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 16 January 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 will need:
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 ▶

P61805A

1/1/1/1/1/1/1/1/1/e2/C2

P 6 1 8 0 5 A 0 1 1 2

Pearson

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

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

1 Aluminium is a metal.

Aluminium is used in power lines.

One reason why aluminium can be used in power lines is because it is ductile.

(a) (i) State **one** other physical property that makes aluminium suitable for use in power lines.

(1)

.....

.....

(ii) Explain why metals are ductile.
You should refer to atoms in your answer.

(2)

.....

.....

.....

.....

(b) (i) Aluminium oxide is a product of the thermite reaction.

Identify the type of bonding in aluminium oxide.

(1)

☒ **A** hydrogen

☒ **B** ionic

☒ **C** metallic

☒ **D** van der Waals

(ii) The thermite reaction can be used to join railway tracks together.

Aluminium is used in this reaction to produce iron from iron oxide.

$$Fe_2O_3 + 2Al \rightarrow 2Fe + Al_2O_3$$

Explain why this reaction is a redox reaction.

(4)

(Total for Question 1 = 8 marks)

BLANK PAGE

2 Figure 1 shows an outline of part of the periodic table.

The shapes show the positions of four elements.

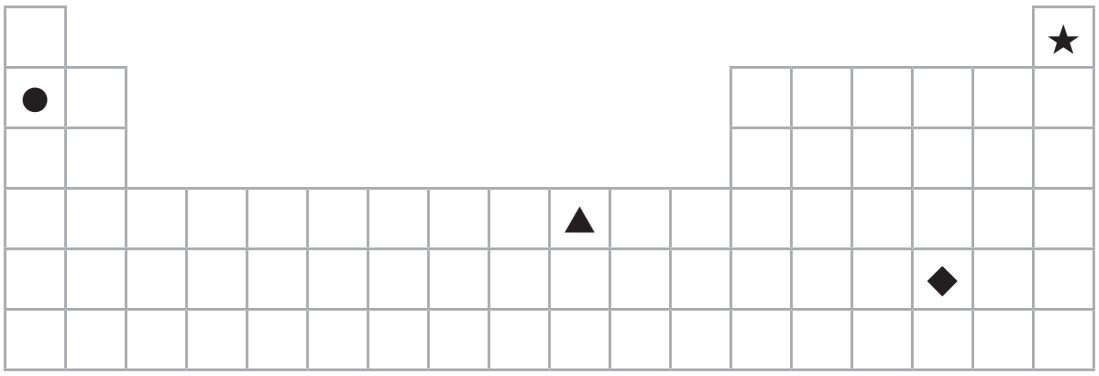

Figure 1

(a) (i) Identify the shape that shows the position of a transition metal in the periodic table.

(1)

- ☒ **A** ●
- ☒ **B** ▲
- ☒ **C** ◆
- ☒ **D** ★

(ii) Identify the shape that shows the position of a non-metal with low melting and boiling points in the periodic table.

(1)

- ☒ **A** ●
- ☒ **B** ▲
- ☒ **C** ◆
- ☒ **D** ★

(b) Element **X** has the electronic configuration $1s^2\,2s^2\,2p^6\,3s^2\,3p^5$.

(i) State the block of the periodic table where the element can be found.

(1)

.....

(ii) The element forms the ion $\mathbf{X}^-$.

Complete the electronic configuration of the $\mathbf{X}^-$ ion.

(1)

$1s^2\,2s^2\,2p^6\,3s^2\,3p$ .....

(c) (i) Figure 2 shows the relative melting points of some of the elements in period 2.

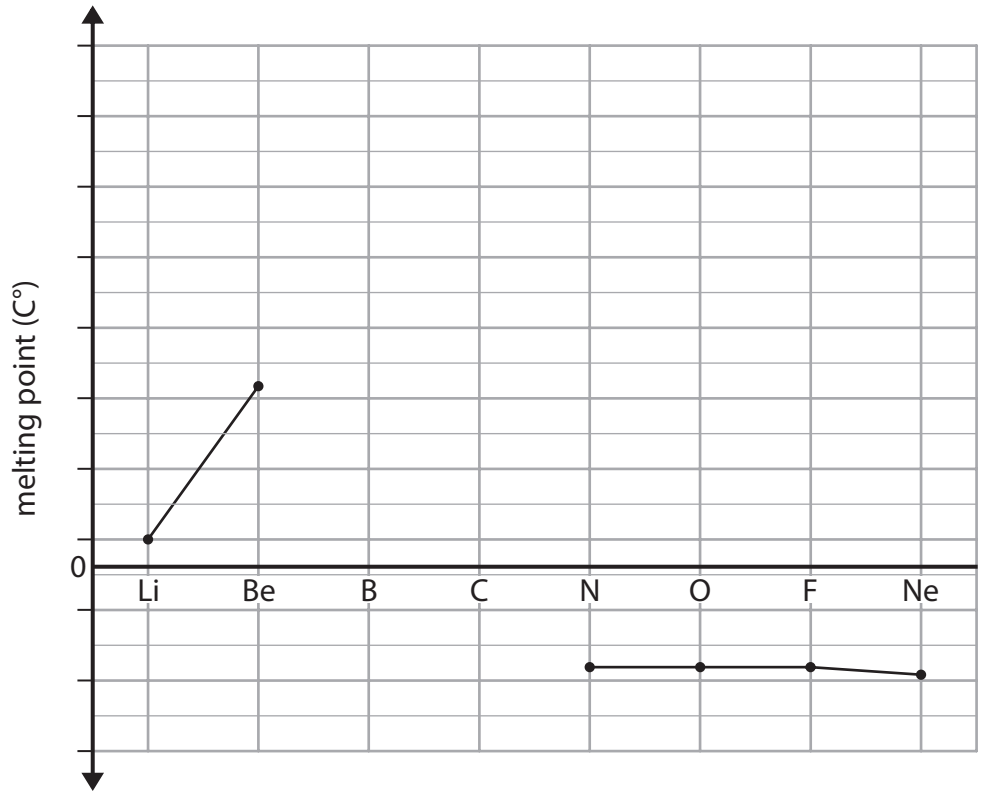

Figure 2

Complete Figure 2 to show how the relative melting points change from Be to N.

(2)

(ii) Table 1 shows the atomic numbers and melting points of the elements in group 7.

group 7	atomic number	melting point (°C)
fluorine	9	−220
chlorine	17	−101
bromine	35	−7
iodine	53	114
astatine	85	302

Table 1

Explain why the melting point increases as the atomic number increases.

(3)

.....

.....

.....

.....

.....

.....

(Total for Question 2 = 9 marks)

3 Oxygen exists as the molecule O_2 in the Earth's atmosphere and is needed for combustion.

(a) Draw the dot and cross diagram for a molecule of oxygen, O_2.

(2)

Show the outer electrons only.

(b) A student burns magnesium in air to produce 1.40 g of magnesium oxide.

The theoretical yield of magnesium oxide for the experiment is 2.00 g.

(i) Calculate the percentage yield for the student's experiment.

(2)

percentage yield = ... %

(ii) Magnesium reacts with oxygen to form magnesium oxide.

$$2Mg + O_2 \rightarrow 2MgO$$

2.43 g of magnesium was burned.

Calculate the theoretical yield of magnesium oxide.

(3)

theoretical yield of magnesium oxide = ...g

(Total for Question 3 = 7 marks)

4 A student collected some data about the atomic radius and ionic radius of three elements and their ions.

Table 2 shows the data.

atomic radius (nm)	ionic radius (nm)
O = 0.073	O^{2-} = 0.140
F = 0.071	F^{-} = 0.133
S = 0.102	S^{2-} = 0.185

Table 2

Discuss the atomic radius and ionic radius data in Table 2.

(6)

(Total for Question 4 = 6 marks)

TOTAL FOR SECTION B = 30 MARKS

The Periodic Table of Elements

1	2											3	4	5	6	7	0 (8) (18)
							1.0 H hydrogen 1										4.0 He helium 2
(1)	(2)		Key: relative atomic mass / atomic symbol / name / atomic (proton) number									(13)	(14)	(15)	(16)	(17)	
6.9 Li lithium 3	9.0 Be beryllium 4											10.8 B boron 5	12.0 C carbon 6	14.0 N nitrogen 7	16.0 O oxygen 8	19.0 F fluorine 9	20.2 Ne neon 10
23.0 Na sodium 11	24.3 Mg magnesium 12	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	27.0 Al aluminium 13	28.1 Si silicon 14	31.0 P phosphorus 15	32.1 S sulfur 16	35.5 Cl chlorine 17	39.9 Ar argon 18
39.1 K potassium 19	40.1 Ca calcium 20	45.0 Sc scandium 21	47.9 Ti titanium 22	50.9 V vanadium 23	52.0 Cr chromium 24	54.9 Mn manganese 25	55.8 Fe iron 26	58.9 Co cobalt 27	58.7 Ni nickel 28	63.5 Cu copper 29	65.4 Zn zinc 30	69.7 Ga gallium 31	72.6 Ge germanium 32	74.9 As arsenic 33	79.0 Se selenium 34	79.9 Br bromine 35	83.8 Kr krypton 36
85.5 Rb rubidium 37	87.6 Sr strontium 38	88.9 Y yttrium 39	91.2 Zr zirconium 40	92.9 Nb niobium 41	95.9 Mo molybdenum 42	[98] Tc technetium 43	101.1 Ru ruthenium 44	102.9 Rh rhodium 45	106.4 Pd palladium 46	107.9 Ag silver 47	112.4 Cd cadmium 48	114.8 In indium 49	118.7 Sn tin 50	121.8 Sb antimony 51	127.6 Te tellurium 52	126.9 I iodine 53	131.3 Xe xenon 54
132.9 Cs caesium 55	137.3 Ba barium 56	138.9 La* lanthanum 57	178.5 Hf hafnium 72	180.9 Ta tantalum 73	183.8 W tungsten 74	186.2 Re rhenium 75	190.2 Os osmium 76	192.2 Ir iridium 77	195.1 Pt platinum 78	197.0 Au gold 79	200.6 Hg mercury 80	204.4 Tl thallium 81	207.2 Pb lead 82	209.0 Bi bismuth 83	[209] Po polonium 84	[210] At astatine 85	[222] Rn radon 86
[223] Fr francium 87	[226] Ra radius 88	[227] Ac* actinium 89	[261] Rf rutherfordium 104	[262] Db dubnium 105	[266] Sg seaborgium 106	[264] Bh bohrium 107	[277] Hs hassium 108	[268] Mt meitnerium 109	[271] Ds darmstadtium 110	[272] Rg roentgenium 111							

Elements with atomic numbers 112-116 have been reported but not fully authenticated

* Lanthanide series

* Actinide series

140 Ce cerium 58	141 Pr praseodymium 59	144 Nd neodymium 60	[147] Pm promethium 61	150 Sm samarium 62	152 Eu europium 63	157 Gd gadolinium 64	159 Tb terbium 65	163 Dy dysprosium 66	165 Ho holmium 67	167 Er erbium 68	169 Tm thulium 69	173 Yb ytterbium 70	175 Lu lutetium 71
232 Th thorium 90	[231] Pa protactinium 91	238 U uranium 92	[237] Np neptunium 93	[242] Pu plutonium 94	[243] Am americium 95	[247] Cm curium 96	[245] Bk berkelium 97	[251] Cf californium 98	[254] Es einsteinium 99	[253] Fm fermium 100	[256] Md mendelevium 101	[254] No nobelium 102	[257] Lr lawrencium 103