

## Chemistry Standard level Paper 1

Thursday 11 May 2017 (afternoon)

45 minutes

## Instructions to candidates

- Do not open this examination paper until instructed to do so.
- Answer all the questions.
- For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.
- The periodic table is provided for reference on page 2 of this examination paper.
- The maximum mark for this examination paper is [30 marks].

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4 9 9.01         4 9.01         5 9.01         Flement         5 10.81           9 9.01         12         3         3	4         4         5	Atomic number         Atomic number           4         Element           901         Element           901         Element           12         Element           12         Relative atomic mass           12         S           13         S           14         S           12         S           13         S           14         S           13         S           13         S           13         S           13         S           13         S           13         S           14         S           13         S           13         S           14         S           13         S <th>4         Atomic number         5         6           12         Element         10.81         10.81           12         Mg         24.31         24.31         26.98         30         31           12         Mg         8         24.31         25.5         26.38         30         31           24.31         24.36         57.9         27         28         29         30         31           24.33         38         40         41         42         25         26.38         69.72         28.93         30         31           20         21         22         23         24         25         26.98         30         31           20         21         22         23         24         25         26.98         69.72         26.98           33         39         40         41         42         44         45         46         47         48         49           87.62         88.91         101.07         102.91         106.42         107.87         114.82         26.98           88         174         75         78         78         46         47         48</th> <th>2     3     4     5     6     7     8     9     10     11     12     13       4     4     4     4     10     11     12     13       12     Atômic number     12     10     11     12     13       12     Be     9.01     12     22     23     24     38       24.31     21     22     23     24     25     26     30       24.31     21     22     23     24     25     26     30     31       20     21     22     23     24     55.85     58.33     58.93     58.93     58.93       24.31     44.96     47.87     50.94     55.85     58.93     58.93     58.93       20     21     22     23     24     55.85     58.93     58.93     58.96     57.5       38     39     40     41     42     44     45     46     47     48       56     57     73     74     75     76     77     78     79       56     57     72     73     74     45     46     47     48       87     72     73     77     &lt;</th>	4         Atomic number         5         6           12         Element         10.81         10.81           12         Mg         24.31         24.31         26.98         30         31           12         Mg         8         24.31         25.5         26.38         30         31           24.31         24.36         57.9         27         28         29         30         31           24.33         38         40         41         42         25         26.38         69.72         28.93         30         31           20         21         22         23         24         25         26.98         30         31           20         21         22         23         24         25         26.98         69.72         26.98           33         39         40         41         42         44         45         46         47         48         49           87.62         88.91         101.07         102.91         106.42         107.87         114.82         26.98           88         174         75         78         78         46         47         48	2     3     4     5     6     7     8     9     10     11     12     13       4     4     4     4     10     11     12     13       12     Atômic number     12     10     11     12     13       12     Be     9.01     12     22     23     24     38       24.31     21     22     23     24     25     26     30       24.31     21     22     23     24     25     26     30     31       20     21     22     23     24     55.85     58.33     58.93     58.93     58.93       24.31     44.96     47.87     50.94     55.85     58.93     58.93     58.93       20     21     22     23     24     55.85     58.93     58.93     58.96     57.5       38     39     40     41     42     44     45     46     47     48       56     57     73     74     75     76     77     78     79       56     57     72     73     74     45     46     47     48       87     72     73     77     <	
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        13.15         13.14         13.15         13.14         13.15         13.14         13.15         13.14         13.15         13.14         13.15         13.14         13.1</th> <th>Atomic number         Atomic number         5         6           9,01         12         12         5         6           9,01         12         12         12         13         14           12         24.31         24         25         26         27         28         280         31         32           24         50.94         55.05         54.94         55.85         58.93         58.69         63.55         65.38         20.72         726         33         31         32         32         32         34         36         55.55         55.38         58.69         55.38         58.09         55.7         726         72         726         727         726</th> <th>4         Atomic number         Atomic number         5         6           4         Be         Relative atomic mass         10.81  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Import         5 <th colspa<="" td=""><td>Addition function           4         5         6           9         9.01         12           12         9.01         12.01           12         9.01         12           13         14         13           14         12         13         14           12         12         12         12         12           14         12         12         12         12         12           15         12         12         12         12         12         12           16         11         12         12         12         12         12         12           16         17         12         12         12         12         12         12         12         12         12         12         12         12         12         12         12         12         13         14         13         13         14         13         14         13         14         12         14         12         13         14         13         13         14         12         13         14  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        24.31         24.31         24.31         26.98         28.06</td> <td>4         Atomic number         Atomic number         5         6         5         6         5         6<td>2         3         4         5         6         7         8         9         10         11         12         13         14           4         Atomic number         4         Atomic number         4         4         13         14         12         13         14           12         B         Element         12         14         12         13         14           12         Monic number         12         13         14         12         13         14           12         Monic number         12         13         14         12         13         14           13         Monic number         12         12         13         14         12         13         14           13         Monic number         12         14         15         13         14         12         13         14         12        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Flement           4         4           9         9.01           12         Relative atomic mass           9         24.31           12         20           12         21         22         23         24         31         31           12         0         40.08         44.96         47.87         50.94         55.05         58.99         58.59         58.59         58.59         58.59         59.7         726           13         8         39         40         41         42         44         55.85         58.59         58.59         58.59         59.72         726           14         42         70         58.65         58.93         58.66         59.72         726           15         87.62         70         78         74         75         76         77         76         77         76         77         76         77         76         77         76         77         76         77         76         77         76         77         76         77         76         77         76         77         78         77         76         77	Felement           4         7         Element           9         9.01         12           9         24.31         12           112         12         10.81         12.0           9         24.31         12         10.81         12.0           9         24.31         26.98         28.0         28.0           9         24.31         22         23         24         25         26         28         28.0           9         40.08         44.96         47.87         50.94         52.00         54.94         55.85         58.99         63.55         69.72         72.6           7         87.62         88.91         91.22         92.91         95.96         (98)         101.07         102.91         106.42         107.87         112.41         114.82         118.7           7         87.62         88.91         91.22         92.91         99.72         72.66         77         78         72.6         72.6         72.6         72.6         72.6         72.6         72.6         72.6         72.6         72.6         72.6         72.6         72.6         72.6         72.7         7	Atomic number         Atomic number         Atomic number         Element         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5 <td>Atomic number         Atomic number         Atomic</td> <td>2         3         4         5         6         7         8         9         10         11         12         13         14           4         Atomic number         Atomic number         Atomic number         6         6         7         8         6         7         13         14           20.01         12         Relative atomic mass         9.01         12         12         13         14           12         24.31         24         25         26         27         28         280</td>	Atomic number         Atomic	2         3         4         5         6         7         8         9         10         11         12         13         14           4         Atomic number         Atomic number         Atomic number         6         6         7         8         6         7         13         14           20.01         12         Relative atomic mass         9.01         12         12         13         14           12         24.31         24         25         26         27         28         280	
