4E Pure SKSS Chemistry Prelim Exam 2019 Paper 1– Answers

1	D	11	C	21	D	31	C
2	D	12	B	22	C	32	C
3	D	13	C	23	A	33	B
4	D	14	D	24	B	34	B
5	D	15	A	25	C	35	D
6	A	16	D	26	B	36	B
7	C	17	C	27	A	37	A
8	C	18	B	28	D	38	D
9	B	19	B	29	A	39	B
10	C	20	A	30	C	40	D

4E Pure SKSS Chemistry Prelim Exam 2019 Paper 2– Answers

1 (a) E (b) B (c) A (d) E (e) C 5

2 (a)

element	most common oxidation states	metal or non-metal?
A	−2	**non-metal**
B	+2, +3, +4, +6, +7	**metal**
C	+1	non-metal
D	+3	**metal**
E	−1	**non-metal**

1 all correct entries

(b) (i) C (ii) A (iii) B 3

(c) Elements in Group 0 have a full valence shell (allow: stable noble gas configuration), 1
they are electronically stable and do not form ions as they are chemically unreactive. 1
(allow: do not need to gain or lose electrons)
(**not accepted**: electronically stable alone / chemically unreactive alone / noble gas alone / full electron shell)

3 (a) Neutralisation occur, a salt and water is produced. 1
(**no mark**: mention neutralisation alone)

(b) Dilute ethanoic acid is a weak acid and is partially ionised into hydrogen ions (H^+) in solution. Hydrochloric acid is strong acid and it is completely ionised into hydrogen ions (H^+) in solution. (**no mark**: mention of strong acid or weak acid alone) } 1

There are more hydrogen ions (H^+) ions per unit volume in hydrochloric acid, hence there are more frequent effective collisions between the reactants and thus rate of reaction of hydrochloric acid with metal oxides is faster than that of ethanoic acid with metal oxides. } 1

(c)

solutions that are mixed	formula of precipitate	colour of precipitate
aqueous copper(II) sulfate and aqueous sodium hydroxide	**$Cu(OH)_2$**	**blue**
aqueous potassium iodide and aqueous silver nitrate	**AgI**	**yellow**
dilute sulfuric acid and aqueous barium chloride	**$BaSO_4$**	**white**

1m for each formula, **max 3**

1m - all correct colours of ppt

Total: [4]

4 (a) Any **2** of the following: 2
chromium is more attractive / shiny than steel /
to improve the appearance of steel /
to resist corrosion / rusting of steel

(**reject:** make it harder / serves as protective layer)

(b) $Cr_2(SO_4)_3$ 1

(c) $Cr^{3+}(aq) + 3e \rightarrow Cr(s)$

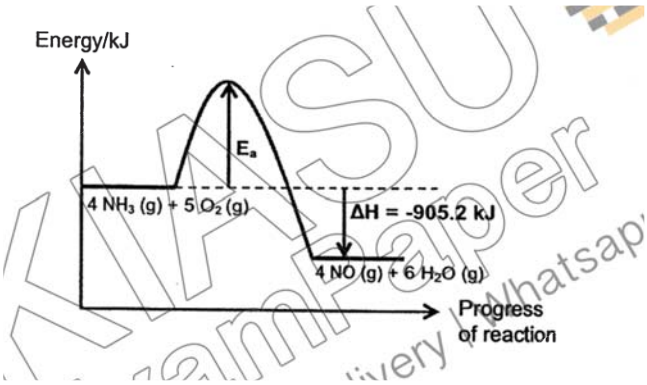
correct equation with correct balancing 1

correct state sym (this mark is only awarded if all the formula are correct) 1

(d) oxygen 1
gas relights / rekindles a glowing splint 1
(**no mark**: glowing splint alone)

(e) to replace chromium ions that are used to plate the steel / chromium ions are used up; 1
copper(II) ions are continually being replaced from copper anode (active electrode) 1

5 (a)



Correct exothermic profile **and** correct labels for axes , reactants and products 1

Correct E_a and ΔH indicated on diagram, and correct direction of arrows 1

(**no mark**: use of double-headed arrows; wrong symbols for E_a or ΔH)

(b) Oxidation occurs in NH_3, oxidation state of N increases from −3 to +2 1

Reduction occurs in O_2, oxidation state of O decreases from 0 to −2 1

(**no mark**: if oxidation state changes are mentioned but did not state oxidation or reduction)

(c) (i) $3NO_2 + H_2O \rightarrow 2HNO_3 + NO$ 1

(ii) distillation 1

(**reject:** fractional distillation / heating / evaporation)

6 (a) (i) bromine and potassium chloride 1
(**reject:** bromine gas)

