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4541/3

Chemistry

Paper 3

August

2018



**SIJIL PENDIDIKAN
MAKTAB RENDAH SAINS MARA
2018**

CHEMISTRY

Paper 3

MARKING SCHEME

FOR EXAMINER'S USE ONLY

ATTENTION

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The marking scheme consists of 15 printed pages

MARKING GUIDELINES
SIJIL PENDIDIKAN
MAKTAB RENDAH SAINS MARA
2018
PAPER 3

| Symbol | Meaning |
|---------------------|--------------------------------------|
| // | - replace the whole sentence |
| / | - replace the previous word |
| [] | - can be summarized from explanation |
| <u> </u> or bold | - key word |
| adp | - avoid double penalty |
| wcr | - wrong cancel right |
| a. | - accept |
| r. | - reject |
| ecf | - error carry forward |

KK0501 Making observation

| Question | Mark Scheme | Mark | | | | | | | | |
|--|---|------|---|-------------|---|---|----|--------------------------|-----|-----------------------------|
| 1 (a) | <i>Able to state all observation correctly</i> Sample answer: | 3 | | | | | | | | |
| | <table border="1"> <thead> <tr> <th>Set</th> <th>Observation</th> </tr> </thead> <tbody> <tr> <td>I</td> <td>Medium flame//smaller than set II and bigger than set III</td> </tr> <tr> <td>II</td> <td>Big flame//biggest flame</td> </tr> <tr> <td>III</td> <td>Small flame//smallest flame</td> </tr> </tbody> </table> | | Set | Observation | I | Medium flame//smaller than set II and bigger than set III | II | Big flame//biggest flame | III | Small flame//smallest flame |
| | Set | | Observation | | | | | | | |
| | I | | Medium flame//smaller than set II and bigger than set III | | | | | | | |
| | II | | Big flame//biggest flame | | | | | | | |
| III | Small flame//smallest flame | | | | | | | | | |
| <i>Able to state two observation correctly //</i> <i>Able to state the colour for all flame correctly</i> | 2 | | | | | | | | | |
| <i>Able to state one observation correctly //</i> <i>Able to state any idea on observation</i> | 1 | | | | | | | | | |
| <i>No response or wrong response</i> | 0 | | | | | | | | | |

KK0504 Making an inference

| Question | Mark Scheme | Mark | |
|----------|--|------|---|
| 1 (b) | <i>Able to state three inferences for set II correctly</i> Sample answer : | 3 | |
| | <ol style="list-style-type: none"> Potassium reacts with oxygen An alkaline solution is produced // potassium hydroxide formed Product formed from combustion of potassium/potassium oxide react with water Heat is released // exothermic reaction Potassium is the <u>most</u> reactive | | |
| | <i>Able to state two inferences for set II correctly</i> | | 2 |
| | <i>Able to state one inferences for set II //</i> <i>Able to state an idea of inference for set II</i> | | 1 |
| | <i>No response or wrong response</i> | | 0 |

KK0508 Interpreting data

| Question | Mark scheme | Mark |
|---|--|------|
| 1 (c) | <i>Able to arrange all three elements in ascending order of reactivity correctly</i> Lithium, sodium, potassium // Li, Na, K | 3 |
| | <i>Able to arrange two adjacent elements in ascending order of reactivity correctly</i> Sample answer: | 2 |
| | <ol style="list-style-type: none"> Potassium, <u>Lithium</u>, <u>Sodium</u> // K, <u>Li</u>, Na <u>Sodium</u>, <u>Potassium</u>, Lithium // <u>Na</u>, K, Li | |
| | <i>Able to place either Li or K in the correct place// Reverse order</i> Sample answer: | 1 |
| <ol style="list-style-type: none"> Li, K, Na / Na, Li, K Potassium, Sodium, Lithium | | |
| | <i>No response or wrong response</i> | 0 |

