UNIT 7 Food and Nutrition

MCQ Section

1. Which component of the diet prevents constipation?
   A fibre  C protein
   B minerals  D vitamins
   [D01/P1/Q7]

2. Tennis players often eat bananas during long matches.
   Which nutrient in a banana is important during the match?
   A carbohydrate  B fibre  C iron  D vitamin C
   [D01/P1/Q11]

3. Which of the following is an energy-rich carbohydrate stored in large quantities in liver and muscle cells?
   A glucose  C haemoglobin
   B glycogen  D starch
   [D01/P1/Q13]

4. The table gives the average dietary requirements of iron in mg per day for females and males of various ages.

<table>
<thead>
<tr>
<th>age / years</th>
<th>females</th>
<th>males</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>10</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>20</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>pregnant</td>
<td>13</td>
<td>-</td>
</tr>
<tr>
<td>lactating</td>
<td>14</td>
<td>-</td>
</tr>
<tr>
<td>60</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

The table shows the recommended daily intakes of energy and iron for females at four different ages: 6 months, 5 years, 25 years and 75 years.

Which shows the recommended daily intakes for the 25 year old?

<table>
<thead>
<tr>
<th>energy / MJ</th>
<th>iron / mg</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2.7</td>
</tr>
<tr>
<td>B</td>
<td>6.5</td>
</tr>
<tr>
<td>C</td>
<td>7.6</td>
</tr>
<tr>
<td>D</td>
<td>8.1</td>
</tr>
</tbody>
</table>
   [D001/P1/Q11]

7. Which substances are needed in the diet to prevent rickets?
   A calcium and vitamin C  B calcium and vitamin D
   C iron and vitamin C  D iron and vitamin D
   [D2000/P1/Q6]

8. A mixture of food gives the following results on testing:
   — a purple colour in the biuret test;
   — a blue colour when heated with Benedict’s solution;
   — a yellow colour with iodine;
   — a white emulsion with ethanol.
   What does the mixture contain?
   A fat and protein  B protein and reducing sugar
   C reducing sugar and starch  D starch and fat
   [D89/P1/Q6]
9. What shows that a solution contains protein?

<table>
<thead>
<tr>
<th>procedure</th>
<th>positive result</th>
</tr>
</thead>
<tbody>
<tr>
<td>A add Benedict’s solution and heat</td>
<td>orange precipitate</td>
</tr>
<tr>
<td>B add biuret reagent</td>
<td>violet colour</td>
</tr>
<tr>
<td>C add ethanol, then pour into water</td>
<td>cloudy white emulsion</td>
</tr>
<tr>
<td>D add iodine solution</td>
<td>blue-black</td>
</tr>
</tbody>
</table>

10. Which substances are needed for healthy bones and teeth?
   A calcium and vitamin C
   B calcium and vitamin D
   C iron and vitamin C
   D iron and vitamin D

11. The table shows some of the components of the daily diet of Mr X, and also the recommended daily intake for a person of his age and occupation.

<table>
<thead>
<tr>
<th>Mr X's daily intake</th>
<th>recommended daily intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>energy</td>
<td>18.0 MJ</td>
</tr>
<tr>
<td>protein</td>
<td>70 g</td>
</tr>
<tr>
<td>vitamin C</td>
<td>40 mg</td>
</tr>
<tr>
<td>vitamin D</td>
<td>3.5 µg</td>
</tr>
<tr>
<td>calcium</td>
<td>550 mg</td>
</tr>
<tr>
<td>iron</td>
<td>10 mg</td>
</tr>
</tbody>
</table>

What will be the likely result, if Mr X continues to eat like this?
   A anaemia
   B obesity
   C rickets
   D scurvy

12. Which food contains the highest concentrations of protein and iron?
   A bread
   B citrus fruits
   C fresh vegetables
   D meat

13. The recommended diet for soldiers in Arctic conditions is different from that recommended for tropical conditions.
What should the Arctic diet include?
   A more fat
   B more fibre
   C more vitamin C
   D more water

14. Which combination of chemical elements is present in carbohydrate molecules?

<table>
<thead>
<tr>
<th>carbon</th>
<th>hydrogen</th>
<th>nitrogen</th>
<th>oxygen</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
</tr>
<tr>
<td>B</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>C</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>D</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

key
✓ = element present
X = element absent

15. Which substances contain magnesium and nitrogen?
   magnesium    nitrogen
   A amino acids protein
   B amino acids starch
   C chlorophyll protein
   D chlorophyll starch

16. The production of urea increases when the diet contains larger amounts of
   A carbohydrates.
   B fat.
   C minerals.
   D protein.
17. Which chemical elements are combined to make molecules of starch and cellulose?
A. carbon, hydrogen and nitrogen
B. carbon, hydrogen and oxygen
C. carbon, nitrogen and oxygen
D. carbon, hydrogen, nitrogen and oxygen

What would be the main end products of digestion of a meal of rice and white fish?
A. amino acids and glycerol
B. amino acids and simple sugars
C. fatty acids and simple sugars
D. simple sugars and glycerol