Image: Fige conditional condita conditional conditional conditional conditional	Automic number           4         4           9         9.01           12         Relative atomic mass           9         24.31           9         24.31           9         24.31           9         24.31           9         24.31           9         24.31           9         24.31           9         24.31           9         24.31           9         24.31           9         24.31           9         24.06           9         20.1           22         23           23         24           56         57.4           57         58.95           58.91         91.22           91.22         92.91           93         30           31         58.69         65.58           58.91         91.22           91.2         20.91           56         57.4           56         57.4           56         57.4           56         57.4           56         57.4           56         57.6<	Atomic number         Atomic number         Element         5         6         5         6         5         6         5         6         6         7         8         6         6         6         7         7         8         7         7         7         7         7         7         7         7         7         7         7         7         7 <t< td=""><td>Atomic number         Atomic number         Atomic number         Element         5         6           4         B         Relative atomic mass         10.81         12.0         14         13         14           12         Mg         24.31         24.31         26.98         28.0         26.98         28.0           12         20         21         22         23         24         25         26         27         28         28.0           20         21         22         23         24         45         46         47         48         49         50.98         28.07           20         21         22         23         24         25         26         27         28         33</td><td>2     3     4     5     6     7     8     9     10     11     12     13     14       4     Atomic number     9.01     12     13     14     12     13     14       12     9.01     12     8     9     10     11     12     13     14       12     80.1     9.01     12     12     12     13     14       12     9.01     12     10     11     12     13     14       12     9.01     10     11     12     10     11     12       12     9.01     12     12     12     13     14     13       13     24.3     4     4     5     5     5     30     31     32       20     21     22     23     24     25     5     30     31     32       20     21     22     23     24     5     6     8     6     6       20     24.3     40     41     42     44     45     46     47     48     49     50       31     32     26     53.9     53.55     58.93     58.69     63.75     56.93</td></t<>	Atomic number         Atomic number         Atomic number         Element         5         6           4         B         Relative atomic mass         10.81         12.0         14         13         14           12         Mg         24.31         24.31         26.98         28.0         26.98         28.0           12         20         21         22         23         24         25         26         27         28         28.0           20         21         22         23         24         45         46         47         48         49         50.98         28.07           20         21         22         23         24         25         26         27         28         33	2     3     4     5     6     7     8     9     10     11     12     13     14       4     Atomic number     9.01     12     13     14     12     13     14       12     9.01     12     8     9     10     11     12     13     14       12     80.1     9.01     12     12     12     13     14       12     9.01     12     10     11     12     13     14       12     9.01     10     11     12     10     11     12       12     9.01     12     12     12     13     14     13       13     24.3     4     4     5     5     5     30     31     32       20     21     22     23     24     25     5     30     31     32       20     21     22     23     24     5     6     8     6     6       20     24.3     40     41     42     44     45     46     47     48     49     50       31     32     26     53.9     53.55     58.93     58.69     63.75     56.93	
Image: Figure and the second condition of the second co	Feilement           4         Feilement           9         901           12         2           9         24.31           12         10.81           12         2           9         24.31           12         2           13         14           14         12           15         2           20         21         22           20         21         22           20         21         22           20         21         22           20         21         22           20         21         22           20         21         22           20         21         22           21         2         24           25         53.3         58.69         63.75           26         88.91         91.22         92.91         99.72           26         88.93         58.69         63.55         65.38         69.72           25         55         58.93         58.69         63.72         16           26         58.93         58.69	Atomic number         Atomic number         Atomic number         5         6         5         6         5         6         5         6         5         6         5         6         5         5         6         5	4         Atomic number         10         10         11         10         11         10         11         10         11         10         11         10         11		
4         4         5	Additional         Feature atomic manual         Element         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         5         6         5         5         6         5	Atomic number         Atomic number         Atomic number         Element         5         6         5         6         5         6         5         6         6         7         7         8         7         12         12         12         12         13         14         12.0         13         14         12.0         13         14         12.0         13         14         12.0         13         14         12.0         13         14         12.0         13         14         12.0         13         14         12.0         13         14         12.0         13         14         12.0         13         14         12.0         13         14         12.0         13         14         12.0         13         13         14         12.0         13         14         12.0         13         13         14         12.0         13         13         14         13         13         14         14         13         13         14         13         13         14         13         13         13         13         14         14         14         14         14         14         14         14         14         14         14 <td>4         Atomic number         5         &lt;</td> <td>2     3     4     5     6     7     8     9     10     11     12     13     14       4     Atomic number     Atomic number     Element     5     6     5     6       9.01     12     Relative atomic mass     Relative atomic mass     10     11     12     13     14       12     NG     24.31     1     26.38     58.93     58.69     53.55     55.38     281     281       24.31     24.36     57.94     55.85     58.93     58.69     63.55     65.38     297     26.38       20     21     22     23     24     25     26     27     28     29     30     31     33       20     21     22     23     24.94     55.85     58.93     58.69     63.53     69.72     72.6       20     21     22     23     24.94     45     46     47     48     49     55       26     57     70     70     70     70     70     70     70     70     70     70     70     70     70     70     70     70     70       38     39     40     41     45     46</td>	4         Atomic number         5         <	2     3     4     5     6     7     8     9     10     11     12     13     14       4     Atomic number     Atomic number     Element     5     6     5     6       9.01     12     Relative atomic mass     Relative atomic mass     10     11     12     13     14       12     NG     24.31     1     26.38     58.93     58.69     53.55     55.38     281     281       24.31     24.36     57.94     55.85     58.93     58.69     63.55     65.38     297     26.38       20     21     22     23     24     25     26     27     28     29     30     31     33       20     21     22     23     24.94     55.85     58.93     58.69     63.53     69.72     72.6       20     21     22     23     24.94     45     46     47     48     49     55       26     57     70     70     70     70     70     70     70     70     70     70     70     70     70     70     70     70     70       38     39     40     41     45     46	
Flement           4         4           9.01         12           12         13           12         10.81           12         10.81           12         10.81           12         10.81           12         10.81           12         10.81           12         10.81           12         10.81           13         14           14         12           15         13           16         11.10           17         10.08           20         21         22           20         21         22           20         21         22           20         21         22           20         21         22           20         23         24           26         58.93         58.69         63.55           26.98         28.01         27.6         26.98           27.6         28.93         58.69         63.55         56.38           27.6         28.93         58.69         63.55         56.38           26         57	4         4         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         7         10	4         Atomic number         5         6         5         6         5         6         5         6         7         8         7         8         7         8         7         8         7         7         7         7         7         7         7         <	4         Atomic number         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         7         <	2       3       4       5       6       7       8       9       10       11       12       13       14         4       Atomic number       Atomic number       Atomic number       6       7       8       6       7       13       14       12       13       14         12       Be       Relative atomic mass       8       7       8       6       6       8       6       7       14       12       13       14         12       Mg       Fe       Relative atomic mass       8       25       56       30       31       13       14       16       10       11       12       13       14       16       10       11       13       14       16       10       11       13       14       11       14       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16 </td	