(ii) colourless solution becomes red-brown 1
(**no mark**: solution becomes red-brown)

(b) **No. of moles of C*l***
$= \frac{(0.366-0.224)}{35.5}$
=0.004

No. of moles of O
$= \frac{0.224}{16}$
= 0.014

1

NOTE: This mark is only awarded if the above working is shown

whole no. ratio of C*l* : O = 1 : 3.5
= 2 : 7 1

Empirical formula is $\mathbf{Cl_2O_7}$ 1

7 (a) calcium oxide (**reject**: CaO) 1

(b) thermal decomposition (**reject**: decomposition) 1

(c) carbon dioxide comes from the thermal decomposition of limestone / 1
carbon dioxide is a product of the reaction
(**no mark:** carbon dioxide is produced from combustion)

(d) neutralising acidic soils / treating acidic lakes / flue gas desulfurisation / drying agent for ammonia gas 1
(**no mark**: neutralise soil / drying agent alone)

(e) **Answers need to be accompanied with specific scientific terms** 1
temperature of Bunsen / temperature of heat source / distance of Bunsen burner from the tube / mass of carbonate used / duration of heating

(**no mark**: amount of carbonate / amount of heat / temperature alone / strength of heat)

(f) (i) calcium carbonate 1

(ii) 27 **cm^3** (mark is **only** awarded when this answer is **indicated on the graph, and with correct units**) 1

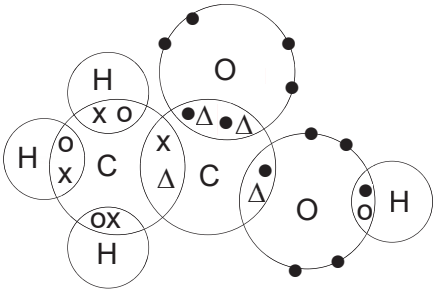
(iii) Calcium carbonate produces carbon dioxide at the highest rate, followed by strontium carbonate, and lastly barium carbonate. 1
(**no mark:** calcium produces highest amount, followed by strontium, and lastly barium ➔ wrong concept , it is not the metal that produces the gas!)

State the trend: less rapid reaction the further down the Group / down Group II 1
(accept reverse argument)

7	(g)	add hydrochloric acid to carbonate		1
		bubble gas (carbon dioxide) through limewater, gas produced white precipitate (accept – ppt) in limewater		1
		carbon dioxide is <u>produced / evolved / given out</u>, carbonate is present (**no mark**: carbon dioxide is present)		1
8	(a)	(i)	In Fig. 8.1, there are **<u>2 ions</u>** (accept particles) / **<u>2 peaks</u>** which have **<u>different m/z values</u>** of **<u>6 and 7</u>**.	1
			This shows that these two ions have **<u>different number of neutrons</u>**.	1
		(ii)	$\left(\frac{3.75}{100}\times 6\right)+\left(\frac{96.25}{100}\times 7\right)=$ 6.9625 ≈ **6.96** (3sf)	1
	(b)	(i)	x = 35 + 37 = 72 y = 37 + 37 = 74 **NOTE:** No mark will be awarded if no working is shown	1 1
		(ii)	Chlorine exists as <u>diatomic molecules</u>. There are 3 possible combinations as follow: 2 atoms of Chlorine – 35 1 atom of Chlorine – 35 and 1 atom of Chlorine – 37 2 atoms of Chlorine – 37 **NOTE:** if student **<u>did not list out the combinations</u>** ➔ **<u>no marks</u>** awarded	1 1
	(c)	(i)	Propane has a <u>relative molecular mass of 44</u> / <u>molar mass of 44 g/mol</u>) (**no mark**: wrong use of terms e.g. mass = 44; molecular mass = 44) The largest m/z value is 44, which belong to the ion formed by the **<u>largest molecule</u>**. This molecule would be that of the unknown hydrocarbon as it is **<u>unbroken</u>**.	1 1
		(ii)	CH_2^+	1
		(iii)	The **<u>highest m/z value</u>** recorded would be **<u>58</u>**. There would also be **<u>more peaks</u>** on the mass spectrum of butane. (**no mark:** vague phrases e.g. should be higher than propane)	1 1

9 (a) carbon, oxygen, hydrogen 1

(b)



Covalent bonding shown + Correct number of shared electrons in all the atoms 1

Correct number of valence electrons on 2 oxygen atoms that are not involved in bonding 1

(c) It will have a **low boiling point**. 1
Not much energy is required to overcome the weak intermolecular forces between the ethanoic acid molecules. 1
(**zero mark**: high boiling point)

(d) (i) magnesium ethanoate and hydrogen 1

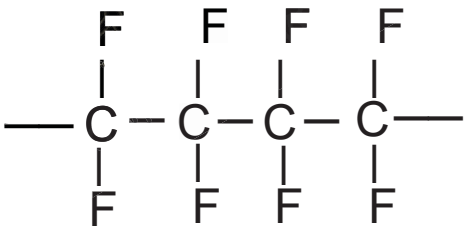
(ii) $Mg(s) + 2CH_3COOH(aq) \rightarrow (CH_3COO)_2Mg(aq) + H_2(g)$

correct formula, equation correctly balanced 1

correct state sym (this mark is only awarded if all the formula are correct 1

E10 (a) (i) addition polymerisation (**reject**: additional polymerisation) 1

(ii) 1



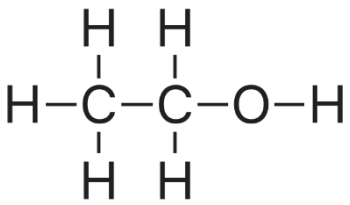
No mark awarded if the end bonds are not drawn / if brackets are drawn

(iii) M_r of one repeat unit = (12 x 2) + (19 x 4) = 100
No. of repeat units = (1.2×10^6) / 100 = **12 000** 1

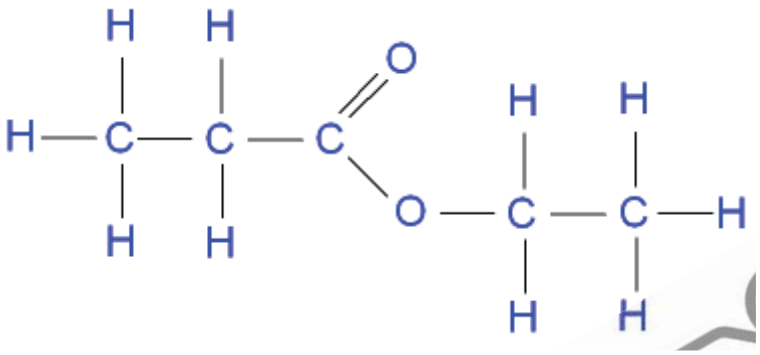
(iv) Low-grade PTFE molecules are smaller in size, hence the force of attraction between the molecules is weaker (accept : weaker intermolecular forces) than that of high-grade PTFE molecules, hence lesser energy is needed to overcome the low-grade PTFE molecules. 1
NOTE: all underlined words must be stated before mark is awarded

(v) Substances made of PTFE are non-biodegradable. 1
If they are disposed by burning, toxic gases are released / 1
if they are disposed by burying, valuable land space is used up as landfills.
(**reject**: greenhouse gases / pollute land and sea)

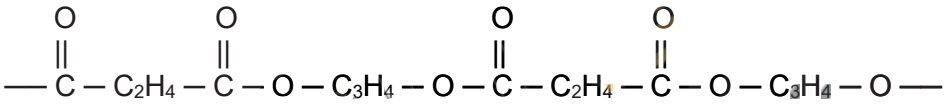
E10 (b) (i) 1



(ii) 1



(c)



1 repeat unit shown 1

2 repeat units shown 2

OR

10 (a) (i) Oxygen is needed to react with / oxidise carbon to reduce the carbon content and produce low-carbon steel. 1

To produce titanium, argon is used to create an inert / unreactive atmosphere, as the presence of oxygen would cause a reaction / oxidation to occur with titanium 1 1

(b) (i) iron(III) oxide (**reject:** Fe_2O_3) 1

(ii) The presence of impurities such as silicon dioxide / sand lower the melting point of iron(III) oxide / haematite. 1

OR The energy released from the combustion of carbon / coke results in a higher temperature in the blast furnace for the iron(III) oxide / haematite to melt.

(c) As seen from the summary flowchart, there are more stages to manufacture titanium, hence more energy is needed. 1

In one day, blast furnace could produce 24 x 20 000 = 480 000 tonnes of metal while the reactor can only produce 1 tonne of metal, hence the **rate of production** is slower. 1

NOTE: relevant data from the information given must be used to support the answers

(d) To remove soluble magnesium chloride from titanium (**reject:** remove impurities) 1

(e) Titanium is below magnesium **AND** above zinc in the reactivity series. 1
(**no mark**: below magnesium alone / middle position)

Magnesium can displace titanium from titanium(IV) chloride, hence magnesium is more reactive than titanium. Titanium dioxide cannot be reduced by coke, but iron(III) oxide can be reduced by coke. Thus, titanium is more reactive than iron. 1