18. Constipation, dental decay and obesity can be caused by poor diet.
Which diets are linked with these conditions?

<table>
<thead>
<tr>
<th>constipation</th>
<th>dental decay</th>
<th>obesity</th>
</tr>
</thead>
<tbody>
<tr>
<td>high energy diet</td>
<td>low fibre diet</td>
<td>high sugar diet</td>
</tr>
<tr>
<td>high fibre diet</td>
<td>low energy diet</td>
<td>low sugar diet</td>
</tr>
<tr>
<td>low fibre diet</td>
<td>high sugar diet</td>
<td>high energy diet</td>
</tr>
<tr>
<td>low sugar diet</td>
<td>high energy diet</td>
<td>high fibre diet</td>
</tr>
</tbody>
</table>

19. A sample of food mixed with water was tested to find out its contents.
The results are shown in the table.

<table>
<thead>
<tr>
<th>test</th>
<th>result</th>
</tr>
</thead>
<tbody>
<tr>
<td>iodine solution added</td>
<td>yellow colour</td>
</tr>
<tr>
<td>Benedict’s solution added and mixture heated</td>
<td>brick-red precipitate</td>
</tr>
<tr>
<td>mixture shaken with ethanol and poured into water</td>
<td>white emulsion</td>
</tr>
<tr>
<td>dilute sodium hydroxide solution added, followed by a few drops of dilute copper sulphate solution</td>
<td>blue colour</td>
</tr>
</tbody>
</table>

Which conclusion can be made from these results?
A. Fat and reducing sugar were both present.
B. Fat and starch were both present.
C. Starch only was present.
D. Reducing sugar only were present.

20. The table shows the protein, fat and carbohydrate content in 10 g of rice and white fish.

<table>
<thead>
<tr>
<th>food</th>
<th>protein g</th>
<th>fat g</th>
<th>carbohydrate g</th>
</tr>
</thead>
<tbody>
<tr>
<td>rice</td>
<td>0.6</td>
<td>0.1</td>
<td>8.7</td>
</tr>
<tr>
<td>white fish</td>
<td>1.6</td>
<td>0.005</td>
<td>0.0</td>
</tr>
</tbody>
</table>

21. Four equal masses of different foods were burned as shown.

The temperature of the water was measured before and after each food sample was burned.
The results are shown in the table. Which food sample is likely to contain most fat?
26. The table shows the chemical elements present in each of four substances.
Which substance could be a protein?

<table>
<thead>
<tr>
<th>substance</th>
<th>carbon</th>
<th>hydrogen</th>
<th>nitrogen</th>
<th>oxygen</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>B</td>
<td>✓</td>
<td>✓</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>C</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>D</td>
<td>✓</td>
<td>×</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

key: ✓ present ✗ absent

27. Which food contains the highest concentrations of protein and iron?
A bread
B citrus fruits
C fresh vegetables
D meat

23. Which food in the table should be given to a person suffering from bleeding gums and easily bruised skin?

<table>
<thead>
<tr>
<th>food</th>
<th>iron mg/100g of food</th>
<th>calcium mg/100g of food</th>
<th>vitamin C mg/100g of food</th>
<th>vitamin D mg/100g of food</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.4</td>
<td>7</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>0.4</td>
<td>28</td>
<td>0</td>
<td>6.38</td>
</tr>
<tr>
<td>C</td>
<td>7.6</td>
<td>39</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>D</td>
<td>0.1</td>
<td>120</td>
<td>0.5</td>
<td>0.002</td>
</tr>
</tbody>
</table>

24. Which component of a balanced diet is used to make new enzyme molecules?
A carbohydrates
B fats
C proteins
D water

28. Which food in the table should be given to a person suffering from anaemia?

<table>
<thead>
<tr>
<th>food</th>
<th>iron mg/100g of food</th>
<th>calcium mg/100g of food</th>
<th>vitamin C mg/100g of food</th>
<th>vitamin D mg/100g of food</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.4</td>
<td>7</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>0.4</td>
<td>28</td>
<td>0</td>
<td>6.38</td>
</tr>
<tr>
<td>C</td>
<td>7.6</td>
<td>39</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>D</td>
<td>0.1</td>
<td>120</td>
<td>0.5</td>
<td>0.002</td>
</tr>
</tbody>
</table>
29. Sunflower seeds contain a nutrient which is broken down by lipase during germination. Which test would detect this nutrient?
   A  Benedict's test
   B  biuret test
   C  ethanol emulsion test
   D  iodine test

   [J95/P1/Q5]

30. The table shows observations made during tests carried out on samples of a particular food.

<table>
<thead>
<tr>
<th>test</th>
<th>observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>biuret test for protein</td>
<td>purple colour</td>
</tr>
<tr>
<td>Benedict's test for reducing sugar</td>
<td>pale blue colour</td>
</tr>
<tr>
<td>iodine test for starch</td>
<td>blue-black colour</td>
</tr>
</tbody>
</table>

What did the food contain?

