear equation in two variables, taking BMI as x and weight as y kg. Draw the graph also. **(3 marks)**
6. Write any three factors responsible for obesity. **(3 marks)**
7. Write any three ways to control obesity in children. **(3 marks)**
8. What is Obesity? Why obesity is such a serious issue? **(3 marks)**
9. Why fasting is not good for weight loss? **(3 marks)**
10. Aditi wants to burn calories gained by eating one pastry and one medium French fries by doing physical activity. She chooses home activities and jogging for the same and spend x hours in home activities and y hours in jogging. Write a linear equation and draw the graph. **(4 marks)**
11. Shreya wants to burn 330 k cal in a day and she work out at the most for 45 minutes. She feels that running up stairs and jogging are most convenient way for her. Write the linear expressions and draw the graph. **(4 marks)**



12. Growing up years is the foundation of adult health, children from age one onwards grows taller and heavier till they reach adolescence at a whopping rate of 2.3 kg every year for weight and 2 inches for height. Taking weight as variable 'x', height as y and age in years as z. Establish a linear relationship between x and y, if weight at age of 1 year is 4 kg and height is 20 inches. **(4 marks)**
13. Body mass Index (BMI) is a person's weight in kilograms divided by the square of height in meters. Taking the height as 180 cm, form a linear equation in two variables, taking BMI as x and weight as y kg. Draw the graph also. **(3 marks)**
14. Recommended calorie intake per day for normal child is six hundred calories less than the active child. If calorie intake per day for normal child is 2200 calories, find the recommended calorie intake per day for the active child by representing them as a linear equation and draw the graph. **(4 marks)**
15. Mohan from age one onwards grew taller at the rate of about 3.2 inches every year and gained weight of about 2.4 kg every year.  
His weight at age 3 years was 9 kg and height 30.4 inches. Assuming x and y to be his weight and height, respectively when his age was t years, then find the relationship between (i) x and t (ii) y and t **(4 marks)**
16. Rahul wants to burn 300 calories in a day by performing physical activity. He jogs for x minutes and runs for y minutes in order to burn the calories. Express the given information as linear relationship between x and y. Also, draw the graph.  
Disclaimer: Unit of the calorie burnt is cal/min instead of k. cal/min as given in the table in the text. **(4 marks)**
17. If square of height in metres is equal to the ratio of weight in kg to the Body mass index(BMI), then taking the height as 200 cm, form a linear equation in two variables taking weight as x kg and body mass index as y. Draw its graph. **(3 marks)**
18. The height of Amit is 200 cm. If x and y represents the BMI and the weight, respectively, then form a linear equation to represent the given information. Draw its graph also. **(3 marks)**
19. It is stated that "Children from age one onwards grows taller and heavier till they reach adolescence at a whopping rate of about 2 kg every year for weight and 3 inches for height."  
If a child at the age 1 weighs 5 kg and its height is 24 inches, then what is height of the child when his weight is 8 kg. **(3 marks)**
20. Aditya wants to burn 50 k cal in exactly 15 minutes by choosing home activities and walking on the basis of table provided in the text. Make plan for Aditya for time spent in home activities and walking by considering x minutes for home activities and y minutes of walking. Identify the suitable time to be invested by Aditya in home activities and walking by the use of graph. **(4 marks)**



21. In a birthday party Aditi took 2 samosas, one pastry, one slice pizza and 200ml cola. If she wants to burn extra calories by doing three physical activities; walking, jogging and running. Establish a linear relationship between
- walking and jogging
  - jogging and running.
- (3 marks)**
22. Body mass Index (BMI) is a person's weight in kilograms divided by the square of height in meters. Taking the height as 190 cm, form a linear equation in two variables, taking BMI as  $x$  and weight as  $y$  kg. Draw the graph also. **(3 marks)**
23. Ajay and Aman are two friends. The height of Ajay is 160 cm where as the height of Aman is 180 cm. The following graph represents the linear relationship between their BMI and weight. **(3 marks)**



State whether the following statements are True/False. Justify your answer.

- If the weight of Aman is 81 kg, then he is obese.
- If Ajay weighs 70 kg, then he is overweight.



24. Consider the calorie measure of the food prepared at a particular restaurant is 'k' times the food prepared at home. Suppose 770 calories measured at restaurant is 420 calories measured when prepared at home. Find the value of k.

(i) If the calorie measure of food article is 264 at home, what will be the calorie measure of that article prepared at same restaurant.

(ii) If the calorie measure of food article prepared at the given restaurant is 264, what will be the calorie measure of that article prepared at home?

**(3 marks)**

25. What is BMI? Taking the height as 215 cm, form a linear equation in two variables, taking BMI as x and weight as y kg. Draw the graph also.

**(3 marks)**

26. If square of height in metres is equal to the ratio of weight in kg to the Body mass index (BMI), then taking the height as 170 cm, form a linear equation in two variables taking weight as x kg and body mass index as y. Draw its graph.

**(3 marks)**

27. Seeta and Geeta are friends. Both of them want to burn same amount of calories by performing physical activity. For the same, Seeta walks for 25 minutes and runs for 30 minutes.

Geeta chooses running and running up stairs as the physical activity to burn the calories. If she spends t minutes in running and s minutes in running up stairs, then express her fitness schedule as a linear equation in t and s. Also, draw the graph of the linear equation taking time spent in running on the y-axis and the time spent in running up stairs on the x-axis.