4         4         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5	Atomic number         Acomic mater         5         6         6         6         7         8         7         8         6         7         6         6         6         7         6         8         6         6         7         6         8         8         8         10         11         10         10         10         10         10 <t< td=""><td>Atomic number         Atomic number         Atomic number         Element         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         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       6         47         48         49         50           56         57.1         78.01         102.91         102.91         102.91         107.07         107.81         118.71         118.71           56         57.1         78         &lt;</td><td>2     3     4     5     6     7     8     9     10     11     12     13     14       Atomic number     Atomic number     Element     5     6     5     6       901     12     8     10     11     12     13     14       12     9.01     12     10     11     12     13     14       12     9.01     12     10     11     12     13     14       12     24.31     24.31     24.31     26.98     28.00     28.00       24.31     24.31     24.36     25.00     54.94     55.85     58.93     58.09     30     31     32       20     21     22     23     24     25     26     27     28     30     31     32       20     21     22     23     24.4     45     46     47     41     31     32       20     21     22     23     23     26.98     30     31     32       20     20     21     7     7     7     45     46     47     48     49     56       31     32     23     52.00     54.94     55.86</td></td></t<>	Atomic number         Atomic number         Atomic number         Element         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         6         7         6         6         6         6         6         7         7         6         6         7         7         7         7         7         7         7         7         7 <td>4         Atomic number         5         6           9.01         Element         5         6           9.01         12         13         14           12         Mg         13         14           12         Mg         13         14           12         13         14         13           12         24         25         28         28.03           24.31         24         25         28         28.03           24.31         7         Cr         Mn         Fe         Co         Ni         26           24.31         24         25         28         28.03         30         31         32           26         88.91         37.87         50.94         55.00         54.94         55.85         58.93         58.05         55.38         58.07         72.65           38         39         40         41         6         47         48         49         50           56         57.1         78.01         102.91         102.91         102.91         107.07         107.81         118.71         118.71           56         57.1         78         &lt;</td> <td>2     3     4     5     6     7     8     9     10     11     12     13     14       Atomic number     Atomic number     Element     5     6     5     6       901     12     8     10     11     12     13     14       12     9.01     12     10     11     12     13     14       12     9.01     12     10     11     12     13     14       12     24.31     24.31     24.31     26.98     28.00     28.00       24.31     24.31     24.36     25.00     54.94     55.85     58.93     58.09     30     31     32       20     21     22     23     24     25     26     27     28     30     31     32       20     21     22     23     24.4     45     46     47     41     31     32       20     21     22     23     23     26.98     30     31     32       20     20     21     7     7     7     45     46     47     48     49     56       31     32     23     52.00     54.94     55.86</td>	4         Atomic number         5         6           9.01         Element         5         6           9.01         12         13         14           12         Mg         13         14           12         Mg         13         14           12         13         14         13           12         24         25         28         28.03           24.31         24         25         28         28.03           24.31         7         Cr         Mn         Fe         Co         Ni         26           24.31         24         25         28         28.03         30         31         32           26         88.91         37.87         50.94         55.00         54.94         55.85         58.93         58.05         55.38         58.07         72.65           38         39         40         41         6         47         48         49         50           56         57.1         78.01         102.91         102.91         102.91         107.07         107.81         118.71         118.71           56         57.1         78         <	2     3     4     5     6     7     8     9     10     11     12     13     14       Atomic number     Atomic number     Element     5     6     5     6       901     12     8     10     11     12     13     14       12     9.01     12     10     11     12     13     14       12     9.01     12     10     11     12     13     14       12     24.31     24.31     24.31     26.98     28.00     28.00       24.31     24.31     24.36     25.00     54.94     55.85     58.93     58.09     30     31     32       20     21     22     23     24     25     26     27     28     30     31     32       20     21     22     23     24.4     45     46     47     41     31     32       20     21     22     23     23     26.98     30     31     32       20     20     21     7     7     7     45     46     47     48     49     56       31     32     23     52.00     54.94     55.86	
Image: Figure atomic mass         Element         5         6         5         6         5         6         5         6         7         8         6         6         6         6         6         7         7         7         7         7         7         7         7         7         7         7         7         7         7         7 </td <td>Autric number         Autric number         5         6         8         C         5         6         8         C         5         6         8         C         7         10.81         12.0°         112         12.0°         112         12.0°         13         14         13         14         13         14         12.0°         10.81         12.0°         10.81         12.0°         10.81         12.0°         10.81         12.0°         10.81         12.0°         10.81         12.0°         10.81         12.0°         10.81         12.0°         10.81         12.0°         10.81         12.0°         10.81         12.0°         10.81         12.0°</td> <td>Atomic number         Atomic number         Element         5         6         5         6         5         6         6         7         7         10.81         12.07         10.81         12.07         10.81         12.07         10.81         12.07         10.81         12.07         10.81         12.07         10.81         12.07         10.81         12.07         10.81         12.07         10.81         12.07         10.81         12.07         10.81         12.07         10.81         12.07         10.81         12.07         10.81         12.07         10.81         12.07         10.81         12.07         10.81         12.07         10.81         12.07</td> <td>4         Atomic number         5         6           9.01         Element         10.81         12.0           9.01         12         9.01         13         14           12         9.01         12.0         10.81         12.0           9.01         12         10.81         12.0         10.81         12.0           12         24.31         24.31         24.31         24.31         23         28.03           20         21         22         23         24.3         28.03         58.03         58.03         28.03         28.03           20         21         22         23         24         44         45         46         47         48         53           20         21         22         23         24.3         58.69         63.55         65.38         69.72         72.68           20         21         22         26         27         28         28.03         58.09         53.55         65.38         69.72         72.68         58.03         58.03         58.03         59.72         72.68         58.03         58.55         58.53         58.53         58.57         72.68         57.55<!--</td--><td>2     3     4     5     6     7     8     9     10     11     12     13     14       Atomic number     Atomic number     Atomic number     Element     5     6     13     14       4     Be     9.01     12     Relative atomic mass     12     13     14       12     Mg     12     8     5     14     10.81     12.00       12     Mg     12     8     5     26     8     5       12     Mg     12     14     10.81     12.00       12     Mg     12     13     14     13     14       12     20.1     21     22     23     24     25     26     27     28       20     21     22     23     24     55.85     58.93     58.69     63.75     72.65       33     30     40     41     6     70     71     73     74     75       38     39     40     41     72     73     74     75     72.65     56.38     60.72     72.65       38     59.91     95.96     58.93     58.69     63.55     65.38     69.72     72.65</td></td>	Autric number         Autric number         5         6         8         C         5         6         8         C         5         6         8         C         7         10.81         12.0°         112         12.0°         112         12.0°         13         14         13         14         13         14         12.0°         10.81         12.0°         10.81         12.0°         10.81         12.0°         10.81         12.0°         10.81         12.0°         10.81         12.0°         10.81         12.0°         10.81         12.0°         10.81         12.0°         10.81         12.0°         10.81         12.0°         10.81         12.0°	Atomic number         Atomic number         Element         5         6         5         6         5         6         6         7         7         10.81         12.07         10.81         12.07         10.81         12.07         10.81         12.07         10.81         12.07         10.81         12.07         10.81         12.07         10.81         12.07         10.81         12.07         10.81         12.07         10.81         12.07         10.81         12.07         10.81         12.07         10.81         12.07         10.81         12.07         10.81         12.07         10.81         12.07         10.81         12.07         10.81         12.07	4         Atomic number         5         6           9.01         Element         10.81         12.0           9.01         12         9.01         13         14           12         9.01         12.0         10.81         12.0           9.01         12         10.81         12.0         10.81         12.0           12         24.31         24.31         24.31         24.31         23         28.03           20         21         22         23         24.3         28.03         58.03         58.03         28.03         28.03           20         21         22         23         24         44         45         46         47         48         53           20         21         22         23         24.3         58.69         63.55         65.38         69.72         72.68           20         21         22         26         27         28         28.03         58.09         53.55         65.38         69.72         72.68         58.03         58.03         58.03         59.72         72.68         58.03         58.55         58.53         58.53         58.57         72.68         57.55 </td <td>2     3     4     5     6     7     8     9     10     11     12     13     14       Atomic number     Atomic number     Atomic number     Element     5     6     13     14       4     Be     9.01     12     Relative atomic mass     12     13     14       12     Mg     12     8     5     14     10.81     12.00       12     Mg     12     8     5     26     8     5       12     Mg     12     14     10.81     12.00       12     Mg     12     13     14     13     14       12     20.1     21     22     23     24     25     26     27     28       20     21     22     23     24     55.85     58.93     58.69     63.75     72.65       33     30     40     41     6     70     71     73     74     75       38     39     40     41     72     73     74     75     72.65     56.38     60.72     72.65       38     59.91     95.96     58.93     58.69     63.55     65.38     69.72     72.65</td>	2     3     4     5     6     7     8     9     10     11     12     13     14       Atomic number     Atomic number     Atomic number     Element     5     6     13     14       4     Be     9.01     12     Relative atomic mass     12     13     14       12     Mg     12     8     5     14     10.81     12.00       12     Mg     12     8     5     26     8     5       12     Mg     12     14     10.81     12.00       12     Mg     12     13     14     13     14       12     20.1     21     22     23     24     25     26     27     28       20     21     22     23     24     55.85     58.93     58.69     63.75     72.65       33     30     40     41     6     70     71     73     74     75       38     39     40     41     72     73     74     75     72.65     56.38     60.72     72.65       38     59.91     95.96     58.93     58.69     63.55     65.38     69.72     72.65	