<table>
<thead>
<tr>
<th>protein reducing starch sugar</th>
</tr>
</thead>
<tbody>
<tr>
<td>A  no yes yes no</td>
</tr>
<tr>
<td>B  no yes yes no</td>
</tr>
<tr>
<td>C  yes no yes yes</td>
</tr>
<tr>
<td>D  yes yes no yes</td>
</tr>
</tbody>
</table>

   [D94/P1/Q5]

32. Four equal masses of different foods were burned as shown in the diagram.

The temperature of the water was measured before and after each food sample was burned.
The results are shown in the table.

<table>
<thead>
<tr>
<th>food sample</th>
<th>water temperature at start/°C</th>
<th>water temperature at end/°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>16</td>
<td>37</td>
</tr>
<tr>
<td>B</td>
<td>17</td>
<td>95</td>
</tr>
<tr>
<td>C</td>
<td>18</td>
<td>87</td>
</tr>
<tr>
<td>D</td>
<td>19</td>
<td>22</td>
</tr>
</tbody>
</table>

Which food sample is likely to contain most fat?

   [J94/P1/Q5]

33. The diagram shows an experiment carried out to investigate photosynthesis.

What were the colours of regions P, Q and R, after the leaf had been tested for starch using iodine solution?

   P  Q  R
   A  blue/black blue/black brown
   B  blue/black brown    brown
   C  brown   blue/black blue/black
   D  brown   brown     blue/black

   [J94/P1/Q7]

31. The diagram shows a human lower jaw.

What are the numbered types of teeth?

   1  2  3  4
   A  canine incisor molar premolar
   B  canine incisor premolar molar
   C  incisor canine premolar molar
   D  incisor canine molar premolar

   [D94/P1/Q9]
34. A sample of food mixed with water was tested to find out its contents. The results are shown in the table.

<table>
<thead>
<tr>
<th>test</th>
<th>result</th>
</tr>
</thead>
<tbody>
<tr>
<td>iodine solution added</td>
<td>yellow colour</td>
</tr>
<tr>
<td>Benedict’s solution added and mixture heated</td>
<td>brick red precipitate</td>
</tr>
<tr>
<td>shaken with ethanol</td>
<td>white emulsion</td>
</tr>
<tr>
<td>sodium hydroxide solution added and then a few drops of copper sulphate solution (biuret)</td>
<td>blue colour</td>
</tr>
</tbody>
</table>

What was present in the food?
A fat and reducing sugar
B fat and starch
C protein only
D reducing sugar only
E starch only

[J93/P1/Q5]

35. The gall bladder stores bile. A patient in hospital has had his gall bladder removed and needs a special diet.

Which menu would be most suitable for this patient?

<table>
<thead>
<tr>
<th>menu A</th>
<th>menu B</th>
<th>menu C</th>
<th>menu D</th>
<th>menu E</th>
</tr>
</thead>
<tbody>
<tr>
<td>cold chicken and green salad</td>
<td>fried fish and chips</td>
<td>pork sausages and boiled potato</td>
<td>fish in sauce</td>
<td>baked beans and butter</td>
</tr>
<tr>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>fresh orange and sweet rice</td>
<td>cream cake</td>
<td>fruit pie</td>
<td>ice cream</td>
<td></td>
</tr>
</tbody>
</table>

[J93/P1/Q8]

36. Which two substances in the diet are necessary for healthy bone formation?
A calcium and vitamin C
B calcium and vitamin D
C fibre and iron
D fibre and vitamin C
E iron and vitamin D

[J93/P1/Q5]

37. A person’s diet contains more protein than is needed for growth and repair. This causes increased production of
A carbon dioxide.
B hormones.
C lactic acid.
D sweat.
E urea.

[J93/P1/Q19]

38. 10 cm³ of a 1% starch suspension was incubated with 10 cm³ of a 10% amylase solution for five minutes at 37 °C. Samples were then tested with iodine solution and with Benedict’s solution.

What are the expected results?

<table>
<thead>
<tr>
<th>colour with iodine solution</th>
<th>colour with Benedict’s solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>A black</td>
<td>blue</td>
</tr>
<tr>
<td>B black</td>
<td>brick-red</td>
</tr>
<tr>
<td>C brown</td>
<td>blue</td>
</tr>
<tr>
<td>D brown</td>
<td>brick-red</td>
</tr>
</tbody>
</table>

[J02/P1/Q11]

39. Which dietary imbalance does not lead to the health problem stated?

<table>
<thead>
<tr>
<th>dietary imbalance</th>
<th>health problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>A lack of fresh fruit</td>
<td>constipation and scurvy</td>
</tr>
<tr>
<td>B lack of milk and cod liver oil</td>
<td>rickets and diarrhoea</td>
</tr>
<tr>
<td>C too many sweets and cakes</td>
<td>anaemia and rickets</td>
</tr>
<tr>
<td>D too much full-fat cheese and fried food</td>
<td>chronic heart disease</td>
</tr>
</tbody>
</table>

[D02/P1/Q10]
40. Which food would be best for a person suffering from anaemia?