KK05011 Making hypothesis

| Question | Mark Scheme | Mark |
|----------|--|------|
| 1 (d) | <i>Able to state the relationship between the manipulated variable and the responding variable with direction correctly</i> <i>Manipulated variable:</i> When going down the Group 1 <i>Direction of responding variable:</i> The reactivity of alkali metals towards oxygen increases <u>Sample answer:</u> When going down the Group 1, the reactivity of alkali metals towards oxygen increases. | 3 |
| | <i>Able to state the relationship between the manipulated variable and the responding variable less correctly</i> <u>Sample answer:</u> 1. When going down the Group 1, the reactivity of alkali metals increases. 2. The reactivity of alkali metals towards oxygen increases/decrease when going down the Group 1. | 2 |
| | <i>Able to state an idea of the hypothesis</i> <u>Sample answer:</u> 1. The reactivity of alkali metal is affected/influenced by position of the metals in periodic table of elements. 2. Different metals, different reactivity | 1 |
| | <i>No response or wrong response</i> | 0 |

KK0505 Making prediction

| Question | Mark Scheme | Mark |
|----------|--|------|
| 1 (e) | <i>Able to predict three observations correctly</i> <u>Sample answer :</u> 1. Rubidium burns with a <u>very</u> bright flame / bigger flame than potassium 2. The colour of solution change from colourless to pink. 3. Burn with violet flame 4. Gas jar become hotter // Gas jar crack | 3 |
| | <i>Able to predict two observation correctly</i> | 2 |
| | <i>Able to predict one observation correctly</i> | 1 |
| | <i>No response or wrong response</i> | 0 |

KK0503 Measure and using numbers

| Question | Mark scheme | Mark | | | | | | | | | | | | |
|--|--|------|--------------------------------------|--------------------------------------|----|---|------|-----|----|------|-----|-----|------|-----|
| 2 (a) | <i>Able to record the three concentration with unit and pH value correctly</i> <u>Sample answer :</u> | 3 | | | | | | | | | | | | |
| | <table border="1"> <thead> <tr> <th>Set</th> <th>Concentration / mol dm⁻³</th> <th>pH</th> </tr> </thead> <tbody> <tr> <td>I</td> <td>0.10</td> <td>1.0</td> </tr> <tr> <td>II</td> <td>0.08</td> <td>1.1</td> </tr> <tr> <td>III</td> <td>0.06</td> <td>1.2</td> </tr> </tbody> </table> | | Set | Concentration / mol dm ⁻³ | pH | I | 0.10 | 1.0 | II | 0.08 | 1.1 | III | 0.06 | 1.2 |
| | Set | | Concentration / mol dm ⁻³ | pH | | | | | | | | | | |
| | I | | 0.10 | 1.0 | | | | | | | | | | |
| | II | | 0.08 | 1.1 | | | | | | | | | | |
| III | 0.06 | 1.2 | | | | | | | | | | | | |
| <i>Able to record any two concentration with unit and pH value correctly or able to record three concentration without unit</i> | 2 | | | | | | | | | | | | | |
| <i>Able to record only one concentration and pH value correctly or able to record all concentration without pH reading or vice versa</i> | 1 | | | | | | | | | | | | | |
| <i>No response or wrong response.</i> | 0 | | | | | | | | | | | | | |

KK05010 Controlling variables

| Question | Mark scheme | Mark | |
|----------|---|------|---|
| 2 (b) | <i>Able to state all three variables correctly</i> <u>Sample answer :</u> Manipulated variable : Concentration of hydrochloric acid/HCl Responding variable : pH value Fixed variable : Acid used/HCl // pH meter | 3 | |
| | <i>Able to state any two variables correctly</i> | | 2 |
| | <i>Able to state only one variable correctly</i> | | 1 |
| | <i>No response or wrong response.</i> | | 0 |

KK0506 Communication

| Question | Mark Scheme | Mark |
|----------|--|------|
| 2 (c) | <p><i>Able to state the relationship between the concentration of hydrochloric acid and the pH value correctly</i></p> <p><u>Sample answer</u></p> <p>1. The higher the concentration hydrochloric acid the lower the pH value.</p> <p>2. The higher the concentration of H⁺ ions the lower the pH value.</p> | 3 |
| | <p><i>Able to state the relationship between the concentration of hydrochloric acid and the pH value</i></p> <p><u>Sample answer</u></p> <p>1. The higher the concentration, the lower the pH value.</p> <p>2. The higher the number of mole/quantity/amount of hydrochloric acid, the lower the pH value.</p> | 2 |
| | <p><i>Able to state an idea on the relationship</i></p> <p><u>Sample answer</u></p> <p>1. The pH values indicate the concentration of H⁺ ions.</p> <p>2. The concentration affect/influence the pH value</p> | 1 |
| | <i>No response or wrong response.</i> | 0 |

