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1

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## Level 1 Chemistry, 2016

### 90933 Demonstrate understanding of aspects of selected elements

2.00 p.m. Monday 21 November 2016  
 Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of aspects of selected elements.	Demonstrate in-depth understanding of aspects of selected elements.	Demonstrate comprehensive understanding of aspects of selected elements.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

**You should attempt ALL the questions in this booklet.**

A periodic table and other reference material are provided in the Resource Booklet L1–CHEMR.

If you need more room for any answer, use the extra space provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–9 in the correct order and that none of these pages is blank.

**YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.**

**Achievement**

**TOTAL**

**09**

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## QUESTION ONE

- (a) (i) Give TWO physical properties each for the elements magnesium and nitrogen.

Magnesium (Mg)

- metal
- malleable
- lustrous
- high density

Nitrogen (N)

- Non-metal
- can come in form of liquid gas

- (ii) Explain how the formation of magnesium ions differs from the formation of nitrogen ions, and link this to the positions of magnesium and nitrogen on the periodic table.

Magnesium and Nitrogen have different ions due to the amount of electrons on outer shell. Magnesium has an electron configuration of (2, 8, 2), this means it has two electrons on outer shell. For the element to become stable it needs to lose 2 electrons, therefore it creates a  $2^+$  ion. Ions are charged particles, formed by loss or gain of electrons. Nitrogen has the <sup>electron</sup> configuration of (2, 5). For it to become stable it needs to gain 3 electrons by giving it the  $3^-$  ions. Magnesium is placed in group two because it is very reactive (doesn't take much to lose 2 electrons) and Nitrogen is in group 15 because it is very unreactive due to having to

- (b) What similarities and differences do elements in the same **group** of the periodic table show, in:
- the reactions they take part in?
  - their reactivity?

Use the elements Li, Na, F, and Cl to illustrate and explain your answer.

In your answer, you should include links to the electron arrangements of these elements.

*No chemical equations are needed.*

The elements that are within the same group on the periodic table have the same amount of electrons on the valance shell (outer shell). Depending on the amount of electrons an outer shell will depend on the reactivity of the elements. For example the elements Li Na are in group one, they only need to lose one electron to become this makes these elements very reactive. Another example is the elements F and Cl, the elements are non-metals that need to gain one electron to become stable, this makes them not very reactive.

electron configuration Li = (2, 1) Na = (2, 8, 1)

electron configuration  $\neq$  F = (2, 7) Cl = (2, 8, 7)

## QUESTION TWO

Iron is a very useful metal because its physical properties make it suitable for uses such as car bodies, framing, and roofs. Iron is often alloyed (combined) with carbon to form steel.

- (a) (i) Describe why alloying iron with carbon to form steel makes it more useful, with reference to the relevant physical and chemical properties of steel.

Iron is a very tough, strong, low density metal. Carbon is very soft and malleable.

Combining the two would make the alloy have strength, toughness but also malleability to make it easy to shape.

Carbon is soft due to the placement of atoms. They are in layers and have room for free electrons allowing the atoms to slide easily. ∴ malleable

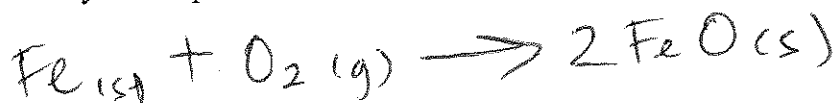
- (ii) For the reaction of iron with oxygen:

- complete the word equation in the box below
- give the balanced symbol equation in the box below.

Word equation:

iron + oxygen → iron oxide

Balanced symbol equation:



(b) Iron and steel can be galvanised with zinc.

Sacrificial protection

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Explain how the physical and chemical properties of zinc make it suitable for galvanising iron/steel.

*You may refer to the activity series in your resource booklet.*

Zinc is a great metal to use for galvanising iron/steel because it is more reactive. Because it is more reactive it will corrode before the iron/steel starts too, this means it will protect the iron/steel from corrosion longer than if you didn't galvanise the material. This process is called sacrificial protection.

Sacrificial protection is when you use a more reactive metal to help hold protect another metal (which is less reactive) from corrosion.

∴ The iron/steel will have better strength because corrosion would weaken the metals.

