GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

# PREPARATORY EXAMINATION

# 2014

# MEMORANDUM

| | |
|---|---|
| **SUBJECT:** | **PHYSICAL SCIENCE P2 (10842)** |

**GAUTENG DEPARTMENT OF EDUCATION**

**PREPARATORY EXAMINATION**

**PHYSICAL SCIENCE**
**(Second Paper)**

**MEMORANDUM**

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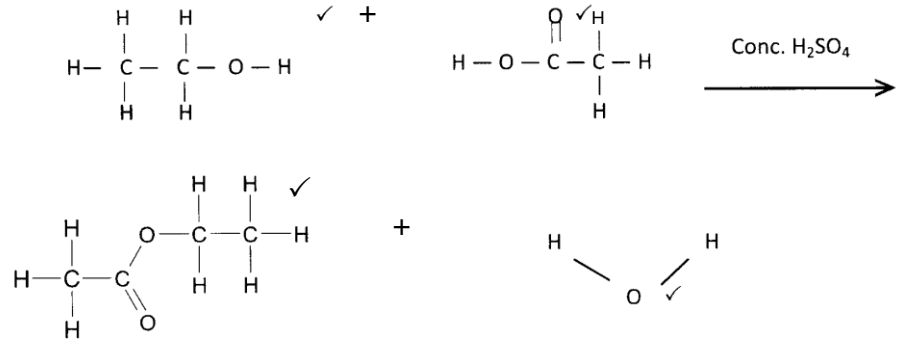
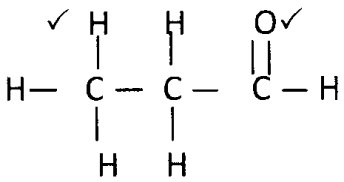
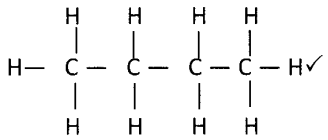
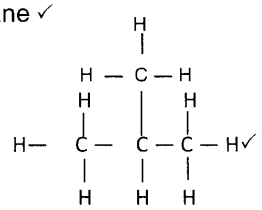
## QUESTION 1/*VRAAG 1*

| | | |
|---|---|---|
| 1.1 | B✓✓ | (2) |
| 1.2 | A✓✓ | (2) |
| 1.3 | C✓✓ | (2) |
| 1.4 | D✓✓ | (2) |
| 1.5 | D✓✓ | (2) |
| 1.6 | C✓✓ | (2) |
| 1.7 | C✓✓ | (2) |
| 1.8 | B✓✓ | (2) |
| 1.9 | C✓✓ | (2) |
| 1.10 | A✓✓ | (2) |

**[20]**

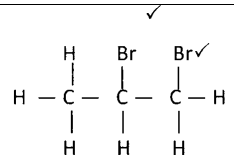
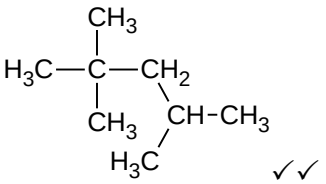
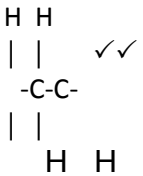
## QUESTION 2/*VRAAG 2*

| | | |
|---|---|---|
| 2.1.1 | Ketone✓ | (1) |
| 2.1.2 | D✓ | (1) |
| 2.1.3 | Chloroethane✓ | (1) |
| 2.1.4 | Ethanoic acid✓ | (1) |

| | | |
|---|---|---|
| 2.1.5 |   | (4) |
| 2.1.6 |  | (2) |
| 2.1.7 | $C_3H_8 + 5O_2$✓(reactants) ⟶ $3CO_2 + 4H_2O$✓ (products)✓balancing | (3) |
| 2.1.8 | Combustion✓/oxidation | (1) |
| 2.2.1 | Chain isomers are compounds with the same molecular formula✓ but the carbon atoms in the chain change position✓ to form different arrangements/structural formulae. | (2) |
| 2.2.2 |  butane ✓  methylpropane✓ | (4) |
| 2.2.3 | Butane✓ | (1) |
| 2.2.4 | Butane is less branched/ has a longer chain/ has a larger surface area. ✓ There are stronger intermolecular forces/ Van der Waals forces between the molecules. ✓ More energy needed to overcome intermolecular forces.✓ **OR** 2-methyl propane is more branched/ more spherical/ has a shorter chain/ has a smaller surface area.✓ Weaker intermolecular forces/ Van der Waals forces.✓ Less energy needed to overcome intermolecular forces.✓ | (3) |