KK0509 Defining operationally

| Question | Mark scheme | Mark |
|----------|---|------|
| 2 (d) | <p><i>Able to state the operational definition of strong acid in this experiment that fulfills the following criteria</i></p> <p>1. What you do 2. What you observe with direction</p> <p><u>Sample answer:</u></p> <p>1. When pH meter is immersed/dip into the acid, the reading of pH meter is 1.0/lower. 2. Solution with lower pH value when a pH meter is dipped into the acid</p> | 3 |
| | <p><i>Able to state the operational definition of strong acid in this experiment that fulfills any one of the criteria</i></p> <p><u>Sample answer:</u></p> <p>1. When pH meter is immersed into the acid // The reading of pH meter is 1.0/lower. 2. Acid that ionizes completely in water to produce high concentration of hydrogen ion</p> | 2 |
| | <p><i>Able to state an idea of operational definition of strong acid</i></p> <p><u>Sample answer:</u></p> <p>1. pH of hydrochloric acid is 1.0. 2. Strong acid is an acid ionise completely in water</p> | 1 |
| | <i>No response or wrong response</i> | 0 |

KK0507 Space time relationship

| Question | Mark scheme | Mark |
|----------|---|------|
| 2 (e) | <p><i>Able to state the relationship between the pH value of acid with time correctly</i></p> <p><u>Sample answer:</u></p> <p>1. The pH value of acid increases with time 2. As the time increases, the pH value of acid increases 3. The longer the time, the higher the pH value of acid</p> | 3 |
| | <p><i>Able to state the relationship between the pH value of acid with time</i></p> <p><u>Sample answer:</u></p> <p>1. The pH value of acid increases 2. The pH value directly proportional with time</p> | 2 |
| | <p><i>Able to state an idea of relationship between the pH value of acid with time</i></p> <p><u>Sample answer:</u></p> <p>The pH increases</p> | 1 |
| | <i>No response or wrong response</i> | 0 |

KK0502 Classification

| Question | Mark scheme | Mark | | | |
|---|--|---------------------------------|-------------|-----------|--|
| 2 (f) | <i>Able to classify all the weak acid and strong acid correctly</i> | 3 | | | |
| | <u>Sample answer:</u> <table border="1" style="margin-left: 40px;"> <thead> <tr> <th>Strong acid</th> <th>Weak acid</th> </tr> </thead> <tbody> <tr> <td>Nitric acid Hydrochloric acid Sulphuric acid</td> <td>Carbonic acid Methanoic acid</td> </tr> </tbody> </table> | | Strong acid | Weak acid | Nitric acid Hydrochloric acid Sulphuric acid |
| | Strong acid | Weak acid | | | |
| | Nitric acid Hydrochloric acid Sulphuric acid | Carbonic acid Methanoic acid | | | |
| | <i>Able to classify two the strong acid and two weak acid correctly</i> | 2 | | | |
| <i>Able to classify one strong acid and one weak acid correctly // Reverse classification</i> | 1 | | | | |
| <i>No response or wrong response</i> | 0 | | | | |

KK05012 Statement of problem

| Question | Mark Scheme | Mark |
|---|---|------|
| 3 (a) | <i>Able to give the problem statement correctly</i> | 3 |
| | <u>Sample answer:</u> 1. Does esters formed from the same alcohol with different carboxylic acid have different scent/smell/fragrance/aroma? 2. Does esters formed from ethanol with ethanoic acid and butanoic acid produce glue and pineapple scent/smell/ fragrance/aroma? OR Does esters formed from pentanol with ethanoic acid and butanoic acid produce banana and apricot scent/smell/fragrance/aroma? | |
| | <i>Able to give the problem statement incorrectly or able to give the aim of experiment</i> | 2 |
| | <u>Sample answers :</u> 1. To prepare two different esters using the same alcohol with different carboxylic acid. 2. Does esters from same alcohol have different smell? | |
| | <i>Able to give an idea of the problem statement or able to give aim</i> | 1 |
| <u>Sample answer:</u> How to prepare ester // To prepare the ester //How to identify ester | | |
| <i>No response or wrong response</i> | 0 | |

