

Please check the examination details below before entering your candidate information

Candidate surname

Other names

**Pearson BTEC  
Level 3  
Nationals  
Certificate**

Centre Number

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

Learner Registration Number

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

**Wednesday 22 May 2019**

Morning (Time: 40 minutes)

Paper Reference **31617H/1C**

**Applied Science / Forensic and Criminal  
Investigation**

**Unit 1: Principles and Applications of Science I  
Chemistry**

**SECTION B: PERIODICITY AND PROPERTIES OF ELEMENTS**

**You must have:**

A calculator and a ruler.

Total Marks

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

### Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and learner registration number.
- Answer **all** questions.
- Answer the questions in the spaces provided  
– *there may be more space than you need.*

### Information

- The exam comprises three papers worth 30 marks each.  
Section A: Structures and functions of cells and tissues (Biology).  
Section B: Periodicity and properties of elements (Chemistry).  
Section C: Waves in communication (Physics).
- The total mark for this exam is 90.
- The marks for **each** question are shown in brackets  
– *use this as a guide as to how much time to spend on each question.*
- The periodic table of elements can be found at the back of this paper.

### Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

P60419A

©2019 Pearson Education Ltd.

1/1/1/1/1/1/1/



Pearson

Answer ALL questions. Write your answers in the spaces provided.

Some questions must be answered with a cross . If you change your mind about an answer, put a line through the box  and then mark your new answer with a cross .

- 1 (a) Sodium chloride is an ionic compound.

One property of ionic compounds is that they conduct electricity when molten or in solution.

They do not conduct electricity when solid.

- (i) Give **one** other property of ionic compounds.

(1)

- (ii) Identify the reason why ionic compounds conduct electricity when molten.

(1)

- A** electrons are free to move
- B** electrons are held tightly in a lattice
- C** ions are free to move
- D** ions are held tightly in a lattice

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



(b) Potassium and calcium are metals.

Table 1 shows some information about potassium and calcium.

|           | melting point (°C) | atomic number | group number |
|-----------|--------------------|---------------|--------------|
| potassium | 63.5               | 19            | 1            |
| calcium   | 842.0              | 20            | 2            |

**Table 1**

Explain why the melting point of potassium is lower than the melting point of calcium. (3)

.....

.....

.....

.....

.....

.....

(c) Metals burn in oxygen to form metal oxides.

(i) Identify the formula of magnesium oxide.

You may use the periodic table to help you answer the question.

(1)

- A MgO
- B MgO<sub>2</sub>
- C Mg<sub>2</sub>O
- D Mg<sub>2</sub>O<sub>3</sub>

(ii) Transition metals have different oxidation states.

Chromium forms an oxide that has the formula Cr<sub>2</sub>O<sub>3</sub>.

Give the oxidation number of chromium in Cr<sub>2</sub>O<sub>3</sub>.

(1)

.....

**(Total for Question 1 = 7 marks)**



2 Ammonium chloride, ammonium sulfate and ammonium nitrate are used in fertilisers.

(a) Calculate the relative formula mass of ammonium chloride,  $\text{NH}_4\text{Cl}$ .

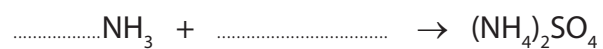
(2)

relative formula mass = .....

(b) Ammonia reacts with sulfuric acid to form ammonium sulfate.

Complete and balance the equation for this reaction.

(2)



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

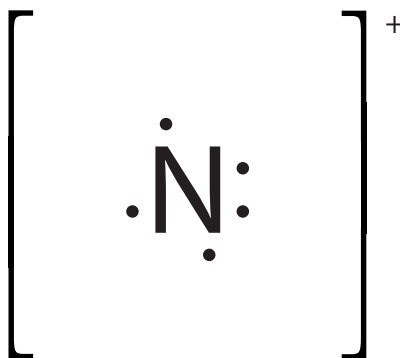


- (c) Figure 1 shows the arrangement of electrons in the outer shell of an atom of nitrogen and in an atom of hydrogen.

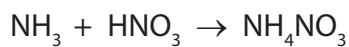


Figure 1

Complete the dot and cross diagram to show the bonding in the ammonium ion,  $\text{NH}_4^+$ .  
(2)



- (d) Ammonia reacts with nitric acid to make ammonium nitrate.