**(4 marks)**

Disclaimer: Unit of the calorie burnt is cal/min instead of k. cal/min as given in the table in the text.

28. In a marriage party Chaitra took 2 Cheese burger, one samosa, 2 Medium French fries and 200ml cola. If she wants to burn extra calories by doing three physical activities; walking, dancing and running. Establish a linear relationship between (i) walking and dancing (ii) dancing and running.

**(3 marks)**

29. Aditya wants to burn 150 kilocalories in a day. He decided to walk for 'x' minutes and jog for 'y' minutes. Form a linear equation between walking and jogging and draw its graph.

**(4 marks)**

30. Vishwanath wants to burn 250 kilocalories in a day. He decided to walk for 'x' minutes and run for 'y' minutes. Form a linear equation between walking and running and draw its graph.

**(4 marks)**





# OPEN TEXT BASED ASSESSMENT

## MATHEMATICS CLASS-IX

### Theme-2: Energy Consumption and Electricity Bill

#### Abstract

*The text given in this article will help teachers to motivate the students to prepare a case study on consumption of electricity in their homes and schools and to identify the ways to reduce the electricity bills by knowing energy saving tips. This will also give an insight into the way the bills are calculated for all basic amenities like electricity, water and telephone. The article will also help the students to understand the difference between the energy factor and power factor and how they impact electricity bill.*

*It also intends to make the students good decision makers. This is the time of informed choices. If the students are well aware of all terms like kWh, power factor, star rating on electrical appliances etc. they can help as well as guide their parents to make wisest choices while purchasing electrical appliances. Children can learn to save energy, save money, awareness about consumer issues by assimilating the ideas given in the text.*

It was a monthly affair in Rohan's home that the moment the electricity bill is dropped at their place a cribbing discussion starts in family about wrong billing, wrong meter reading, raised rates etc. Rohan always wanted to know on what basis bills are generated? How electricity board manages to raise separate bill for each house?

Are bills always correct? If not, how to check? He discussed these questions with his friends and found that all of them are puzzled over these questions. They went to their Mathematics teacher to understand the complexity of billing process.

On hearing them the Mathematics teacher announced in the class that everyone shall paste the last three electricity bills in their notebooks and they will do comparative study of the bills.

All students very enthusiastically participated in the activity and pasted the bills in their notebooks and found that all of them were getting bills of different amount. They asked their teacher the reason of getting bills of different amount. Teacher discussed with them the significance of knowing all the terms and units written on the bill. She explained the meaning of the following terms:

1. Electricity Bill
2. Electrical energy consumption and its unit
3. Power and its unit



### Electricity bill

An **electricity bill** is a **bill** for the consumption of **electric** energy

### Electrical Energy

It refers to the actual consumption of electricity. On all electricity bills the consumption of electricity is shown in kWh or kilowatt hours.

Usage of 1000 Watts or 1 Kilo watt of power for 1 hour implies consumption of 1 unit or 1 Kilowatt-Hour (kWh) of electricity. When a 100-Watt bulb is kept on for 10 hours it consumes:

$100 \times 10 = 1000 \text{ Watt-Hour} = 1 \text{ Kilo watt-Hour (kWh)} = 1 \text{ unit (on your meter)}$ .

**Rohan:** Madam we have purchased an Air Conditioner of three and half tons yesterday. On its box 6.5 kW is printed. What it means?

**Teacher:** It refers to the rate at which electricity is used by it.

$$\text{So, Power} = \frac{\text{Energy}}{\text{Time}}$$

Power is represented in watt (W) or kilowatt (kW). A thousand (1000) watts make one kilowatt. So if any appliance is rated as 6.5 kW then it means that it consumes electricity at a rate of 6500 W.

To estimate the units consumed by any appliance daily; units and monthly units consumed can be calculated using the following equation:

$$\text{Daily Units} = (\text{Wattage} \times \text{Usage hours per day}) \div 1000$$

$$\text{Monthly Units} = \text{Daily Units} \times \text{no. of days in a month}$$

Once you know the units consumed in a day or in a month you need to know the tariff plan applicable in your state.

Tariff is slab wise rate per unit of electrical consumption.

**For example: If tariff plan of some state is as follows**

Slab of Units	Rate per unit
First 150 units	Rs 2.20
Next 250 units	Rs. 4.20
Above 400 units	Rs.4.40



For example, electricity bill for consumption of 800 units for a month can be calculated as follows:

Slab of Units	Rate per unit	Total
First 150 units	Rs 2.20	150 units x 2.20 = Rs. 445
Next 250 units	Rs. 4.20	250 units x 4.20 = Rs. 1050
Above 400 units	Rs.4.40	400 units x 4.40= Rs. 1760
<b>TOTAL</b>		<b>Rs. 3255</b>

After this explanation, teacher asked the students to verify the following actual bills and to observe the difference between them:

Meter Reading Status : DL  
Billing Period : JAN-15  
Bill Date : 24-01-2015

Tariff Category : Domestic Cycle No. : 11

**Customer Care Centre No. (ग्राहक सेवा केंद्र का नं०) 39 99 97 07**

Meter No. (मीटर नं.)	Unit (यूनिट)	Billed Consumption (Current)		Billed Consumption (Previous)		Multiplication Factor (गुणक)	Current Consumption (एक मास का उपभोग)	Unit (यूनिट)
		Date of Meter Reading (मीटर पढ़ने की तिथि)	Reading (पढ़ाव)	Date of Meter Reading (मीटर पढ़ने की तिथि)	Reading (पढ़ाव)		Days (दिन)	
22068661	KWH	19-01-2015	89179.00	19-12-2014	88696.00	1.00	31	483.00
22068661	KW	19-01-2015	5.58	19-12-2014	-	1.00		5.58

**Billing Details (बिल का विवरण)**  
Current Period Charges (वर्तमान अवधि का शुल्क) (20-12-2014 to 19-01-2015)

Fixed Charge "A" (₹)	Consumption Measured During (कुल मास का उपभोग)	Energy Units Consumed / Billed (किलो वाट घंटा / किलो वाट घंटा)	Slabwise Energy Charge (मीटर खासियत अनुसार शुल्क)	Slabwise Power Purchase Adjustment Charge (इस खासियत के अनुसार शुल्क)	Time of Day (TOD) Charge (दिन के 24 घंटों का शुल्क)	Surcharge @ 8% on Energy Charge - Fixed Charge - Rebate = "C"	Electricity Tax @ 8% on Energy Charge, Surcharge on Energy Charge, PPAAC amount & TOD Surcharge/ Rebate amount = "D"	Total Amount (A+B+C+D+E) (कुल रकम)
		Units Rate (₹)	Amount = "B" (₹)	PPAC % on B (₹)	TOD % on "B" (₹)			
225.00	200.00	4.00	800.00			225.67	140.16	3196.75
1.00 MP(स)	200.00	5.95	1190.00					
	83.00	7.30	605.90					
Total Units = 483		Total (B) = 2595.90		Total (C) =		Total (D) =		

**Past Dues / Refunds / Subsidy (पिछला भुकाया / कपसी / राशिवादी)**

Arrears / Refunds (वसूली / कपसी)	Late Payment Surcharge (LPSC) (दिने के मुताबिक पर अधिकतम)	Other Charges, if any (अन्य शुल्क, यदि हो तो)	Total Charges Payable (कुल देय शुल्क)	Rebate / Subsidy (₹ / कपसी)	Net Amount Payable (कुल देय रकम)
Amount (₹)		4.55	3191.30		3191.30

Amount not immediately payable, if any. (रकम जो तुरंत देय नहीं है, यदि हो तो) ₹ \_\_\_\_\_ Reasons (कारण) \_\_\_\_\_

Security Deposit with DISCOM (डिस्कॉ के पास जमा सुरक्षा राशि) ₹4500.00

Interest accrued for FY 2013-14, already adjusted in bill No. 102220804093 (generated for the period 20-01-2014 to 15-04-2014) ₹(270.00)

Interest for FY 2014-15 will be adjusted in your first bill to be generated in FY 2015-16.

**₹ 3190.00**  
Due Date of Payment (पुस्तक देय तिथि) **11-02-2015**

If payment is made after the due date, LPSC for the delay, shall be charged in the next bill. (निश्चित तिथि के बाद भुगतान करने पर इस किराने हेतु अगले बिल में एलपीएससी जोड़ दिया जाएगा)

Last payment ₹ 2819.00 received on 09-01-2015. Payment accounted upto 21-01-2015. The connection shall be liable for disconnection on non-payment of all dues (including arrears of previous bill(s)) by due date, after notice as per Section 56(1) of the Electricity Act, 2003

LCC 26609982 65982 2076



**Customer Care Centre No. (ग्राहक सेवा केंद्र का नंबर) 39 99 97 07**

Meter No. (मीटर नं.)	Unit (यूनिट)	Billed Consumption (Current)		Billed Consumption (Previous)		Multiplication Factor (गुणक)	Current Consumption (धारा वस्तु)	
		Date of Meter Reading (मीटर रीडिंग की तिथि)	Reading (रीडिंग)	Date of Meter Reading (मीटर रीडिंग की तिथि)	Reading (रीडिंग)		Days (दिने)	Unit (यूनिट)
22068661	KWH	23-03-2015	90116.00	19-02-2015	89663.00	1.00	32	453.00
22068661	KW	23-03-2015	5.28	19-02-2015		1.00		5.28

**Billing Details (बिल का विवरण)**  
Current Period Charges (वर्तमान अवधि का शुल्क) (20-02-2015 to 23-03-2015)

Fixed Charge = "A" (स्थायी शुल्क)	Consumption Measured During (धारा जल्दी चढ़)	Energy Units Consumed / Billed (इकाई / बिल में शामिल इकाई युनिट)	Slabwise Energy Charge (मीटर स्लैब वीज शुल्क)	Slabwise Adjustment Charge (मीटर स्लैब वीज अनुकूलन शुल्क)	PPAC % on B (अनुकूलन शुल्क)	PPAC Amount = "C" (अनुकूलन शुल्क)	TOD % on "B" (दिने शुल्क)	TOD Surcharge/Rebate Amount = "D" (दिने शुल्क/रिबेट)	Surcharge @ 8% on Energy Charge + Fixed Charge - Rebate = "E" (शुल्क)	Electricity Tax @ 5% on Energy Charge, PPAC amount & TOD Surcharge/Rebate amount = "F" (शुल्क)	Total Amount (H = A+B+C+D+E+F) (कुल राशि)
739.26 (1.06 MNX)		213.00	4.00	852.00					204.56	125.16	2986.78
		212.00	5.95	1261.40							
		28.00	7.30	204.40							
PPAC on Fixed Charge = "G" (अनुकूलन शुल्क)											
0.00											
Total Units = 453		Total (B) = 2317.80		Total (C) =		Total (D) =					