<table>
<thead>
<tr>
<th>food</th>
<th>iron / mg per 100g of food</th>
<th>calcium / mg per 100g of food</th>
<th>vitamin C / mg per 100g of food</th>
<th>vitamin D / mg per 100g of food</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>bananas</td>
<td>0.4</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>B</td>
<td>fish</td>
<td>0.4</td>
<td>28</td>
<td>0</td>
</tr>
<tr>
<td>C</td>
<td>lentils</td>
<td>7.6</td>
<td>39</td>
<td>0</td>
</tr>
<tr>
<td>D</td>
<td>milk</td>
<td>0.1</td>
<td>120</td>
<td>0.5</td>
</tr>
</tbody>
</table>

After 20 minutes at 35°C a sample of water from each tube, outside the bag, is boiled with Benedict’s solution.

What are the results?

<table>
<thead>
<tr>
<th>tube 1</th>
<th>tube 2</th>
<th>tube 3</th>
<th>tube 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>blue</td>
<td>orange</td>
<td>blue</td>
</tr>
<tr>
<td>B</td>
<td>blue</td>
<td>orange</td>
<td>orange</td>
</tr>
<tr>
<td>C</td>
<td>orange</td>
<td>blue</td>
<td>blue</td>
</tr>
<tr>
<td>D</td>
<td>orange</td>
<td>blue</td>
<td>orange</td>
</tr>
</tbody>
</table>

41. Milk produces a red precipitate when heated with Benedict’s solution. A purple colour develops when the biuret test is used on milk.

Using these results only, which nutrients does milk contain?
A fat and protein  
B fat and starch  
C reducing sugar and protein  
D reducing sugar and starch

42. A person’s diet contains more protein than is needed for growth and repair.

This causes increased production of
A carbon dioxide.  
B hormones.  
C sweat.  
D urea.

43. Which element in the molecule of urea shows that it is formed from amino acids and not from glucose?
A carbon  
B hydrogen  
C nitrogen  
D oxygen

44. Four bags made of partially permeable membrane are placed in tubes as shown in the diagram.

45. Which food in the table would be best for a person suffering from bleeding gums and easily bruised skin?

<table>
<thead>
<tr>
<th>food</th>
<th>iron mg / 100g of food</th>
<th>calcium mg / 100g of food</th>
<th>vitamin C mg / 100g of food</th>
<th>vitamin D mg / 100g of food</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>bananas</td>
<td>0.4</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>B</td>
<td>fish</td>
<td>0.4</td>
<td>28</td>
<td>0</td>
</tr>
<tr>
<td>C</td>
<td>lentils</td>
<td>7.6</td>
<td>39</td>
<td>0</td>
</tr>
<tr>
<td>D</td>
<td>milk</td>
<td>0.1</td>
<td>120</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.002</td>
</tr>
</tbody>
</table>
UNIT 7 Food and Nutrition

THEORY Section

Question 1

Explain why water is an essential part of our diet. [6]

Solution

Water is an essential constituent of living protoplasm. It acts as a solvent and medium of transport for food substances, chemicals, gases, waste products etc. in the body. It is an important medium for chemical reactions to occur e.g. digestion of food in the alimentary canal. Water is also an important constituent of sweat, which is secreted by the sweat glands in the skin when the body temperature increases. Evaporation of sweat removes excess heat from the body.

Question 2

Table 4.1 shows the pH value of the plaque surrounding the teeth of a girl over 24 hours.

<table>
<thead>
<tr>
<th>Time/h</th>
<th>pH</th>
<th>Time/h</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>00.00</td>
<td>7.0</td>
<td>13.00</td>
<td>5.5</td>
</tr>
<tr>
<td>01.00</td>
<td>7.0</td>
<td>14.00</td>
<td>4.1</td>
</tr>
<tr>
<td>02.00</td>
<td>7.1</td>
<td>15.00</td>
<td>5.0</td>
</tr>
<tr>
<td>03.00</td>
<td>7.1</td>
<td>16.00</td>
<td>6.0</td>
</tr>
<tr>
<td>04.00</td>
<td>7.1</td>
<td>17.00</td>
<td>5.8</td>
</tr>
<tr>
<td>05.00</td>
<td>7.2</td>
<td>18.00</td>
<td>4.1</td>
</tr>
<tr>
<td>06.00</td>
<td>7.2</td>
<td>19.00</td>
<td>5.1</td>
</tr>
<tr>
<td>07.00</td>
<td>7.2</td>
<td>20.00</td>
<td>5.6</td>
</tr>
<tr>
<td>08.00</td>
<td>8.1</td>
<td>21.00</td>
<td>6.0</td>
</tr>
<tr>
<td>09.00</td>
<td>5.9</td>
<td>22.00</td>
<td>8.0</td>
</tr>
<tr>
<td>10.00</td>
<td>5.0</td>
<td>23.00</td>
<td>7.9</td>
</tr>
<tr>
<td>11.00</td>
<td>5.5</td>
<td>24.00</td>
<td>7.0</td>
</tr>
<tr>
<td>12.00</td>
<td>6.4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4.1

Plaque is a deposit which collects around teeth.

(a) Other than food remains, state three constituents of plaque. [2]

(b) (i) State the times during the day when the girl brushed her teeth. Explain your answer. [2]

(ii) State the times of the day when conditions were most favourable for the process of tooth decay. Explain your answer. [2]

(iii) Suggest an explanation for the pH values of the plaque at 14.00 hours and at 18.00 hours. [2]

Solution

(a) 1. acid
2. saliva
3. bacteria

COMMENT on QUESTION

What are the important functions of water in the human body?

(b) ii) The question requires student to select the times of the day where the rate of tooth decay is fastest due to a highest amount acid (lowest pH) produced by the bacteria in the plaque.
(b) (i) Times: 08.00 and 22.00

*Explanation*: The pH value is the highest at these times. Brushing with toothpaste removes plaque from the surface of the teeth. Toothpaste, being slightly alkaline, neutralizes the acids produced by the bacteria acting on the food deposits.

(ii) Times: 14.00 and 18.00

*Explanation*: The plaque at both these times have the lowest pH measured, indicating the highest amount of acid produced by the bacteria within the plaque. The acids dissolve the tooth enamel and dentine leading to dental caries.

(iii) The girl has just taken her lunch at 14.00 and dinner at 18.00. The food deposits onto the plaque increasing the thickness of the layer. More bacteria multiply and act on the food remains, particularly, to produce more acids. The increase in the amount of acid produced lowers the pH value to 4.1.

**Question 3**

Fig. 10.1 shows a family running some risks to their health.

![Fig. 10.1](image)

Suggest an alternative diet for the family which might help to avoid some of the harmful effects. Give reasons for your answer. [5]

[J98/P2/Q10b]

**Solution**

A healthy balanced diet which contain all the basic classes of food taken in sufficient quantities and in the correct proportion is recommended. In this case, the amount of fatty food must be reduced to a minimum and the amount of dietary fibre, proteins, vitamin and minerals in the diet increased. The butter can be replaced by using polyunsaturated fats such as margarine. More high fibre
foods such as wholemeal bread, cereals, beans, peas, fruits and vegetables must be included in the existing diet to provide more roughage, vitamins and minerals. The indigestible cellulose fibres provides bulk to food and assist in peristaltic movement along the alimentary canal, help to retain water, absorb poisonous substances from the gut and soften faeces. Vitamins and minerals are essential for maintenance of good health.

The amount of protein in the diet can also be increased by consuming more fish, lean meat, peas and beans. Protein is a source of amino acids for growth of new tissues and repair of worn out tissues.

**Question 4**

(a) Explain what is required in the diet of a man who does regular, hard, physical work. [5]

(b) Distinguish between the terms *starvation* and *malnutrition.* [4]

(c) Outline the problems which contribute to famine. [3]

**Solution**

(a) The man must have a balanced diet which provides all the basic classes of food required by his body in sufficient quantities and in the correct proportion. The diet should provide sufficient energy to maintain his high basal metabolic rate and to sustain his strenuous manual activities at work.

He requires a well balanced diet of carbohydrates, proteins, fats, water, vitamins and mineral salts, in particular a high proportion of carbohydrates, proteins and water.

Carbohydrates is the main source of energy in diet e.g. glucose is the main respiratory substrate which is oxidised to produce immediate energy. Proteins are used for growth of new tissues and replacement of cell components and the formation of strong muscles, tendons and ligaments. Drinking more water replaces the water lost in sweat produced during the hard, physical activities and helps to maintain a constant blood concentration in the body.

(b) Starvation occurs when there is a complete lack of food for consumption or nutrition for the body over a long period of time due to food shortage. Starvation results in a huge loss of body weight as storage fat and proteins in muscles are broken down to provide energy for the vital functions of the body to continue. As starvation proceeds, the amount of protein decline so drastically that essential organs become seriously affected and the person has a very much weakened resistance to infection. The longer the time a person is deprived of food the more serious the effects of starvation.

Starvation in children results in protein deficiency disorders such as kwashiorkor. The signs and symptoms of this disorder are swelling belly, reduced resistance to disease and poor mental development.

A person whose diet lacks one or more essential constituents of a balanced diet nutritious diet suffers from malnutrition. Malnutrition is any poor health or deficiency diseases caused by an inadequate diet in both quantity and quality.

For example, inadequate amounts of vitamin D in the diet results in disorders of bone formation leading to softening and bowing of bones in adults and rickets in children.

**COMMENT on QUESTION**

"(a) Students are required to highlight the specific requirements of the man's diet in relation to the occupation of the man (most probably a labourer or a manual worker) and the basal metabolic rate. A mere description of the functions of every component of a balanced diet is not appropriate.

**COMMENT on ANSWER**

"(a) The basal metabolic rate is the energy needed for vital bodily functions (such as heart beat, circulation, brain function and essential chemical reactions in liver and other organs) to keep alive when the body is completely at rest. The basal metabolic rate of a manual worker is high compared to an office worker with a desk bound job.