KK05012 All the variables

| Question | Mark Scheme | Mark |
|-----------------|---|-------------|
| 3 (b) | <i>Able to state the three variables correctly</i> <u>Sample answer:</u> Manipulated variable: Carboxylic acid// butanoic acid and ethanoic acid Responding variable : Esters of <u>different scent/smell/fragrance/aroma</u> Fixed variable : Alcohol/ethanol/pentanol | 3 |
| | <i>Able to state any two variables correctly</i> | 2 |
| | <i>Able to state any one variables correctly</i> | 1 |
| | <i>No response given or wrong response</i> | 0 |

KK05012 Statement of hypothesis

| Question | Mark Scheme | Mark |
|----------|--|------|
| 3 (c) | <p><i>Able to state the relationship between the manipulated variable and the responding variable correctly (MV → RV)</i></p> <p><u>Sample answer:</u></p> <ol style="list-style-type: none"> If ethanol react with butanoic acid will produce the smell of pineapple and if ethanol react with ethanoic acid will produce the smell of glue. If pentanol react with ethanoic acid will produce the smell of banana and if pentanol react with butanoic acid will produce the smell of apricot. | 3 |
| | <p><i>Able to state the relationship between the manipulated variable and the responding variable</i></p> <p><u>Sample answer:</u></p> <ol style="list-style-type: none"> If ethanol react with butanoic acid will produce the smell of pineapple If ethanol react with ethanoic acid will produce the smell of glue If pentanol react with ethanoic acid will produce the smell of banana If ethanol react with butanoic acid acid will produce the smell of apricot. If ethanol/pentanol react with different carboxylic acid will produce esters of different scent/smell/fragrance/aroma Ester with different scent/smell/fragrance/aroma produced when alcohol reacts with different carboxylic acid (RV → MV) | 2 |
| | <p><i>Able to state the idea of hypothesis</i></p> <p><u>Sample answer:</u></p> <ol style="list-style-type: none"> Different carboxylic acid produce different ester | 1 |
| | <i>No response or wrong response</i> | 0 |

| Question | Mark Scheme | Mark |
|----------|---|------|
| 3 (d) | <p><i>Able to list all the materials and apparatus</i></p> <p><u>Sample answer:</u> Experiment 1 Materials: 1. Absolute/pure ethanol/pentanol 2. Glacial ethanoic acid and butanoic acid 3. Concentrated sulphuric acid 4. Water</p> <p>Apparatus: 1. Test tube/boiling tube 2. Dropper 3. Beaker 4. Test tube holder 5. Bunsen burner 6. [Measuring cylinder]</p> <p>OR</p> <p>Experiment 2 (Reflux method) Materials: 1. Absolute/pure ethanol/pentanol 2. Glacial ethanoic acid and butanoic acid 3. Concentrated sulphuric acid 4. Water</p> <p>Apparatus: 1. Beaker 2. Round bottom flask 3. Liebig condenser 4. Bunsen burner 5. Tripod stand 6. Retort stand and clamp 7. Wire gauze 8. [Measuring cylinder]</p> | 3 |

| Question | Mark Scheme | Mark |
|----------|-------------|------|
|----------|-------------|------|

| | | |
|-------|---|---|
| 3 (d) | <p><i>Able to list the following materials and apparatus</i></p> <p><u>Sample answer:</u></p> <p>Experiment 1 Materials:</p> <ol style="list-style-type: none"> 1. Ethanol/pentanol 2. Ethanoic acid and butanoic acid 3. Concentrated sulphuric acid <p>Apparatus:</p> <ol style="list-style-type: none"> 1. Test tube / boiling tube 2. Bunsen burner 3. Test tube holder <p>OR</p> <p>Experiment 2 (Reflux method) Materials:</p> <ol style="list-style-type: none"> 1. Ethanol/pentanol 2. Ethanoic acid and butanoic acid 3. Concentrated sulphuric acid <p>Apparatus:</p> <ol style="list-style-type: none"> 1. Round/flat bottom flask 2. Liebig condenser 3. Bunsen burner 4. Tripod stand/retort stand | 2 |
| | <p><i>Able to list the following materials and apparatus</i></p> <p><u>Sample answer:</u></p> <p>Materials:</p> <ol style="list-style-type: none"> 1. Any carboxylic acid 2. Any alcohol <p>Apparatus:</p> <ol style="list-style-type: none"> 1. [Suitable container] 2. Bunsen burner | 1 |
| | <i>No response or wrong response</i> | 0 |