**Past Dues / Refunds / Subsidy (पिछला बकाया / वापसी / सस्तिही)**

Amount (राशि)	Period to which it relates (दिया अवधि से संबंध है)	Late Payment Surcharge (LPSC) (दिली से शुल्क पर अधिसूचना)	Other Charges, if any* (अन्य शुल्क, यदि हो तो)	Total Charges Payable (कुल देय शुल्क)	Rebate / Subsidy (रिबेट / सस्तिही)	Net Amount Payable (कुल देय राशि)
			3.74	2890.52		2890.52

**Bill Amount Payable (बिल देय राशि)**  
**₹ 2890.00**  
**Due Date of Payment (भुगतान देय तिथि) 13-04-2015**

**IMPORTANT MESSAGE (महत्वपूर्ण सूचना)**

**Rahul:** Madam, how is slab based tariff structure designed?

**Teacher:** In all states the tariff structures for residential consumers are designed in such a way that per unit charge is less, if your consumption is less and more if your consumption is more. In fact it increases significantly as you increase your electricity consumption. For example in a city the tariff is as below:

First 100 units	Rs 2.96/unit
Next 200 units (from 101 to 300)	Rs 5.56/unit
Next 200 units (from 301 to 500)	Rs 9.16/unit
Any units after that (above 500)	Rs 10.61/unit

You will pay higher amounts per unit as your consumption increases.

**The motive behind such structure is to motivate people to consume less electricity.**

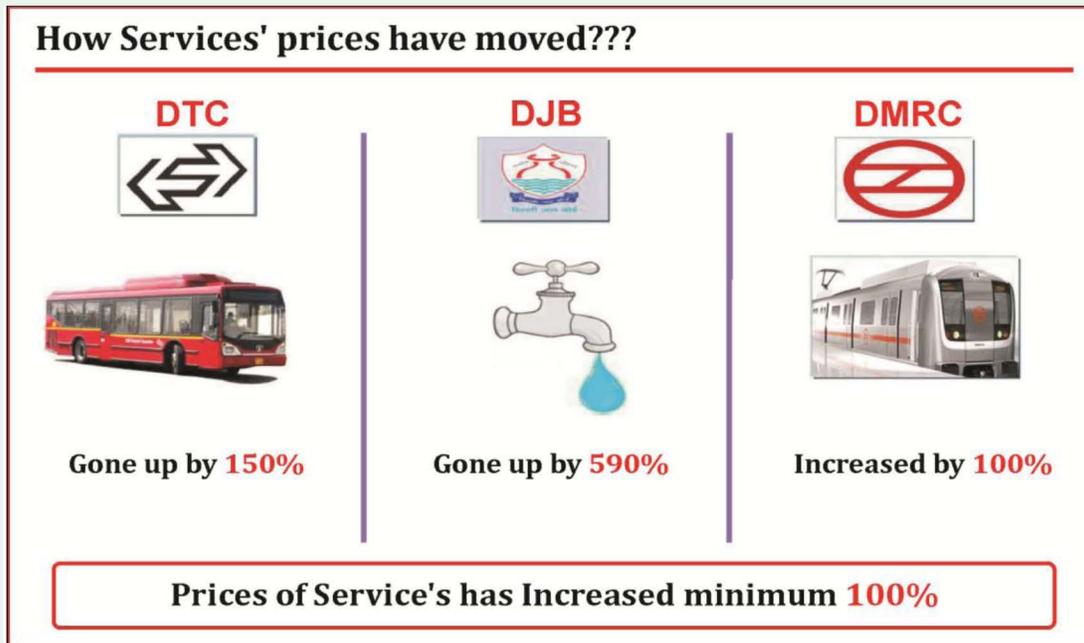
**Soham:** Madam, apart from the tariff slab, bill is showing some other charges.

**Teacher:** Soham you have sharp eye. Apart from the tariff slabs there is a fixed charge and 8% surcharge on total amount of fixed charge and electrical charge. Then there is electricity tax at the rate of 5% over the total electricity bill.