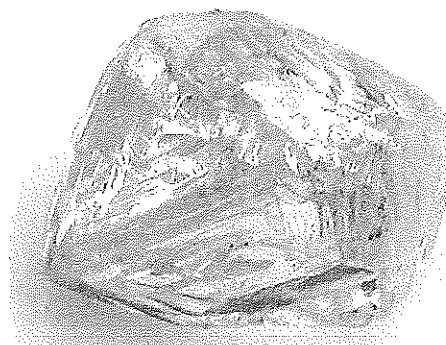
## QUESTION THREE

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The elements sulfur,  $S_8$ , and diamond, C, are both important in many manufacturing processes.



<http://www.pbase.com/merlotadl/image/55921128>



<http://www.safarinsouthafrica.com/day-safaris/diamonds-tour.html>

- (a) Give TWO ways that the two elements are different in their physical properties.

Sulfur is a yellow, brittle, solid.  
Diamond is the hardest substance discovered on earth and is very shiny. (lustrous)

- (b) Carbon exists in different forms, called allotropes, which allow it to be used for a wide variety of uses. Two common uses for carbon allotropes are:

- pencil tips
- miniature wires in electrical circuits.

Complete the table below by naming the allotrope of carbon that is most likely to be used for each of the uses given above.

Explain your choice by linking the uses to the properties of each allotrope.

Use	Carbon allotrope
pencil tips	Graphite
miniature wires in electrical circuits	Graphite

$C_{60}$  ~~graphite~~, graphite, diamond

**Explanation**ASSESSOR'S  
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Pencil tips: Graphite would be the perfect allotrope of carbon used to make pencil tips because it is very soft. 3 Carbon atoms join together to form graphite, these atoms organise each other in a network of layers. This means the electrons can flow between them, allowing movement and the atoms to slide over each other.

**Miniature wires:**

When making miniature wires I would also use graphite as it is a weak conductor of electricity because the electrons between the atoms have room to move this means the charge can easily flow through.

**Question Three continues  
on the following page.**

(c) Oxygen also exists in different forms. Ozone,  $O_3$ , is an allotrope of oxygen,  $O_2$ .

Give one use for each of the allotropes,  $O_2$  and  $O_3$ , and link each use to a physical and a chemical property of the allotrope.

Support your answer with balanced symbol equations, where relevant.

Oxygen  $O_2$  - colourless, odourless gas + tasteless  
- used in respiratory system of organism  
and is an important part of medical care.

Ozone  $O_3$  - pale blue, pungent odour, suffocating gas  
- ozone protects our earth from harmful  
UV light from sun (99-97% UV light).  
Takes up around 70% of atmosphere.  
- 13% more soluble than oxygen.  
- ozone is also used as a disinfectant  
It's powerful at killing bacteria  
It's used to sterilise water, used over  
chlorine because it doesn't create any  
harmful chemical by products.

Balanced symbol equations:

A3





## Annotated Exemplar Template

### Achievement Exemplar 2016

Subject:	Chemistry	Standard:	90933	Total score:	09
Q	Grade score	Annotation			
1	A3	<p>The candidate has been awarded A3 for this response as they have given physical properties of magnesium and identified nitrogen as a non-metal in part (a)(i). In (a)(ii), the candidate has linked the number of valence electrons to the charge on the ion formed (this part of the candidate's response is Merit level).</p> <p>In part (b), the candidate has shown recognition of similar reactions within a group of elements in group 1. There was an attempt to add reactivity in their description of group 17, but stated that group 17 elements are unreactive. Correct explanation in this part of the response would have lifted the candidate into Merit for this question.</p>			
2	A3	<p>The candidate has been awarded A3 as they have shown recognition that alloying iron with carbon can give more desirable physical properties in part (a)(i). In part (a)(ii), the candidate has identified iron oxide as the product in the word equation but they have gone on to complete the symbol equation with the <math>\text{Fe}^{2+}</math> ion being formed rather than the <math>\text{Fe}^{3+}</math> ion.</p> <p>Finally, in part (b) of the question, the candidate has stated that zinc is more reactive than iron. Greater detail about the physical and / or chemical properties of zinc including things such as its lower melting point, malleability or that it provides a physical barrier would move this response up to Merit.</p>			
3	A3	<p>In part (a), the candidate has given a physical property of both sulfur (brittleness, as colour was not accepted) and diamond (hardness). In part (b), graphite has been identified as a suitable allotrope of carbon for use in pencil tips and they have gone on to explain its physical properties (this part of the candidate response is moving into Merit territory).</p> <p>Finally, in part (c), the candidate has identified a use of ozone (disinfectant) and given a physical property of both the <math>\text{O}_2</math> and <math>\text{O}_3</math> allotropes (gases). The candidate could have linked the identified use of ozone (disinfectant) to its physical properties to start to move towards Merit.</p>			