(b) Kwashiorkor is also caused by protein malnutrition i.e. inadequate protein diet. In third world countries where rice and flour is the staple food, kwashiorkor tends to occur in children."
Malnutrition is a result of starvation, poor diet and poor eating habits, either from over-indulgence in the wrong foods or through custom — a local diet based on polished rice with inadequate amounts of vitamin B1 results in widespread deficiency disease beri-beri in the population.

(c) Famine is caused by a number of interrelated factors. Large areas of the world do not produce enough food for its increasing population. Despite huge improvements in agriculture and food production, the population of many third world countries of the world continue to increase at a rate that outstrip food production. Apart from overpopulation, other factors such as failure of crop in massive scale, drought, disastrous floods, destruction by earthquakes, sudden disease or pests can push such countries into full scale famine.

Question 5
Using named examples, explain how plants form a valuable part of a healthy diet. [3]

Solution
Leafy vegetables such as spinach is rich in vitamin A, B1 and C and minerals calcium and iron necessary for maintenance of health, formation of strong bones and teeth and haemoglobin respectively.

Leguminous plants such as beans and peas are rich in protein required for making new protoplasm for growth and repair of tissues.

Most vegetable and fruits, especially, high fibre vegetables such as broccoli and spinach contain indigestible cellulose fibres which provide roughage. The cellulose fibres add to the bulk of food in the alimentary canal to assist in peristaltic movement, especially in the large intestine. This helps to prevent constipation and reduce the risk of cancer of the large intestine.

Question 6
A student carried out an experiment on the fat content of two different milk samples, A and B. Fig. 3A shows a sequence of steps in the experiment. The pH indicator used is colourless when the pH is 7 or less, and purple when the pH is over 7.

---

**Fig. 3A**
The experiment was carried out at different temperatures. The times taken for the pH indicator to lose its colour are shown in Fig. 3B.

![Graph showing time vs. temperature for samples A and B.]

**Fig. 3B**

(a) State one condition, other than temperature or fat content, which might affect the rate of the chemical reaction controlled by the lipase. [1]

(b) State two reasons why bile salts were added to the milk at the start of the experiment. [2]

(c) Explain how the action of the lipase led to the indicator losing its colour. [2]

Table 1 shows the time taken for the indicator to lose its colour when goat’s milk was used.

<table>
<thead>
<tr>
<th>temperature /°C</th>
<th>time taken for indicator to lose its colour / min</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>17</td>
</tr>
<tr>
<td>22</td>
<td>7</td>
</tr>
<tr>
<td>31</td>
<td>4</td>
</tr>
</tbody>
</table>

(d) (i) Using the information in Fig. 3B and Table 1, place the three milk samples in order of their fat content, starting with the lowest.

(ii) Explain your answer. [2]

**Solution**

(a) Concentration of enzyme.

(b) Bile salts can emulsify fat, thereby increasing the surface area of fat exposed for lipase action. This in turn increases the rate of reaction so that the rate can be more conveniently monitored. Bile salts also react with fatty acids to form soluble soaps, enabling the latter to dissolve and interact with the pH indicator.

(c) When fat is hydrolyzed by lipase, fatty acid and glycerol are produced. The former is acidic and reduces the pH of the reaction mixture. This decrease in pH causes the colour of the pH indicator to change.

(d) (i) lowest fat content: Sample A

medium fat content: Goat’s milk

highest fat content: Sample B

**COMMENT on ANSWER**

"(d) The information in table 1 can be used to plot a simple graph of time required for colour to disappear against temperature reaction (Fig. 3B). We can then compare rates of reaction of the three samples at each temperature reading off from Fig. 3B."
(ii) At each temperature, sample B takes the shortest time for the colour to disappear, indicating that the rate of reaction is the fastest. The rate of reaction is fast when the concentration of substrate (in this case, fat) is high. Thus, sample B has the highest concentration of fat. By the same token, since sample A takes the longest time for the colour of the pH indicator to disappear, we can conclude that it contains the lowest concentration of fat.

**Question 7**

(i) What do the chemical structures of carbohydrates and fats have in common?

(ii) How do their chemical structures differ? [3]

**Solution**

(i) Both carbohydrates and fats are organic compounds composed of the three elements carbon, hydrogen and oxygen.

(ii) Carbohydrates contain hydrogen and oxygen atoms in the ratio of 2:1, i.e. they have a general formula of \( \text{C}_n\text{H}_{2n}\text{O}_m \). Fats on the other hand contain much less oxygen in proportion to hydrogen, e.g. tristearin has the formula \( \text{C}_{36}\text{H}_{102}\text{O}_6 \). The elements in fats do not occur in definite proportions so there is no generalized formula for fats like that for carbohydrates.

**Question 8**

Figs 3A and 3B show the effects of two diseases caused by dietary deficiency.

![Fig. 3A](image)

![Fig. 3B](image)

Complete the table below by

(i) identifying each disease;

(ii) stating which constituent was lacking in the diet;

(iii) naming a food which could have prevented the disease.