**[24]**

**QUESTION 3/*VRAAG 3***

| | | |
|---|---|---|
| 3.1.1 | Addition/ Halogenation/ Bromination✓ | (1) |
| 3.1.2 |  ✓ | (2) |
| 3.1.3 | Yes✓ | (1) |
| 3.2.1 | Addition/ Hydration✓ | (1) |
| 3.2.2. | Propan – 2 – ol✓✓ | (2) |
| 3.2.3 | Alcohol/Alkanol✓ | (1) |
| 3.3.1 | Cracking is the breaking up of large organic molecules into smaller useful molecules.✓✓ | (2) |
| 3.3.2 | | |
| |  ✓✓ | (2) |
| 3.4.1 |  ✓✓ | (2) |
| 3.4.2 | B✓ | (1) |
| 3.4.3 | Plastic bags, squeeze bottles, cling wrap, bullet-proof vests.✓ | (1) |

**[16]**

**QUESTION 4/*VRAAG 4***

| | | |
|---|---|---|
| 4.1 | temperature✓ | (1) |
| 4.2 | Rate of reaction✓ | (1) |
| 4.3 | Rate = gradient of graph✓= 60-0/30-0✓= 2 $cm^3 \cdot s^{-1}$✓ | (3) |
| 4.4 | Less than ✓ | (1) |
| 4.5 | The rate of change (or gradient) is less✓ | (1) |
| 4.6 | decrease ✓ | (1) |
| 4.7 | As the surface area increases, there are <u>more particles</u> available for reacting.✓ Thus there will be more collisions per second, and thus a <u>greater number of effective collisions per second</u>✓ <u>and thus the reaction rate will increase.</u>✓ | (3) |

| | | |
|---|---|---|
| 4.8 | n(Mg) = m/M<br>= 20/24✓<br>= 0,833 moles<br><br>n ($H_2SO_4$) =c x V<br>=1 x0,1<br>=0,1 moles<br>0,1 moles of Mg will react with 0,1 moles of sulphuric acid✓<br><br>$n_{Mg}$ left = 0,83-0,1 moles✓= 0,733 moles<br><br>thus mass of Mg = n x M = 0,733 x 24 ✓= 17,6 g✓<br><br>Alt. Method<br>24 g Mg ✓reacts with 1 mol $H_2SO_4$<br>∴ $x$g →✓ 0,1 mol<br>$x$ = 2,4 g✓<br>mass left = 20-2,4✓<br>= 17,6 g✓<br><br>Option 1<br>✓ mass → mole<br>✓ relationship<br>✓ $x$g-0,1 mole } to obtain 2,4 g<br>✓ subtraction<br>✓ answer<br><br>Option 2<br>✓ mole → mole<br>✓ relationship<br>✓ subtraction<br>✓ substitution<br>✓ answer | (5) |
| 4.9 | A substance that increase the rate of a chemical reaction without undergoing permanent change. ✓✓ | (2) |
| | | **[18]** |

**QUESTION 5/*VRAAG 5***

5.1

| | **$X_2$** | **$3Y_2$** | **$\rightleftharpoons 2XY_3$** | |
|---|---|---|---|---|
| No of moles | 1,65✓ | 2✓ | 0 | |
| Change | 0,4 | 1,2 | 0,8 | Ratio✓ |
| Moles at equm | 1,25 | 0,8 | 0,8 (0,4 x2) | X 2✓ |
| Conc at equm (mol·dm$^{-3}$) | 0,625 | 0,4 | 0,4 | |

$K_c = \frac{[XY_3]^2}{[X_2][Y_2]^3}$ ✓

✓4 $= \frac{[0,4]^2}{[X_2][0,4]^3}$ ✓

$[X_2] = \frac{[0,4]^2}{4[0,4]^3}$

=0,625 mol·dm$^{-3}$ ✓

No. of mol $X_2$ = 1,65 mol

No. of mol $Y_2$ = 2 mol (9)

MARK ALLOCATION STARTING WITH $K_c$ calculation and then working back to answer in table.