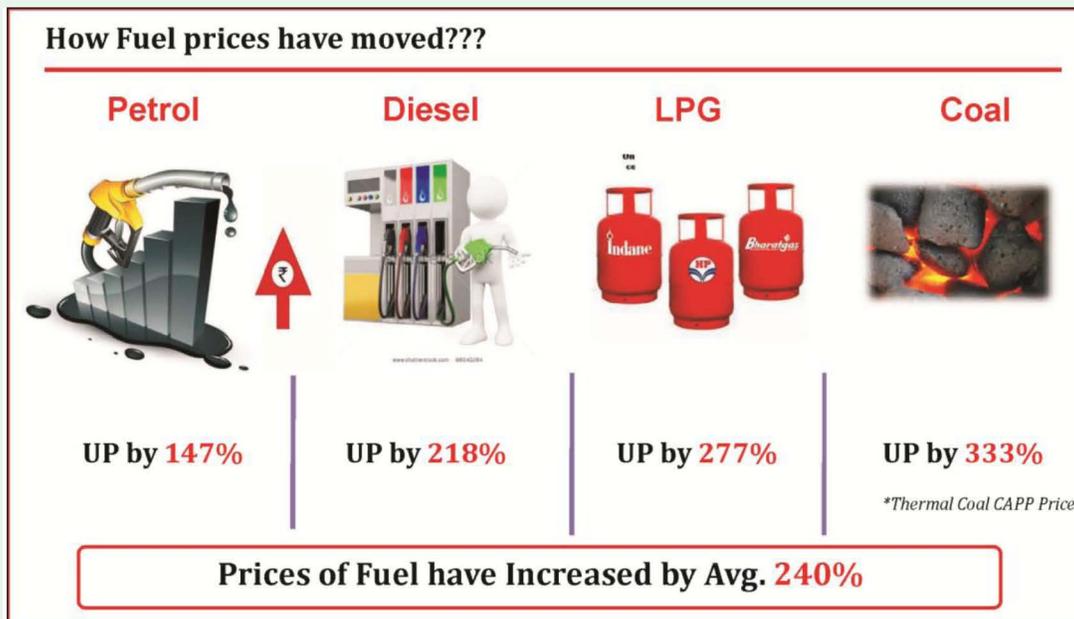


**Tina:** Madam, why there is surcharge when already the electricity consumption charges are taken?

**Teacher:** Very interesting question. As an aware citizen you must acquire the knowledge of these kinds of issues. In past few years fuel cost is raised by 240% due to which power generation cost is increased by 80% .However the electricity charges were not raised continuously for 6 years i.e. from year 2005-2011 which has caused heavy losses to electricity regulatory bodies. An interesting comparison chart is given in BSES report as follows:



Source: <http://www.bsedelhi.com>



Source: <http://www.bsedelhi.com>



To overcome the losses to the power generation and distribution companies due to hike in fuel prices and transportation costs surcharge is imposed for the first time by Government of India for temporary period.

**Diya:** Madam, why there is separate electricity tax?

**Teacher:** Cost of supplying electricity to all, costs more to govt. But in our country in order to make electricity affordable for all traditions of providing electricity to common man at lesser rate is adopted after independence. To compensate the expenses of government required to maintain the huge infrastructure some electricity tax is imposed by the government.

**Mahima:** Madam, I have observed that when less units are consumed, the bill amount is also less. Is it possible for us to reduce the consumption of electricity and hence the bills?

**Teacher:** Yes, if you know the power of all appliances you can definitely calculate the electricity consumed in a day. Also you can keep a check on wastage and reduce the time for which an electrical appliance is used. Here is a suggestive table of load and consumption time in order to keep the consumed units below 400 units in summer and winter:

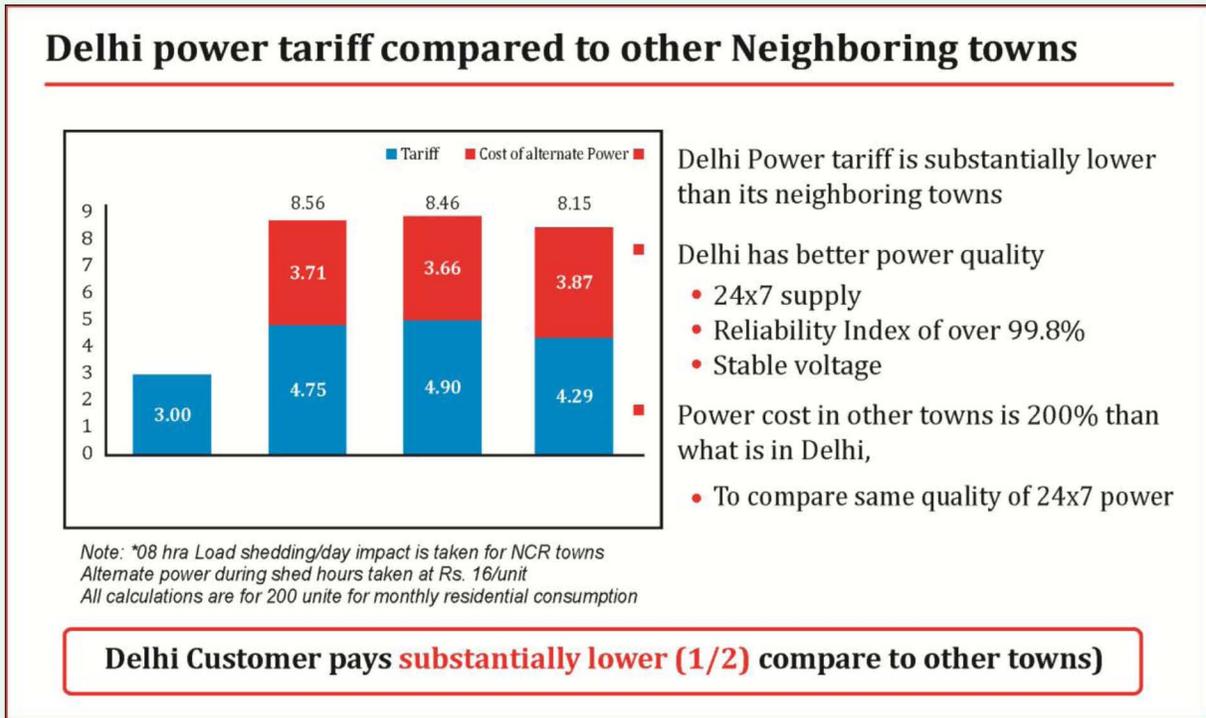
Approximate power consumption by consumers