<table>
<thead>
<tr>
<th>disease</th>
<th>constituent</th>
<th>food</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fig. 3A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fig. 3B</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[3]

**COMMENT on ANSWER**

"(d) ii) In Fig. 3B, the graph shows time taken for pH indicator to lose its colour. The amount of fatty acid produced as a result of lipase action. Do not confuse this for indicator to lose colour with time to lipase to conv all fats into fatty acids."
Solution

<table>
<thead>
<tr>
<th></th>
<th>disease</th>
<th>constituent</th>
<th>food</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fig. 3A</td>
<td>scurvy</td>
<td>vitamin C</td>
<td>oranges</td>
</tr>
<tr>
<td>Fig. 3B</td>
<td>rickets</td>
<td>vitamin D</td>
<td>cod – liver oil</td>
</tr>
</tbody>
</table>

Question 9

Fig. 1 shows the proportions of the main chemical substances found in the human body.

![Pie chart showing proportions of substances](chart.png)

(a) What is the percentage of carbohydrate? Show your working. [1]
(b) What are substances X and Y most likely to be? [1]
(c) Name two inorganic ions and, for each one, state its function in the body. [2]
(d) Removal of a person’s gall bladder could affect the digestion of one of the substances shown in Fig. 1. Name the substance and explain how its digestion might be affected. [3]

Solution

(a) Percentage of carbohydrate = \( \frac{18}{360} \times 100\% = 5\% \)

(b) X: Protein
    Y: Water

c) 1. **Named inorganic ion:** Calcium
   **Function:** Calcium is required for the building of bones and teeth.
   2. **Named inorganic ion:** Iron
   **Function:** Iron is needed for haemoglobin formation.

d) **Substance:** Fat
   **Explanation:** If the gall bladder is removed, the bile secreted by the liver cannot be discharged to the small intestine. Without bile, fat digestion would be slowed down to a great extent.

COMMENT on ANSWER

"Rickets can also be caused by a deficiency in calcium, present in foods like cereals, green vegetables, milk, eggs and fruits."

COMMENT on QUESTION

"(a) Calculate the percentage of carbohydrate from the pie chart.
(b) State the functions of 2 named mineral salts."

COMMENT on ANSWER

"(a) All the angles add up to 360°.
(b) Water makes up about 70% of our body weight. The other major nutrient not shown on the chart is protein.
(c) Only one function is required for each mineral salt.
(d) The gall bladder stores bile, which is secreted by the liver. When the gall bladder contracts, bile is discharged via the bile duct into the small intestine. Bile aids in the digestion of fat by emulsifying it, thus speeding up its digestion."
Question 10

(a) Define the term balanced diet.

(b) Explain the special food requirements of
   (i) a child,
   (ii) a pregnant woman,
   (iii) a man who does hard physical work.

(c) Explain how malnutrition can lead to
   (i) constipation, and
   (ii) obesity.

Solution

(a) A balanced diet contains the right amount of carbohydrates, fats, proteins, vitamins, minerals, water and roughage to meet the daily requirements of the body.

(b) (i) Growing children require more energy food (i.e. carbohydrates) because they have a higher basal metabolic rate than adults. They also need slightly more calcium for the building of bones and teeth.

   (ii) A pregnant woman needs to pay special attention to her diet for the healthy growth and development of the foetus and for her own health. She requires sufficient amount of the following in her diet:
      — calcium and phosphates for the development of bones and cartilage;
      — iron for the formation of red blood cells;
      — proteins for the formation of new protoplasm;
      — vitamins.

   (iii) A man who does hard physical work will need more energy per day. Hence, more carbohydrates are needed.

(c) (i) Constipation results from insufficient dietary fibres, which can be obtained from fresh fruits, vegetables, bran, cereals and wholemeal bread. Dietary fibre provides bulk to the intestinal contents and helps peristalsis. If proper peristalsis does not occur, the undigested matter in the large intestine cannot be moved along fast enough and too much water will be absorbed, resulting in constipation.

   (ii) If a person consumes more energy than is needed for his daily activities, the excess will be stored up as fats in his body and he will gain weight. Hence, obesity is the result of overnutrition.

COMMENT on QUESTION

"(b) The question asks for special food requirements, i.e. something that is different from the normal balanced diet.

(c) Malnutrition refers to dietary imbalance. It may be due to too little or too much of some type/s of food substances."

COMMENT on ANSWER

"(a) There are 2 components here: to have some of all nutrients; and to have the right amounts for the person.

(c) Obesity is due to overnutrition, constipation is due to deficiency or undernutrition."

COMMON ERROR

"(b) Students tend to list all the food substances in a balanced diet, this is not necessary."
**Question 11**

Fig. 4 shows the average numbers of teeth lost per person in two towns, T and U.

![Graph showing average number of teeth lost per person by age in towns T and U.]

(a) What type of organism causes tooth decay? [1]

(b) Use the graph to find the average number of teeth lost by
   (i) a 37 year-old in town T, [2]
   (ii) a 29 year-old in town U.

(c) State four possible reasons for the differences between the average numbers of teeth lost in the two towns. [4]

(d) Suggest why information is not provided for children younger than 15 years. [2]

---

**Solution**

(a) Bacteria can cause tooth decay.

(b) (i) 6
   (ii) 1

(c) 1. Water supplies in town T are not fluoridated.
   2. People in town T do not eat food containing sufficient calcium, vitamin D and phosphorous.
   3. Town T residents do not use fluoride toothpaste.
   4. Town T residents do not visit the dentist regularly for checkups.

(d) Children have a set of milk or deciduous teeth, which are gradually replaced by a permanent set of teeth in adults. This is the same for both towns.

---

**COMMENT on QUESTION**

"(c) Factors that would cause tooth decay.

(d) How children's teeth are different from adults'."

**COMMENT on ANSWER**

"(b) Find the required ages on the horizontal axis, move up to the appropriate line for Town T or Town U, and find the number of teeth on the y-axis.

(c) Any 4 reasons, including not brushing teeth regularly, to explain why there are higher numbers of teeth lost in Town T compared to Town U.

(d) Children in both towns should be the same. Note converging lines on the graph."
Question 12

Fig. 3.1 shows some chemical molecules found in the human body and how they join to form larger molecules.

(a) Identify molecules K, L and M. [3]
(b) Reaction N occurs in the liver.
   (i) Name the complex carbohydrate manufactured by this reaction.
   (ii) Some people develop a disease as a result of which this reaction does not occur.
        Name the disease and explain why this reaction does not take place. [4]
(c) Complex carbohydrates are digested in the duodenum. Fig. 3.2 shows the effect of pH on the enzyme that controls this reaction.

(i) Name this enzyme.
(ii) Explain how the optimum pH for this enzyme is maintained in the duodenum. [3]
**Solution**

(a) **K**: Amino acids; **L**: Glycerol; **M**: Fatty acids

(b) (i) Glycogen

(ii) **disease**: Diabetes

   **explanation**: The liver regulates blood sugar concentration to ensure that it does not escalate after meals, or fall drastically between meals.

(c) (i) Amylase

(ii) Glands in the duodenum wall discharge intestinal juice. Also, pancreatic juice helps in neutralising the acidity in chyme.

---

**Question 13**

Fig. 1.1 shows the proportions of the chemical constituents of the human body.

![Diagram showing proportions of chemical constituents](image)

(a) Identify constituents **A** and **B**.  

(b) Name a principle source of a **named** salt and of a **named** vitamin essential for strong bone development.

---

**Solution**

(a) **A**: water  
   **B**: fats

(b) **salt**: calcium phosphate  
   **source**: fresh milk  
   **vitamin**: vitamin D  
   **source**: fish-liver oil

---

**COMMENT on QUESTION**

"(b) Note that a named salt is required and not the element or ion."
Question 14

Fig. 3.1 represents part of a starch molecule.

![Fig. 3.1](image)

(a) (i) Name the enzyme in the human alimentary canal that digests this molecule.

(ii) Draw a diagram to show the result of this enzyme’s action on the starch molecule.

(iii) List the regions in the alimentary canal where this enzyme is most active.

(b) Olestra is a synthetic, edible fat similar to naturally-occurring saturated (animal) fats. The human alimentary canal and associated organs cannot produce an appropriate enzyme to act on it.

(i) State a process that all fats, including olestra, undergo in the alimentary canal.

(ii) State two processes that all fats, other than olestra, undergo in the alimentary canal.

(c) Suggest two health-related advantages of using olestra in food preparation.

(d) Suggest a possible disadvantage of using olestra.

Solution

(a) (i) Amylase

(ii) Maltose

![Diagram of starch digestion](image)

(iii) Mouth and duodenum

(b) (i) Emulsification.

(ii) 1. Digestion by enzyme: All other fats will be broken down into fatty acids and glycerol by action of lipase in the duodenum.

   2. Absorption of fatty acids and glycerol: by the lacteals of the numerous villi projecting from the wall of the ileum.

(c) 1. Olestra does not cause high blood cholesterol level

   2. Olestra does not accumulate in the body and cause weight problems such as obesity.

(d) A diet with all fat replaced by olestra over a long period of time will result in a lack of fat in the body which is an important constituent of protoplasm and also serves as an insulating layer under the skin.

COMMENT on QUESTION

- (b) ii) Olestra cannot be digested by human beings.

COMMENT on ANSWER

- (a) ii) Starch is a polysaccharide made up of many glucose units linked together. During hydrolysis, the salivary amylase catalyses the breakdown of complex substrate molecules into simpler and smaller maltose molecules.

- (iii) Salivary amylase is found in saliva in the mouth and pancreatic amylase is found in pancreatic juice which is secreted by the pancreas.

- (b) i) In the duodenum, bile, which is produced by the liver, emulsifies fat. It breaks fats into minute fat globules to increase the surface area of the fats for faster digestion by lipase.

- (c) The person had a diet rich in natural animal fats and cholesterol is likely to have high blood cholesterol level leading to the deposition of fats on the walls of blood vessels. The fatty deposits cause the hardening of the artery, a condition called atherosclerosis.

- (d) Fat is also an efficient source and store of energy.