| Question | Mark Scheme | Mark |
|----------|---|------|
| 3 (e) | <p>Able to list all the steps of the procedure correctly</p> <p><u>Sample answer:</u></p> <p>Experiment 1</p> <ol style="list-style-type: none"> 1. <u>Pour</u> [2 cm³] of glacial ethanoic acid in a boiling tube. 2. <u>Add</u> [4 cm³] of absolute/pure ethanol/pentanol to the acid. 3. <u>Swirl/shake</u> the mixture. 4. <u>Add</u> a few drops of concentrated sulphuric acid. 5. <u>Boil</u> the mixture gently for about 2 to 3 minutes// a few minutes 6. <u>Pour</u> the contents of the boiling tube into the beaker fill with water. 7. <u>Record</u> the observation. 8. <u>Repeat</u> step 1 to 7 by replacing ethanoic acid with butanoic acid <p>OR</p> <p>Experiment 2 (Reflux method)</p> <ol style="list-style-type: none"> 1. <u>Measure</u> [50-100 cm³] of absolute ethanol/pentanol and pour into a round bottom flask. 2. <u>Add</u> [25-50 cm³] of glacial ethanoic acid and swirl. 3. <u>Add</u> slowly [5 cm³] of concentrated sulphuric acid. 4. <u>Heat</u> under reflux for 15 – 20 minutes. 5. <u>Pour</u> the contents of the round bottom flask into the beaker fill with water. 6. <u>Record</u> the observation. 7. <u>Repeat</u> step 1 to 6 by replacing ethanoic acid with butanoic acid | 3 |
| | <p>Able to list the following steps</p> <p>Experiment 1 Able to state steps 1, 2, 4, 5, 6, 7 and 8</p> <p>OR</p> <p>Experiment 2 Able to state steps 1, 2, 3, 4, 6 and 7</p> | 2 |
| | <p>Able to list the following steps only</p> <p>Experiment 1 Able to state steps 1, 2 and 4</p> <p>OR</p> <p>Experiment 2 Able to state steps 1, 2 and 3</p> | 1 |
| | No response or wrong response | 0 |