Element           4         4           901         12           12         10.81           12         10.81           12         10.81           12         10.81           12         10.81           12         10.81           12         10.81           12         12.01           12         12           12         12           13         14           14         12.01           15         10.81           16         17.87           17         10.81           18         12.01           19         12.2           23         24         25.85           26         65.85           38         39           40         44           68         69.15           87.65         88.91           91.22         92.91           95.95         93           56         57.1           56         57.1           56         57.1           56         57.1           56         57.1      <	Addition function           4         4         5         6           9.01         12         10.81         12.01           12         9.01         12         10.81         12.01           12         Mg         12         10.81         12.01           12         Mg         12         10.81         12.01           13         Mg         12         10.81         12.01           14         Mg         12         10.81         12.01           13         Mg         12         10.81         12.01           14         Mg         12         12.01         13.2           13         14         12         13.2         14           14         12         12         13.2         13.2           15         26         23.3         58.69         63.55         65.38         69.72         75.63           16         41.96         47.87         50.94         55.85         58.99         63.55         65.38         69.72         75.63           18         7         7         7         7         7         7         7         7         7         7<	Atomic number         Atomic number         Atomic number         Feature atomic name         Featur	Atomic number         Atomic number         Atomic number         Element         5         6         5         6         6         7 <td>2     3     4     5     6     7     8     9     10     11     12     13     14       4     Atomic number     4     Felement     6     7     8     9     10     11     12     13     14       4     Be     9.01     12     Felement     10.81     12.01     10.81     12.01       12     Mg     Felement     10     1     26.98     28.06     28.06     28.06     28.06     28.06     28.06     28.06     28.06     28.06     28.06     28.06     28.06     28.05     28.07     72.63     28.07     78.7<!--</td--></td>	2     3     4     5     6     7     8     9     10     11     12     13     14       4     Atomic number     4     Felement     6     7     8     9     10     11     12     13     14       4     Be     9.01     12     Felement     10.81     12.01     10.81     12.01       12     Mg     Felement     10     1     26.98     28.06     28.06     28.06     28.06     28.06     28.06     28.06     28.06     28.06     28.06     28.06     28.06     28.05     28.07     72.63     28.07     78.7 </td	
4         4         5         6           4         9.01         10.81         12.01           9         9.01         12         10.81         12.01           9         24.31         24         25         26         27         28         28.09           0         40.08         44.96         47.87         50.94         55.85         58.93         58.69         63.55         66         66           7         87.6         70         74         75         76         77         78         79         80         81         80         50	Feilement           4         4           9.01         12           9.01         12           12         10.81           12         10.81           12         10.81           12         10.81           12         10           12         12           12         12           13         14           12         13           14         12           12         13           13         14           14         12           15         14           16         12           17         14           18         12           19         12           10         12           11         12           12         12           13         25           14         26           26         28           26         28           26         28           26         28           26         28           27         28           28         29           29<	Atomic number         Atomic number         Element         5         6         5         6         7         14         120         14         15         6         16         16         17         17         14         120         120         14         120	4         Atomic number         5         6           9,01         Element         5         6           9,01         12         10.81         12.01           12         24.31         1         10.81         12.01           12         12         24.31         1         13         14           12         12         26.33         26.94         25.83         30         31         32           26.33         80.10         58.93         58.93         58.69         65.56         65.38         69.72         75.63           38<39	2     3     4     5     6     7     8     9     10     11     12     13     14       4     Atomic number     Atomic number     Element     5     6     5     6       9.01     12     Relative atomic mass     9.01     12     10     11     12.01       12     Relative atomic mass     9.01     24.31     24.31     26.98     28.09       24.31     24.31     24.31     24.34     25     26     27     28       20     21     22     23     24     25     26     27     28       20     21     22     23     24.34     58.69     63.75     65.38     69.72     72.63       20     21     22     23     24     25     26     27     28     28.09       20     21     22     23     24.34     55.83     58.69     63.75     72.63       20     21     22     23     24     44     45     46     47     48     49     50       31     32     24.3     58.69     63.55     58.33     58.69     63.72     72.63       33     33     34.4     45     46	
4         5         6           4         4         8         6         6           9         9.01         12         10.81         12.01           12         12         12         13         14           12         12         12         13         14           12         12         12         13         14           12         12         13         14         31           13         14         12         10.81         12.01           14         12         11         1         12         13         14           15         13         14         12         13         14         32           20         21         22         23         24         33	Atomic number           4         4           4         4           9.01         12           9.01         12           12         10.81           12         10.81           12         10.81           12         10.81           12         12           12         12           12         12           12         12           12         12           13         14           14         12           15         12           16         17           17         12           18         12           19         14           10         12           11         12           12         12           13         14           14         12           15         12           12         12           13         12           14         12           15         13           14         13           15         10           14         10           14	Atomic number         Atomic number         Element         5         6         9           9.01         12         5         6         10.81         12.01         14         12         14         15         14         15         14         15         14         15         14         15         14         12         14         14         15         14         15         14	Atomic number         Atomic number         Element         5         6         5         6         7         14           12         Be         9.01         10.81         12.01         10.81         12.01         10.81         12.01           12         Mg         24.31         24         25         26         27         28         29.01         31         32           20         21         22         23         24         25         26         8.03         31         32           20         21         22         23         24         25         26         30         31         32           26.98         38         39         40         41         45         46         47         48         49         50           38         39         40         41         45         46         47         48         49         50           38         39         40         41         45         46         47         48         49         50           38         39         40         44         45         46         47         48         49         50 <td< td=""><td>2     3     4     5     6     7     8     9     10     11     12     13     14       4     Atomic number     Atomic number     10     11     12     13     14       9.01     12     Felement     10     11     12     13     14       12     8.01     24.31     24     25     26     21     26.98     28.09       24.31     24.36     27     28     29     30     31     32       26.38     44.96     47.87     50.94     55.85     58.93     58.69     69.72     72.63       38     39     40     41     42     43     44     45     46     47     48     49     50       87.62     88.91     91.22     92.91     95.96     (98)     101.07     102.91     106.42     107.87     112.41     114.82     18.71</td></td<>	2     3     4     5     6     7     8     9     10     11     12     13     14       4     Atomic number     Atomic number     10     11     12     13     14       9.01     12     Felement     10     11     12     13     14       12     8.01     24.31     24     25     26     21     26.98     28.09       24.31     24.36     27     28     29     30     31     32       26.38     44.96     47.87     50.94     55.85     58.93     58.69     69.72     72.63       38     39     40     41     42     43     44     45     46     47     48     49     50       87.62     88.91     91.22     92.91     95.96     (98)     101.07     102.91     106.42     107.87     112.41     114.82     18.71	
4         Felament         5         6           12         20         21         22         23         24.31           9         24.31         12         13         14           12         12         13         14         13           12         12         2         23         24.31         26.98         28.09           20         21         22         23         24.34         55.85         58.93         58.69         63.55         58.93           0         40.08         44.96         47.87         50.94         55.85         58.93         58.69         63.55         65.38         69.72         72.63           38         39         40         41         42         84         45         46         47         48         49         50.63           38.91         91.22         92.91         95.96         (98)         101.07         102.91         106.42         107.87         112.41         114.82         118.71	Atomic number         Felement         5         6         5         6         7         12         10.081         12.01         12.01         12.01         12.01         12.01         12.01         12.01         12.01         12.01         12.01         12.01         13.01         14         53.02	Atomic number         Atomic number         Element         5         6         5         6         5         6         7         12         12         12         12         13         14         24         21         22         23         24         25         26<	Atomic number         Atomic number         Element         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         5         6         6         5         6         6         5         6         5         6         5         5         6         5         5         6         5         5         6         5         5         6         5         5         6         5         5         6         5 </td <td>2     3     4     5     6     7     8     9     10     11     12     13     14       4     Atomic number     Atomic number     Element     6     6     6     6     6     7     10     11     12     14       4     Be     9.01     12     Element     12     10     11     12     14       12     Be     Relative atomic mass     2.0     2.1     2.0     2.1     12.01       12     Mg     2.0     2.1     2.2     2.3     2.4     2.5     2.6     2.1       12     Mg     4.0     6     2.1     2.2     2.3     2.4     3.0     3.1     3.2       20     2.1     2.2     2.3     2.4     2.5     2.6     2.7     3.0     3.1     3.2       21     2.2     2.3     2.4     5.33     5.8.6     6.3.5     6.9.3     6.9.3       20.0     2.1     2.2     2.3     2.4     4.4     4.5     4.6     4.7     4.9     5.0.9       31     2.0     54.9     55.95     58.93     58.69     6.7.2     2.63     5.7.2       38     39     40     4.1     <td< td=""></td<></td>	2     3     4     5     6     7     8     9     10     11     12     13     14       4     Atomic number     Atomic number     Element     6     6     6     6     6     7     10     11     12     14       4     Be     9.01     12     Element     12     10     11     12     14       12     Be     Relative atomic mass     2.0     2.1     2.0     2.1     12.01       12     Mg     2.0     2.1     2.2     2.3     2.4     2.5     2.6     2.1       12     Mg     4.0     6     2.1     2.2     2.3     2.4     3.0     3.1     3.2       20     2.1     2.2     2.3     2.4     2.5     2.6     2.7     3.0     3.1     3.2       21     2.2     2.3     2.4     5.33     5.8.6     6.3.5     6.9.3     6.9.3       20.0     2.1     2.2     2.3     2.4     4.4     4.5     4.6     4.7     4.9     5.0.9       31     2.0     54.9     55.95     58.93     58.69     6.7.2     2.63     5.7.2       38     39     40     4.1 <td< td=""></td<>	
Image: Figure at the stand series in the series in the stand series in the stand series in the stand series in the stand series in the seri	Additionation 4           4         4           8         4           901         12           12         10.81           12         10.81           12         10.81           12         10.81           9         24.31           20         21           20         21           20         21           20         21           20         21           20         21           20         21           20         21           20         21           20         21           20         21           20         21           20         21           20         21           20         23           20         23           20         23           20         23           20         23           20         23           20         23           21         25           25         26           20         23           21         23           2	Atomic number         Atomic number         Atomic number         Element         5         6           9.01         9.01         10.81         10.81         12.01         10.81         12.01           9.01         12         9.01         12         12.01         12.01         12.01         12.01         12.01           12         9.01         24.31         12         12.01         13.01         14.01	Atomic number         Atomic n	2       3       4       5       6       7       8       9       10       11       12       13       14         4       4       Felement       4       Felement       10       11       12       13       14         4       4       9.01       1       8       1       10       11       12       13       14         9       9.01       1       2       2       8       1       10.81       12.01       1       14         12       9.01       1       2       2       2       1	
H         Element         5         6           9.01         9.01         10.81         12.01           9.01         12         10.81         12.01           9         24.31         10.81         12.01           9         24.31         10.81         12.01           9         24.31         10.81         56.98         28.09           9         24.31         26.98         58.09         58.69         58.09           9         24.31         27         28         28.09         58.69         58.09           9         24.31         27         28         28.03         58.69         57.2         26.38           9         40.08         44.96         57.00         54.94         55.85         58.93         58.69         57.2         26.38           9         24.34         55.85         58.93         58.69         63.75         72.63           9         40         41         42         44         45         46         47         48         49         50           9         40         41         45         46         47         48         49         50         56	Autric number         Autric number           4         4           8         9.01           12         9.01           12         12           13         14           12         13           14         12           12         13           13         14           13         14           13         14           13         14           13         14           13         14           13         14           14         12.01           15         13           14         13           15         14           16         10.81           17         13           18         14           19         26.98           20         21           21         22           22         23           24.31         20.94           55.05         58.93           28         29           29         26.98           20         26.98           25.00         54.94           26	Atomic number         Atomic number         Atomic number         Image: Second Secon	4       Atomic number       Atomic number         9.01       Element         9.01       12         9.01       12         9.01       12         9.01       12         12       9.01         13       14         14       12         12       13         14       13         15       14         16       10.81         17       17         18       26.98         24.31       27         28       29       30         38       39       40       41       42         41       45       46       47       48       49       50         58.69       63.55       58.93       58.69       63.55       56       57         50       40       41       45       46       47       48       49       50	2       3       4       5       6       7       8       9       10       11       12       13       14         4       4       Flement       Flement       Flement       10       11       12       13       14         4       4       9.01       12       8       7       8       9       10       11       12       13       14         4       8       8       9.01       12       12       12       12       14       12       14       12       14       12       14       12       14       12       14       12       14       12       14       12       14       12       14       12       14       12       14       12       14       12       14       14       14       12       14       12       14       12       14       12       14       14       14       14       12       14       14       12       14       12       14       14       14       14       14       14       14       14       14       14       14       14       14       14       14       14       14       14       14      <	
Image: Figure atomic mass	Admit number         Admit number           4         4           8         6           9.01         12           12         13           12         13           12         13           12         13           12         10.81           12         10.81           12         10           12         12           13         14           12         10.81           12         10.81           13         14           14         10.81           12         13           13         14           14         10.81           12         26           26         23           27         28           28         29           39         40           41         45           38         39           40         45           44         45           46         47           48         49	4         Atomic number         5         6           4         4         8         9.01         10.81         12.01           9.01         9.01         12         10.81         12.01         12.01           9.01         24.31         25         26         8         8           24.31         24.31         25         26         30         31         32           26.98         58.93         58.69         65.38         69.72         72.63         30         31         32           10.08         44.96         47.87         50.94         55.85         58.93         58.69         63.55         65.38         69.72         72.63           38         39         40         41         42         43         44         45         46         47         49         50	Atomic number       Atomic number       Atomic number $\mathbf{F}$	2         3         4         5         6         7         8         9         10         11         12         13         14           4         Atomic number         Atomic number         Atomic number         1         1         12         1	
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4         Element         5         6           9.01         12         10.81         12.01           12         20         21         22         23         24.31           9         201         22         26         58.69         58.69         58.69           0         40.08         44.96         47.87         50.94         55.85         58.93         58.69         65.38         69.72         72.63	Atomic number         Atomic number         Fement         5         6         7         7         12         12         12         12         13         14         12         13         14         26.98         28.09         28	Atomic number         Atomic number         Element         5         6         6         7         7         12         12         12         12         13         14         23         24         21         22         23         26.98         23.09         21         22         23         26.98         23.09         21         22         23         23         23         23         23         23         23         23         23         23         23         23         23	Atomic number       Atomic number       Atomic number       Element       5       6       5       6       6       7 <th 7<="" td=""><td>2       3       4       5       6       7       8       9       10       11       12       13       14         4       4       4       Fetement       4       10       11       12       13       14         4       8       9.01       12       12       13       14       12       13       14         12       9.01       12       12       13       14       13       14       13       14         12       9.01       24       25       26       26.98       28.09&lt;</td></th>	<td>2       3       4       5       6       7       8       9       10       11       12       13       14         4       4       4       Fetement       4       10       11       12       13       14         4       8       9.01       12       12       13       14       12       13       14         12       9.01       12       12       13       14       13       14       13       14         12       9.01       24       25       26       26.98       28.09&lt;</td>	2       3       4       5       6       7       8       9       10       11       12       13       14         4       4       4       Fetement       4       10       11       12       13       14         4       8       9.01       12       12       13       14       12       13       14         12       9.01       12       12       13       14       13       14       13       14         12       9.01       24       25       26       26.98       28.09<
H       4       Element       5       6         12       Be       12       10.81       12.01         12       12       12       13       14         12       12       12       13       14         12       12       12       13       14         12       12       12       13       14         13       14       13       14       13         14       Mg       12       13       14         12       13       14       13       14         13       14       13       14       13       14         14       12       13       14       13       14         15       13       14       13       14       13       14         15       14       12       13       14       13       14       13       14       13       14       13       14       13       14       13       14       13       14       13       14       13       14       13       14       13       14       14       14       14       14       14       14       14       14 <t< td=""><td>Automic number         Automic number           4         4           Be         9.01           12         9.01           12         10.81           12         10.81           12         10.81           12         10.81           12         10.81           12         13           14         13           12         13           13         14           13         14           13         14           14         12.01           12         13           14         12.01           12         13           14         12.01           12         20           21         22           23         24.31           20         21           20         21           20         23           20         23           20         24.34           55.85         58.93           66.93         53.65           23.33         58.69           23.55         58.93           24.94         55.83</td><td>Atômic number         Atômic number         Atômic number         5         6           4         8         6         8         6         8         6           9.01         12         8         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    23     24     25     26     26       20     21     V     Cr     Mn     Fe     Co     Ni     Cu       40.08     44.96     47.87     50.94     52.00     54.94     55.83     58.69     63.55     66	
H       Element         4       4         8       5         9.01       9.01         12       9.01         12       12         12       12         12       23         24       25         20       21         20       21         20       21         20       21         20       21         20       21         20       21         20       21         20       21         20       21         20       21         20       21         20       21         20       21         20       21         20       31         20       31         20       31         21       23         26       28         20       31         21       28         20       31         31       32	Adomic number         Adomic number           4         4           4         5           8         9.01           9.01         12.01           12         10.81           12         10.81           12         11           12         26.98           20         21           20         21           20         21           20         31           20         31           20         21           20         21           20         21           20         31           20         31           20         21           20         23           20         24           20         27           20         31           20         31           20         31           20         31           20         31           20         31           20         31           20         31           20         31           20         31           31         32 <td>Atomic number       Atomic number         4       4         Be       6         9.01       9.01         12       12         12       23         24.31       24.31         20       21         22       26         23       26         20       31         20       31         20       31         21       28         20       31         21       28         20       31         20       31         21       28         20       31         20       31         20       31         20       31         21       28         20       31         21       28         20       31         31       32         32       30         31       32</td> <td>Atomic number       Atomic number         Atomic number       Atomic number         Atomic number       B         9.01       12         9.01       12         12       12         12       12         12       12         12       10.81         12       10.81         12       13         13       14         13       14         13       14         13       14         13       12         13       12         11       13         12       26         13       26         26       27         28       29         31       32         26       33         27       28         28       29         29       30         31       32         32       33         33       34         60       33         33       33         34       68</td> <td>2       3       4       5       6       7       8       9       10       11       12       13       14         4       Atômic number       4       Element       5       6       7       8       9       10       11       12       13       14         4       Be       Relative atomic mass       9.01       1       12       1       13       14       10.81       12.01       13       14       13</td>	Atomic number       Atomic number         4       4         Be       6         9.01       9.01         12       12         12       23         24.31       24.31         20       21         22       26         23       26         20       31         20       31         20       31         21       28         20       31         21       28         20       31         20       31         21       28         20       31         20       31         20       31         20       31         21       28         20       31         21       28         20       31         31       32         32       30         31       32	Atomic number       Atomic number         Atomic number       Atomic number         Atomic number       B         9.01       12         9.01       12         12       12         12       12         12       12         12       10.81         12       10.81         12       13         13       14         13       14         13       14         13       14         13       12         13       12         11       13         12       26         13       26         26       27         28       29         31       32         26       33         27       28         28       29         29       30         31       32         32       33         33       34         60       33         33       33         34       68	2       3       4       5       6       7       8       9       10       11       12       13       14         4       Atômic number       4       Element       5       6       7       8       9       10       11       12       13       14         4       Be       Relative atomic mass       9.01       1       12       1       13       14       10.81       12.01       13       14       13	
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Element       5       6         4       5       5         Be       9.01       10.81       12.01         12       12       13       14         13       14       21       13         13       14       21       21         13       14       201       21         13       14       201       21         13       24       21       21         13       24       21       21         13       24       21       21	Adomic number     Adomic number       4     4       8e     9.01       12     10.81       12     13       13     14       Si     4	Atomic number 4 8 9.01 12 13 14 10.81 12.01 12.01 12.01 13 14 12.01 12.01 13 14 12.01 13 14 15 16 10.81 12.01 12.01 12.01 12.01 13 14 15 15 15 15 15 15 15 15 15 15	Atomic number       Atomic number         Atomic number       4         Be       6         9.01       8         12       10.81         13       12.01         13       12.01         13       14         13       14         13       12.01         13       14         13       14         13       14         14       12.01	2       3       4       5       6       7       8       9       10       11       12       13       14         Atomic number       Atomic number       Atomic number       Atomic number       12       13       14         12       9.01       12       13       14       12.01       13       14         12       12       13       14       12.01       13       14         12       12       14       12.01       12.01       13       14         12       12       13       14       12.01       15.01       15.01         MG       12       13       14       12.01       12.01       13       14	
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## M17/4/CHEMI/SPM/ENG/TZ2/XX

1. What is the sum of the coefficients when the equation is balanced with whole numbers?

 $\underline{C}_{8}H_{18}(g) + \underline{O}_{2}(g) \rightarrow \underline{CO}(g) + \underline{H}_{2}O(l)$ 

- A. 26.5
- B. 30
- C. 53
- D. 61
- **2.** How many moles of oxygen atoms are there in 0.500 mol of hydrated iron(II) ammonium sulfate,  $(NH_4)_2Fe(SO_4)_2\cdot 6H_2O(s)$ ?
  - A. 4.00
  - B. 7.00
  - C. 8.00
  - D. 14.00
- 3. What is the maximum volume, in dm<sup>3</sup>, of  $CO_2(g)$  produced when 1.00 g of  $CaCO_3(s)$  reacts with 20.0 cm<sup>3</sup> of 2.00 mol dm<sup>-3</sup> HCl (aq)?

$$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$$

Molar volume of gas = 22.7 dm<sup>3</sup> mol<sup>-1</sup>;  $M_r$  (CaCO<sub>3</sub>) = 100.00

- A.  $\frac{1}{2} \times \frac{20.0 \times 2.00}{1000} \times 22.7$
- B.  $\frac{20.0 \times 2.00}{1000} \times 22.7$
- C.  $\frac{1.00}{100.00} \times 22.7$
- D.  $\frac{1.00}{100.00} \times 2 \times 22.7$

- I. Pressure
- II. Temperature
- III. Empirical formula
- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III
- **5.** What does  ${}^{24}_{12}$ Mg<sup>2+</sup> represent?
  - A. An ion with 12 protons and 24 neutrons
  - B. An ion with 14 protons and 24 neutrons
  - C. An ion with 12 protons and 12 neutrons
  - D. An ion with 12 protons and 22 neutrons
- 6. Which electron transition emits radiation of the longest wavelength?



- 7. Which property increases down Group 1, the alkali metals?
  - A. Atomic radius
  - B. Electronegativity
  - C. First ionization energy
  - D. Melting point

- 8. Which element is a lanthanide?
  - A. Hf
  - B. Tb
  - C. U
  - D. Y
- 9. How many bonding electrons are there in the urea molecule?



- A. 8
- B. 16
- C. 20
- D. 24
- **10.** Which bonds cause the boiling point of water to be significantly greater than that of hydrogen sulfide?
  - A. London (dispersion)
  - B. Covalent
  - C. Ionic
  - D. Hydrogen
- **11.** What are the approximate bond angles and structure of crystalline  $SiO_2$ ?

	O–Si–O	Structure
A.	90°	giant molecule
B.	109°	giant molecule
C.	180°	small molecule
D.	180°	giant molecule

- 12. Which metal has the strongest metallic bond?
  - A. Li
  - B. Na
  - С. К
  - D. Rb
- 13. What can be deduced from this reaction profile?



- A. The reactants are less stable than the products and the reaction is exothermic.
- B. The reactants are less stable than the products and the reaction is endothermic.
- C. The reactants are more stable than the products and the reaction is exothermic.
- D. The reactants are more stable than the products and the reaction is endothermic.
- **14.** Why is the value of the enthalpy change of this reaction calculated from bond enthalpy data less accurate than that calculated from standard enthalpies of formation?

 $2C_2H_6(g) + 7O_2(g) \rightarrow 4CO_2(g) + 6H_2O(g)$ 

- A. All the reactants and products are gases.
- B. Bond enthalpy data are average values for many compounds.
- C. Elements do not have standard enthalpy of formation.
- D. Standard enthalpies of formation are per mole.

- **15.** What can be deduced from the facts that ozone absorbs UV radiation in the region of 340 nm and molecular oxygen in the region of 242 nm?
  - A. The bond between atoms in molecular oxygen is a double bond.
  - B. The bonds in ozone are delocalized.
  - C. The bonds between atoms in ozone are stronger than those in molecular oxygen.
  - D. The bonds between atoms in molecular oxygen need more energy to break.

Questions 16 and 17 refer to the following reaction.

 $CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$ 

- **16.** Which change does **not** increase the initial rate of reaction when  $CaCO_3(s)$  is added to excess HCl(aq)?
  - A. Decrease in the size of the  $CaCO_3(s)$  particles
  - B. Increase in the temperature of the reaction mixture
  - C. Increase in the concentration of HCl (aq), keeping the same volume
  - D. Increase in the volume of HCl (aq), keeping the same concentration
- 17. Which methods can be used to monitor the progress of this reaction?
  - I. Change in colour of this reaction mixture
  - II. Change in mass of this reaction mixture
  - III. Change in volume of gas evolved
  - A. I and II only
  - B. I and III only
  - C. II and III only
  - D. I, II and III

**18.** What is the equilibrium constant expression,  $K_c$ , for the following reaction?

 $2NH_3(g) + 2O_2(g) \rightleftharpoons N_2O(g) + 3H_2O(g)$ 

- A.  $\frac{3[H_2O][N_2O]}{2[NH_3]2[O_2]}$
- $\mathsf{B}. ~~ \frac{\left[\mathsf{N}\mathsf{H}_{3}\right]^{2} \left[\mathsf{O}_{2}\right]^{2}}{\left[\mathsf{N}_{2}\mathsf{O}\right] \left[\mathsf{H}_{2}\mathsf{O}\right]^{3}}$
- $C. ~~ \frac{2[NH_{_3}]2[O_{_2}]}{3[H_{_2}O][N_{_2}O]}$

D. 
$$\frac{[N_2O][H_2O]^3}{[NH_3]^2[O_2]^2}$$

19. Which of the following does not react with dilute HCl (aq)?





- A. Na<sub>2</sub>CO<sub>3</sub>
- B. Cu
- C. Zn
- D. CuO

20. Which of the following is correct?

- A. A weak acid is a proton donor and its aqueous solution shows good conductivity.
- B. A weak acid is a proton donor and its aqueous solution shows poor conductivity.
- C. A weak acid is a proton acceptor and its aqueous solution shows good conductivity.
- D. A weak acid is a proton acceptor and its aqueous solution shows poor conductivity.

21. Which element is reduced in the following decomposition?

$$(NH_4)_2Cr_2O_7(s) \rightarrow N_2(g) + Cr_2O_3(s) + 4H_2O(g)$$

- A. N
- В. Н
- C. Cr
- D. O
- 22. Which of the following is not a redox reaction?
  - A.  $CH_4(g) + Cl_2(g) \rightarrow CH_3Cl(g) + HCl(g)$
  - B.  $C(s) + O_2(g) \rightarrow CO_2(g)$
  - C.  $2CO(g) \rightarrow CO_2(g) + C(s)$
  - D.  $CH_3COOH(aq) + NaOH(aq) \rightarrow CH_3COONa(aq) + H_2O(l)$
- 23. What occurs at the anode (positive electrode) during the electrolysis of molten strontium bromide?
  - A. Formation of bromine and oxidation
  - B. Formation of bromine and reduction
  - C. Formation of strontium and oxidation
  - D. Formation of strontium and reduction

24. Which functional group is present in paracetamol?



- A. Carboxyl
- B. Amino
- C. Nitrile
- D. Hydroxyl
- 25. Which describes the reaction between a halogen and ethane?

	Mechanism	Bond fission in halogen
A.	free radical	homolytic
B.	free radical	heterolytic
C.	addition	homolytic
D.	addition	heterolytic

- 26. Which conditions are used to convert ethanol to ethanal?
  - A. Excess oxidizing agent and reflux
  - B. Excess oxidizing agent and distillation
  - C. Excess ethanol and reflux
  - D. Excess ethanol and distillation

- 27. Which compound contains a secondary carbon atom?
  - A.  $CH_3CH(Cl)CH(CH_3)_2$
  - B.  $(CH_3)_2CHCH_2Cl$
  - C. (CH<sub>3</sub>)<sub>3</sub>CCl
  - D.  $CH_3CH_2Cl$
- 28. Which information can be gained from an infrared (IR) spectrum?
  - A. Ionization energy of the most abundant element
  - B. Number of different elements in the compound
  - C. Bonds present in a molecule
  - D. Molecular formula of the compound
- **29.** What can be deduced from the following <sup>1</sup>HNMR spectrum?



- A. There is only one hydrogen atom in the molecule.
- B. There is only one hydrogen environment in the molecule.
- C. The molecule is a hydrocarbon.
- D. There is only one isotope in the element.

**30.** What is the graphical relationship between *n* and *T* in the ideal gas equation, pV = nRT, all other variables remaining constant?