APPROXIMATE POWER CONSUMPTION BY CONSUMERS							
 <h2>SUMMER</h2> <h3>WHAT YOU CAN RUN ON 400 UNITS AND LESS</h3>				 <h2>WINTER</h2> <h3>WHAT YOU CAN RUN ON 400 UNITS AND LESS</h3>			
APPLIANCES	APPROXIMATE LOAD (WATTS)	AVERAGE HOURS/DAY	APPROXIMATE UNITS/mth	APPLIANCES	APPROXIMATE LOAD (WATTS)	AVERAGE HOURS/DAY	APPROXIMATE UNITS/mth
Tube Lights (2)	40	7	17	Tube Lights (2)	40	7	17
Lamp (1)	100	5	15	Lamp (1)	100	5	15
Electric Iron (1)	600-1000	1	30	Electric Iron (1)	600-1000	1	30
Refrigerator (1)	200	24	144	Refrigerator (1)	200	24	144
Desert Cooler (1)	200	7	42	TV (1)	200	4	24
Ceiling Fan (2)	60-100	10	48	Computer (1)	200	1	6
TV (1)	200	4	24	Pump Motor (1)	740	1	22
Computer (1)	200	1	6	Geyser	1000-2000	1	60
Pump Motor (1)	740	1	22	Washing Machine (1)	700	1	10
Washing Machine (1)	700	1	10	Mixer Grinder (1)	200	1	6
Exhaust Fan (1)	200	1	6	Exhaust Fan (1)	150	1	5
Exhaust Fan (1)	150	1	5	Toaster (1)	750	1	22
Toaster (1)	750	1	22				
<b>A TOTAL OF 391 UNITS/MONTH CONSUMED.</b> HOWEVER IF THE AIR COOLER (42 UNITS/MONTH), IS REPLACED BY AN AIR CONDITIONER (1.5 TON) FOR A DURATION OF 7 HOURS/DAY THAT UNITS WOULD GO UP BY 37 & UNITS/MONTHS.				<b>A TOTAL OF 361 UNITS/MONTH CONSUMED.</b>			



**Chanchal:** Madam, I have shifted to Delhi recently. Are electricity tariffs same in all states or living in capital costly for electricity consumers?

**Teacher:** (Smiling) surprisingly this is not true. Look at the comparative rates of all states in the year 2013.



*Source: <http://www.bsesdelhi.com>*

Following are the tariff slabs of electricity charges applicable in different states in the Year 2013 in various categories like domestic, commercial, industrial etc.

TARIFF COMPARISON ACROSS DIFFERENT STATE UTILITIES NEAR DELHI NCR						
CATEGORY	Units	Delhi (TPDDL)	Haryana (DHBVNL)	Uttar Pradesh (NPCL)	Rajasthan	Punjab
		Rs. / Unit	Rs. / Unit	Rs. / Unit	Rs. / Unit	Rs. / Unit
Domestic - 2 kW	200	2.15	5.40	4.38	5.16	5.29
Domestic - 2 kW	400	2.53	5.41	4.44	5.17	5.76
Non Domestic- 10 kW	1500	8.57	6.22	7.73	7.13	6.57
LT Industrial - 10 kW	1500	8.13	7.08	7.50	6.78	5.74
HT Industrial - 100kW/108 KVA	15000	7.50	6.38	7.70	6.51	6.33
Power Outage During Summer(Avg.)**	Hours/day	0	4-6	2-4	2-2.5	2-2.5



### TARIFF COMPARISON ACROSS DIFFERENT UTILITIES OF METRO CITIES IN INDIA

CATEGORY		Delhi (TPDDL)	Mumbai (R-infra)	Kolkata (CESC)	Chennai (TNEB)
	Units	Rs./Unit	Rs./Unit	Rs./Unit	Rs./Unit
Domestic - 2 kW	200	2.15	3.88	5.69	2.98
Domestic - 2 kW	400	2.53	4.83	6.44	4.46
Non Domestic - 10 kW	1500	8.57	6.47	7.80	7.31
LT Industrial - 10 kW	1500	8.13	6.95	6.20	5.70
HT Industrial - 100kW/108KVA	15000	7.50	8.81	7.95	9.16

Sources: <http://www.ndpl.com>

**Teacher:** I hope you all will review your electricity bills and will be able to help your parents understand the bill.

**Students:** Yes, we have also got an idea about how to reduce power consumption and save electricity and to save money.

### SAMPLE QUESTIONS

**Note:** Attempt all questions given below without taking into account surcharge and electricity tax.

Q2. Form a linear equation if the total bill of a house in Delhi is above Rs. 3000 for a month assuming that the consumption is of  $x$  units as per Delhi tariff slabs shown in actual bill.

3 Marks

Q3. Form linear equations to calculate bill for consumption of electricity units between 200 units and 400 units for all states and metro cities given in last table.

4 Marks

Q5. Amit has three bedrooms flat. He installed four fans and two air conditioners of 1 ton in the house. He observed that his total consumption for light and other electrical appliances excluding fan and air conditioner is 200 units in a month. He wishes that his monthly consumption of electricity should be 550 units in a month. Establish a linear equation for the same assuming that he is using all fans for  $m$  number of hours and air conditioner for  $p$  number of hours. AC of 1 ton take load of 1900W.