| Question | Mark Scheme | Mark | | | | | | | | | | | | | | | | | | |
|----------------------------------|--|-----------------------------|--------------------------|-----------------------------|------------------|------------------|--|------------------|--------------------------|---------------|---------|-----------------------------|----------------------------------|--------------------|----------------------------------|--|---|--|--|---|
| 3 (f) | <p><i>Able to tabulate the data which consist of;</i></p> <p>1. Manipulated variable 2. Responding variable</p> <p><u>Sample answer:</u></p> <p>1.</p> <table border="1" data-bbox="391 464 1230 615"> <thead> <tr> <th>Alcohol</th> <th>Acid</th> <th>Observation/scent/ smell</th> </tr> </thead> <tbody> <tr> <td>Ethanol/Pentanol</td> <td>Ethanoic acid</td> <td></td> </tr> <tr> <td>Pentanol/Ethanol</td> <td>Butanoic acid</td> <td></td> </tr> </tbody> </table> <p>2.</p> <table border="1" data-bbox="391 688 1208 840"> <thead> <tr> <th>Mixture</th> <th>Observation/scent/ smell</th> </tr> </thead> <tbody> <tr> <td>Ethanoic acid + Ethanol/pentanol</td> <td></td> </tr> <tr> <td>Butanoic acid + Ethanol/pentanol</td> <td></td> </tr> </tbody> </table> | Alcohol | Acid | Observation/scent/ smell | Ethanol/Pentanol | Ethanoic acid | | Pentanol/Ethanol | Butanoic acid | | Mixture | Observation/scent/ smell | Ethanoic acid + Ethanol/pentanol | | Butanoic acid + Ethanol/pentanol | | 2 | | | |
| Alcohol | Acid | Observation/scent/ smell | | | | | | | | | | | | | | | | | | |
| Ethanol/Pentanol | Ethanoic acid | | | | | | | | | | | | | | | | | | | |
| Pentanol/Ethanol | Butanoic acid | | | | | | | | | | | | | | | | | | | |
| Mixture | Observation/scent/ smell | | | | | | | | | | | | | | | | | | | |
| Ethanoic acid + Ethanol/pentanol | | | | | | | | | | | | | | | | | | | | |
| Butanoic acid + Ethanol/pentanol | | | | | | | | | | | | | | | | | | | | |
| | <p><i>Able to give an idea of tabulation of data</i></p> <p><u>Sample answer :</u></p> <table border="1" data-bbox="391 1014 1073 1129"> <thead> <tr> <th>Alcohol</th> <th>Observation/scent/ smell</th> </tr> </thead> <tbody> <tr> <td>Ethanol/pentanol</td> <td></td> </tr> <tr> <td>Pentanol/ethanol</td> <td></td> </tr> </tbody> </table> <table border="1" data-bbox="391 1163 1073 1278"> <thead> <tr> <th>Acid</th> <th>Observation/scent/ smell</th> </tr> </thead> <tbody> <tr> <td>Ethanoic acid</td> <td></td> </tr> <tr> <td>Buthanoic acid</td> <td></td> </tr> </tbody> </table> <table border="1" data-bbox="391 1312 1073 1428"> <thead> <tr> <th>Ester/Acid/Alcohol</th> <th>Observation/scent/ smell</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> </tr> <tr> <td></td> <td></td> </tr> </tbody> </table> | Alcohol | Observation/scent/ smell | Ethanol/pentanol | | Pentanol/ethanol | | Acid | Observation/scent/ smell | Ethanoic acid | | Buthanoic acid | | Ester/Acid/Alcohol | Observation/scent/ smell | | | | | 1 |
| Alcohol | Observation/scent/ smell | | | | | | | | | | | | | | | | | | | |
| Ethanol/pentanol | | | | | | | | | | | | | | | | | | | | |
| Pentanol/ethanol | | | | | | | | | | | | | | | | | | | | |
| Acid | Observation/scent/ smell | | | | | | | | | | | | | | | | | | | |
| Ethanoic acid | | | | | | | | | | | | | | | | | | | | |
| Buthanoic acid | | | | | | | | | | | | | | | | | | | | |
| Ester/Acid/Alcohol | Observation/scent/ smell | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| | <i>No response given or wrong response</i> | 0 | | | | | | | | | | | | | | | | | | |

TEST SPECIFICATION TABLE

CHEMISTRY PAPER 3
SIJIL PENDIDIKAN MRSM 2018

| Question | Topic | Mark |
|----------|----------------------------|-----------|
| 1 | Periodic Table of Elements | 15 |
| 2 | Acid and bases | 18 |
| 3 | Carbon compound | 17 |
| | TOTAL | 50 |

| ELEMENT CODE | ASPECT CODE | ASPECT | QUESTION | SCORE | |
|---|------------------------------|-----------------------------------|--------------|-----------|---|
| KK05 | KK0501 | Making Observation | 1(a) | 3 | |
| | KK0502 | Classification | 2(f) | 3 | |
| | KK0503 | Measure and Using Numbers | 2(a) | 3 | |
| | KK0504 | Making Inference | 1(b) | 3 | |
| | KK0505 | Making Prediction | 1(e) | 3 | |
| | KK0506 | Communication | 2(c) | 3 | |
| | KK0507 | Space time relationship | 2(e) | 3 | |
| | KK0508 | Interpreting data | 1(c) | 3 | |
| | KK0509 | Defining Operationally | 2(d) | 3 | |
| | KK05010 | Controlling Variables | 2(b) | 3 | |
| | KK05011 | Making Hypothesis | 1(d) | 3 | |
| | KK05012 | KK05012 (Statement of problem) | | 3 (a) | 3 |
| | | KK05012 (All the variables) | | 3 (b) | 3 |
| | | KK05012 (Statement of hypothesis) | | 3 (c) | 3 |
| KK05012 (List of substances and apparatus) | | 3 (d) | 3 | | |
| KK05012 (Procedure of the experiment) | | 3 (e) | 3 | | |
| | KK05012 (Tabulation of data) | | 3 (f) | 2 | |
| | | | TOTAL | 50 | |

END OF MARKING SCHEME