- Calculation of Kc (5 marks)
- Moles at equilibrium (1 marks)
- Change (1 marks)
- Initial Moles (2 marks)

| | | |
|---|---|---|
| 5.2 | endothermic✓ | (1) |
| 5.3 | As temp increases the Kc increases, [product] increases, indicating the forward reaction is favoured. ✓ A temperature increase favours the endothermic reaction, thus the forward reaction is the endothermic reaction.✓ | (2) |
| 5.4. 1 | increase✓ | (1) |
| 5.4.2 | decrease✓ | (1) |
| 5.5 | $X_2$✓ | (1) |
| 5.6 | At a lower temperature the Kc is smaller indicating fewer products ✓and more reactants. ✓ | (2) |
| | | **[17]** |

**QUESTION 6/*VRAAG 6***

| | | |
|---|---|---|
| 6.1 | It is a weak acid✓ | (1) |
| 6.2 | An acid that forms a large no of moles per volume of water✓✓ | (2) |
| 6.3 | $H_2PO_4^-$ + $H_2O$ ✓⇌ $H_3PO_4$ + $OH^-$ ✓ | (2) |
| 6.4 | $H_2O/OH^-$✓<br>or<br>$H_2PO_4^-$ /$H_3PO_4$✓ | (1) |
| 6.5.1 | m = cMV✓ = 58 ✓ x 0,2✓ x 0,5✓=5,8g✓ | (5) |
| 6.5.2 | 0,1x2=0,2 mol·dm $^{-3}$ ✓ | (2) |
| 6.5.3 | Not safe✓ positive marking<br>[OH-]=0.2 mol.dm$^3$✓<br>pOH = -log[OH-]= -log(0,2) ✓=0,7✓<br>pH + pOH = 14<br>pH=14-0,7=13,3✓<br><br>OR<br>$[H^+][OH^-] = 10^{-14}$✓<br>$[H^+](0,2) = 10^{-14}$✓<br>$[H^+] = 5 \times 10^{-14}$ mol·dm$^{-3}$✓<br>pH = - log$[H^+]$ = - log ($5 \times 10^{-14}$) = 13,3✓ | (5) |
| 6.6 | $\frac{n_a}{n_b} = \frac{c_aV_a}{c_bV_b}$✓<br><br>2/1✓ = $\frac{(0,1)V}{(0,2)25}$ ✓<br><br>V = 100 cm$^3$✓ | (4) |
| | | **[22]** |

**QUESTION 7/*VRAAG 7***

| | | |
|---|---|---|
| 7.1 | The cell where a chemical compound is broken down with the aid of an electric current. ✓✓ | (2) |
| 7.2 | $Al^{3+}$ ✓ and $O^{2-}$ ✓ OR aluminium ion and oxide ion | (2) |
| 7.3 | $2\ O^{2-} \rightarrow O_2 + 4e^-$ ✓✓ | (2) |
| 7.4 | $Al^{3+} + 3e^- \rightarrow Al$ ✓✓ | (2) |
| 7.5 | $E^{\theta}_{cell/sel} = E^{\theta}_{cathode/katode} - E^{\theta}_{anode}$ ✓<br>= -1,66 ✓– (- 0,56) ✓<br>= - 1,1 V ✓ | (4) |
| 7.6 | $O^{2-}$ ions in the melt are oxidised to produce $O_2$ which then reacts with the graphite ( carbon) rods to produce $CO_2$ and so the rods get corroded away and have to be replaced regularly. ✓ | (1) |
| | | **[13]** |

**QUESTION 8/*VRAAG 8***

| | | | |
|---|---|---|---|
| 8.1 | The process in which electrons are lost by a substance.✓✓ | | (2) |
| 8.2 | 8.2.1 | Aℓ✓ | (1) |
| | 8.2.2 | Zn✓ | (1) |
| 8.3 | As reaction proceeds, the $Ag^+$ ion concentration decreases while the $Zn^{2+}$ ion concentration increases.✓According to Le Chatelier's principle, the rate of reverse reaction will increase✓ to reduce the increase in product ion concentration, thus favouring the reverse reaction and lowering the forward reaction leading to the decrease in the overall cell potential.✓ | | (3) |
| 8.4 | $A\ell^{3+} + 3e^-$✓ → Aℓ✓ | | (2) |
| 8.5 | Chemical to electrical energy✓ | | (1) |
| | | | [10] |

**QUESTION 9/*VRAAG 9***

| | | |
|---|---|---|
| 9.1 | Vanadium pentoxide✓ | (1) |
| 9.2 | $N_2$ (g) + $H_2$ (g) ✓ (reactants) ⇌ $2NH_3$ (g) ✓ (products) balancing✓ | (3) |
| 9.3 | 22% of 5 kg ✓= 1,1 kg<br><br>7/11✓ x 1,1 = 0,7 kg = 700 g✓<br><br>n=m/M = 700/14✓= 50 moles ✓ | (5) |
| 9.4 | Excess plants block sunlight from aquatic life and organisms die✓./Lack of oxygen. | (1) |
| | | **[10]** |