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 ▶

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P 6 0 4 1 9 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 (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

(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_2

☒ **C** Mg_2O

☒ **D** Mg_2O_3

(ii) Transition metals have different oxidation states.

Chromium forms an oxide that has the formula Cr_2O_3.

Give the oxidation number of chromium in Cr_2O_3.

(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, NH_4Cl.

(2)

relative formula mass = ...

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

Complete and balance the equation for this reaction.

(2)

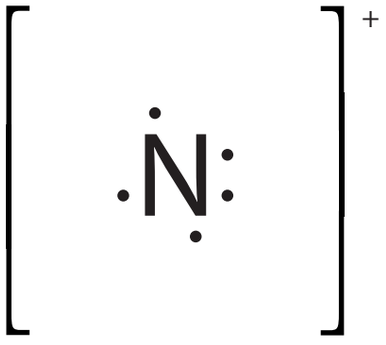
..... NH_3 + ... $\rightarrow$ $(NH_4)_2SO_4$

(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, NH_4^+.

(2)



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

$$NH_3 + HNO_3 \rightarrow NH_4NO_3$$

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

relative formula mass of $NH_3 = 17$

relative formula mass of $NH_4NO_3 = 80$

(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)

$1s^{\cdots\cdots}$ $2s^{\cdots\cdots}$

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

(2)

(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^{-1})
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)

4 Water, H_2O, and methane, CH_4, are simple covalent compounds.

The boiling point of water is 100°C.
The boiling point of methane is –164°C.

Explain the difference in boiling points between water and methane, in terms of intermolecular forces present.

(6)

(Total for Question 4 = 6 marks)

TOTAL FOR SECTION B = 30 MARKS

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The Periodic Table of Elements

1	2											3	4	5	6	7	0 (8)
							1.0 H hydrogen 1										(18) 4.0 He helium 2
(1)	(2)											(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 radium 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							

Key: relative atomic mass / **atomic symbol** / name / atomic (proton) number

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

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

* Lanthanide series

* Actinide series