Calculate the mass of ammonia required to make 5.0 g of ammonium nitrate.

relative formula mass of  $\text{NH}_3 = 17$

relative formula mass of  $\text{NH}_4\text{NO}_3 = 80$

(3)

mass of ammonia ..... g

**(Total for Question 2 = 9 marks)**



3 (a) Lithium, Li, is a metal in group 1 of the periodic table.

(i) What is the name given to group 1 of the periodic table?

(1)

- A alkali metals
- B alkaline earth metals
- C halogens
- D transition metals

(ii) Lithium has an atomic number of 3.

Complete the electronic configuration of lithium.

(1)

1s<sup>.....</sup> 2s<sup>.....</sup>

(iii) Write the equation to show the first ionisation energy of lithium.

(2)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



(b) Table 2 shows the atomic number and first ionisation energy of some of the elements in group 1.

| element   | atomic number | first ionisation energy (kJ mol <sup>-1</sup> ) |
|-----------|---------------|---|
| lithium   | 3             | 520   |
| sodium    | 11            | 496   |
| potassium | 19            | 419   |

**Table 2**

Explain why the first ionisation energy of the group 1 elements in Table 2 decreases as the atomic number increases.

(4)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

**(Total for Question 3 = 8 marks)**







DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Handwriting practice area with 25 horizontal dotted lines.