3 Marks



## MARKING SCHEME

- Sol. 2** Given total consumption =x units 3  
As per given tariff slab rates of first 200 units and next 200 units are fixed.  
Consumption of electricity above 400 units.  
 $= x - 400$   
Hence linear equation is  
 $200 \times 4.00 + 200 \times 5.95 + (x-400) \times 7.30$  [Without any fixed charges]
- Sol. 3** Let x be the consumption of electricity between 200 units and 400 units and y be the total electrical charges in respective states. Then as per the tariff slab given in last table linear equations will be as follows: 4  
For Delhi  
 $Y = 2.15 \times 200 + 2.53x$   
For Haryana  
 $Y = 5.40 \times 200 + 5.41x$   
For UP  
 $Y = 4.35 \times 200 + 4.44x$   
For Rajasthan  
 $Y = 5.16 \times 200 + 5.17x$   
For Punjab  
 $Y = 5.29 \times 200 + 5.76x$   
For Mumbai  
 $Y = 3.88 \times 200 + 4.83x$   
For Kolkata  
 $Y = 5.69 \times 200 + 6.44x$   
For Chennai  
 $Y = 2.98 \times 200 + 4.46x$
- Sol. 5**  $80(4m)/1000 + \frac{1900}{1000} 1n = 550$  3  
Given average load of fan in table in text is 60-100 W so 80 is taken as average load for fan. It is multiplied by 4m because 4 fans will run for m hours. The total energy consumed by fans are divided by 1000 because 1000 watt consumption shows for 1 hour 1 unit on meter.



## THEME – 2: ENERGY CONSUMPTION AND ELECTRICITY BILL

### SOME PROBABLE QUESTIONS

1. Form a linear equation if the total bill of a house in Delhi is above Rs. 4000 for a month assuming that the consumption is of 'x' units as per Delhi tariff slabs shown in actual bill. **(3 marks)**
2. Form linear equations to calculate bill for consumption of electricity units between 300 units and 500 units for all states and metro cities given in last table of the text. **(3 marks)**
3. Amit has four bedrooms flat. He installed five fans and three air conditioners of 1 ton in the house. He observed that his total consumption for light and other electrical appliances excluding fan and air conditioner is 200 units in a month. He wishes that his monthly consumption of electricity should be 600 units in a month. Establish a linear equation for the same assuming that he is using all fans for 'm' number of hours and air conditioner for 'p' number of hours. AC of 1 ton take load of 2000 W. **(4 marks)**
4. Mohan uses a 20 Watt tube light and a 100 Watt lamp to light up his room. The usage hours per day of the tube light are three times the usage hours per day of the lamp. Form a linear equation to calculate the total number of units consumed in the month of November of a particular year. Also, draw its graph. **(4 marks)**
5. The electricity tariff plan of a particular city is as follows:

First 200 units	Rs 2.00/unit
Next 150 units	Rs 3.00/unit
Next 150 units	Rs x/unit
Any units above 500	Rs 6.00/unit

The total electrical charges of a particular house in the city are Rs 3,400 for y ( $y > 500$ ) units of consumption. Establish a linear relationship between x and y. If  $x = 5$ , then what is the value of y? **(3 marks)**
6. Amit has two bedrooms flat. There are three fans and one air conditioner of 1.5 tons in the house. His total consumption of electricity for light and other electrical appliances excluding fans and the air conditioner is 150 units. He wishes that his monthly consumption of electricity should be 600 units in a month. Form a linear equation representing the given information assuming that he is using all fans for x number of hours and air conditioner for y number of hours. (Assume air conditioner of 1.5 tons takes load of 2500 W) **(3 marks)**
7. For the consumption of x units for a month as per Delhi Tariff slabs shown in actual bill, form a linear equation in the total cost Rs. y and total consumption x units lies between 400 units and 600 units. Find the total consumption, if total electric bill for a month is Rs. 2136. **(4 marks)**



8. For the consumption of  $x$  units, lies between 200 units and 400 units for a month as per Delhi Tariff slabs shown in actual bill, form a linear equation in the total cost Rs.  $y$  and total consumption  $x$  units. Find the total consumption, if total electric bill for the month is Rs. 1752. **(4 marks)**
9. For the consumption of  $x$  units, lies between 200 units and 400 units for a month as per Delhi Tariff slabs shown in actual bill, form a linear equation in the total cost Rs.  $y$  and total consumption  $x$  units. Find the total bill, if total consumption for the month is 380 units. **(4 marks)**

10. The following table shows the types of electrical appliances and their average usage per day in a particular home in Delhi.

Appliances	Approximate Load(Watts)	Average hours/day
Tube lights (3)	40	7
Electric Bulbs (2)	100	$x$
Electric Iron	800	0.5
Refrigerator	180	24
Computer	200	$y$

The total electrical charges of the home in a particular month are Rs 423.12. Form a linear relationship between  $x$  and  $y$ . If  $x = 3$ , then find the number of hours for which computer was used in the month. **(3 marks)**

11. Rohan has a house and a factory in Delhi. In a particular month, 1200 units were consumed in the factory and  $x$  number of units between 200 and 400 were consumed in the house. Form a linear equation to calculate the total amount of electrical charges incurred. **(3 marks)**

12. The electricity tariff plan of a particular state is as follows:

First 100 units	Rs 2.50/unit
Next 150 units	Rs 3.00/unit
Next 150 units	Rs 4.50/unit
Any units above 400	Rs 7.50/unit

The fixed charge is Rs 250. Form a linear equation if the total bill of a particular house (excluding surcharge and electricity tax) in the state is above Rs 2,000 for a month assuming that  $x$  units are consumed in the actual bill. **(3 marks)**

13. For the consumption of  $x$  units for a month as per Mumbai Tariff slabs shown in actual bill, form a linear equation in the total cost Rs.  $y$  and total consumption  $x$  units lies between 400 units and 600 units. Find the total consumption, if total electric bill for a month is Rs. 2136. **(4 marks)**
14. For the consumption of  $x$  units, lies between 200 units and 400 units for a month as per Chennai Tariff slabs shown in actual bill, form a linear equation in the total cost Rs.  $y$  and total consumption  $x$  units. Find the total consumption, if total electric bill for the month is Rs. 1752. **(4 marks)**



15. For the consumption of  $x$  units, lies between 200 units and 400 units for a month as per Chennai Tariff slabs shown in actual bill, form a linear equation in the total cost Rs.  $y$  and total consumption  $x$  units. Find the total bill, if total consumption for the month is 380 units. **(4 marks)**
16. Find the total amount of electric consumption of 325 units for a month as per tariff given for Kolkata after forming a linear relationship between consumption and cost. **(3 marks)**
17. Find the total amount of electric consumption of 325 units for a month as per tariff given for Mumbai after forming a linear relationship between consumption and cost. **(3 marks)**
18. Form linear equations to calculate electric bill for consumption of electricity units between 200 units and 650 units for four metro cities given in last table. **(3 marks)**
19. Form linear equations to calculate electric bill for consumption of electricity units between 400 units and 800 units for different state utilities near Delhi NCR. **(3 marks)**
20. Amit has two bedrooms flat in a city of Mumbai. He installed 6 fans, 7 tube lights. He uses his refrigerator for 24 hours, electric iron for 30 minutes, Computer for 2 hours and TV for 3 hours. He wishes that his monthly consumption of electricity should be 630 units per month. Establish a linear equation for the same assuming that he is using all fans and tube lights for  $x$  hours and one air conditioner for  $y$  hours per day for a month of 30 days, where AC take load of 1900 W. **(3 marks)**
21. Form a linear equation to prepare an electricity bill for consumption of electric units between 1000 and 1200 units as per tariff plan of some state given in the text in the form of slabs for first 150 units, next 250 units and above 400 units. Also, find the total cost, if consumption is 1050 units. **(3 marks)**
22. Form a linear equation to prepare an electricity bill for consumption of electric units between 800 and 900 units as per tariff plan of some state given in the text in the form of slabs for first 100 units, next 200 units, next 200 units and above 500 units. Also, prepare a bill for consumption is 840 units. **(3 marks)**
23. As per BSES report, write in percent, how fuel prices have moved in Delhi? **(3 marks)**
24. As per BSES report, write in percent, how services have moved in Delhi? **(3 marks)**
25. In Delhi power tariff, eight hours load shedding per day impact is taken for NCR towns. From 200 units of a house, if  $x$  units are used during shed hour, then form a linear equation in total cost factor and units consumed. Also, find the total cost, if consumption during shed hour is 50 units. **(3 marks)**



26. In Chennai power tariff, eight hours load shedding per day impact is taken for towns. From 200 units of a house, if  $x$  units are used during shed hour, then form a linear equation in total cost factor and units consumed. Also, find the total cost, if consumption during shed hour is 50 units. **(3 marks)**
27. In Mumbai power tariff, eight hours load shedding per day impact is taken for towns. From 200 units of a house, if  $x$  units are used during shed hour, then form a linear equation in total cost factor and units consumed. Also, find the total cost, if consumption during shed hour is 50 units. **(3 marks)**
28. In Kolkata power tariff, eight hours load shedding per day impact is taken for towns. From 200 units of a house, if  $x$  units are used during shed hour, then form a linear equation in total cost factor and units consumed. Also, find the total cost, if consumption during shed hour is 50 units. **(3 marks)**
29. Aditya has three bedrooms flat in a city of Chennai. He installed 10 fans, 12 tube lights. He uses his refrigerator for 24 hours, electric iron for 30 minutes, Computer for 2 hours and TV for 5 hours. He wishes that his monthly consumption of electricity should be 700 units per month. Establish a linear equation for the same assuming that he is using all fans and tube lights for  $x$  hours and one air conditioner for  $y$  hours per day for a month of 30 days, where AC take load of 1900 W. **(3 marks)**
30. The electricity tariff plan of a particular state is as follows:
- |                     |              |
|---------------------|--------------|
| First 100 units     | Rs 3.00/unit |
| Next 150 units      | Rs 3.50/unit |
| Next 150 units      | Rs 5.00/unit |
| Any units above 400 | Rs 8.00/unit |

The fixed charge is Rs 300. Form a linear equation if the total bill of a particular house (excluding surcharge and electricity tax) in the state is above Rs 2,000 for a month assuming that  $x$  units are consumed in the actual bill. **(3 marks)**

.....