**(Total for Question 4 = 6 marks)**

**TOTAL FOR SECTION B = 30 MARKS**





DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

**BLANK PAGE**



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

**BLANK PAGE**



# The Periodic Table of Elements

|       | 1                                    | 2  | 3   | 4                                    | 5                                     | 6                                       | 7                                     | 0 (8)                                   |   |   |  |   |   |                                    |                                      |                                      |                                   |  |  |
|-------|--------------------------------------|--|-----|--------------------------------------|---------------------------------------|---|---------------------------------------|---|---|---|--|---|---|------------------------------------|--------------------------------------|--------------------------------------|-----------------------------------|--|--|
|       | 1.0<br><b>H</b><br>hydrogen<br>1     |  |     |                                      |                                       |   |                                       | 4.0<br><b>He</b><br>helium<br>2         |   |   |  |   |   |                                    |                                      |                                      |                                   |  |  |
| (1)   | 6.9<br><b>Li</b><br>lithium<br>3     | 9.0<br><b>Be</b><br>beryllium<br>4       | (2) |                                      |                                       |   |                                       | 19.0<br><b>F</b><br>fluorine<br>9       | 20.2<br><b>Ne</b><br>neon<br>10         |   |  |   |   |                                    |                                      |                                      |                                   |  |  |
|       | 23.0<br><b>Na</b><br>sodium<br>11    | 24.3<br><b>Mg</b><br>magnesium<br>12     |     |                                      |                                       |   |                                       | 35.5<br><b>Cl</b><br>chlorine<br>17     | 39.9<br><b>Ar</b><br>argon<br>18        |   |  |   |   |                                    |                                      |                                      |                                   |  |  |
| (3)   | 39.1<br><b>K</b><br>potassium<br>19  | 40.1<br><b>Ca</b><br>calcium<br>20       | (4) | 47.9<br><b>Ti</b><br>titanium<br>22  | 50.9<br><b>V</b><br>vanadium<br>23    | 52.0<br><b>Cr</b><br>chromium<br>24     | 54.9<br><b>Mn</b><br>manganese<br>25  | 58.9<br><b>Co</b><br>cobalt<br>27       | 63.5<br><b>Cu</b><br>copper<br>29       | 65.4<br><b>Zn</b><br>zinc<br>30           | 69.7<br><b>Ga</b><br>gallium<br>31       | 72.6<br><b>Ge</b><br>germanium<br>32  | 74.9<br><b>As</b><br>arsenic<br>33      | 79.0<br><b>Br</b><br>bromine<br>35 | 83.8<br><b>Kr</b><br>krypton<br>36   |                                      |                                   |  |  |
|       | 85.5<br><b>Rb</b><br>rubidium<br>37  | 87.6<br><b>Sr</b><br>strontium<br>38     |     | 91.2<br><b>Zr</b><br>zirconium<br>40 | 92.9<br><b>Nb</b><br>niobium<br>41    | 95.9<br><b>Mo</b><br>molybdenum<br>42   | [98]<br><b>Tc</b><br>technetium<br>43 | 101.1<br><b>Ru</b><br>ruthenium<br>44   | 102.9<br><b>Rh</b><br>rhodium<br>45     | 106.4<br><b>Pd</b><br>palladium<br>46     | 107.9<br><b>Ag</b><br>silver<br>47       | 112.4<br><b>Cd</b><br>cadmium<br>48   | 114.8<br><b>In</b><br>indium<br>49      | 118.7<br><b>Sn</b><br>tin<br>50    | 121.8<br><b>Sb</b><br>antimony<br>51 | 126.9<br><b>I</b><br>iodine<br>53    | 131.3<br><b>Xe</b><br>xenon<br>54 |  |  |
|       | 132.9<br><b>Cs</b><br>caesium<br>55  | 137.3<br><b>Ba</b><br>barium<br>56       |     | 178.5<br><b>Hf</b><br>hafnium<br>72  | 180.9<br><b>Ta</b><br>tantalum<br>73  | 183.8<br><b>W</b><br>tungsten<br>74     | 186.2<br><b>Re</b><br>rhenium<br>75   | 190.2<br><b>Os</b><br>osmium<br>76      | 192.2<br><b>Ir</b><br>iridium<br>77     | 195.1<br><b>Pt</b><br>platinum<br>78      | 197.0<br><b>Au</b><br>gold<br>79         | 200.6<br><b>Hg</b><br>mercury<br>80   | 204.4<br><b>Tl</b><br>thallium<br>81    | 207.2<br><b>Pb</b><br>lead<br>82   | 209.0<br><b>Bi</b><br>bismuth<br>83  | [210]<br><b>At</b><br>astatine<br>85 | [222]<br><b>Rn</b><br>radon<br>86 |  |  |
| (223) | [223]<br><b>Fr</b><br>francium<br>87 | [226]<br><b>Ra</b><br>radium<br>88       | (3) | 227<br><b>Ac*</b><br>actinium<br>89  | [262]<br><b>Db</b><br>dubnium<br>105  | [266]<br><b>Sg</b><br>seaborgium<br>106 | [264]<br><b>Bh</b><br>bohrium<br>107  | [277]<br><b>Hs</b><br>hassium<br>108    | [268]<br><b>Mt</b><br>meitnerium<br>109 | [271]<br><b>Ds</b><br>darmstadtium<br>110 | [272]<br><b>Rg</b><br>roentgenium<br>111 | Elements with atomic numbers 112-116 have been reported but not fully authenticated |   |                                    |                                      |                                      |                                   |  |  |
|       | 140<br><b>Ce</b><br>cerium<br>58     | 141<br><b>Pr</b><br>praseodymium<br>59   |     | 144<br><b>Nd</b><br>neodymium<br>60  | 150<br><b>Sm</b><br>samarium<br>62    | 152<br><b>Eu</b><br>europium<br>63      | 157<br><b>Gd</b><br>gadolinium<br>64  | 163<br><b>Dy</b><br>dysprosium<br>66    | 165<br><b>Ho</b><br>holmium<br>67       | 167<br><b>Er</b><br>erbium<br>68          | 169<br><b>Tm</b><br>thulium<br>69        | 173<br><b>Yb</b><br>ytterbium<br>70   | 175<br><b>Lu</b><br>lutetium<br>71      | * Lanthanide series                |                                      |                                      |                                   |  |  |
|       | 232<br><b>Th</b><br>thorium<br>90    | [231]<br><b>Pa</b><br>protactinium<br>91 |     | 238<br><b>U</b><br>uranium<br>92     | [242]<br><b>Pu</b><br>plutonium<br>94 | [243]<br><b>Am</b><br>americium<br>95   | [247]<br><b>Cm</b><br>curium<br>96    | [251]<br><b>Cf</b><br>californium<br>98 | [254]<br><b>Es</b><br>einsteinium<br>99 | [253]<br><b>Fm</b><br>fermium<br>100      | [256]<br><b>Md</b><br>mendelevium<br>101 | [254]<br><b>No</b><br>nobelium<br>102   | [257]<br><b>Lr</b><br>lawrencium<br>103 | * Actinide series                  |                                      |                                      |                                   |  |  |



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA