VISION GROUP

NATIONAL PRIDE • GLOBAL EXCELLENCE

HOME SCHOOLING MATERIAL

PASS O' LEVEL

MATHS, ICT, CHEMISTRY

ANSWERS TO ISSUE 4 (OC004)

SECTION A

1	C	6	A	11	D	16	C
2	A	7	B	12	B	17	B
3	B	8	A	13	C	18	D
4	B	9	C	14	C	19	B
5	C	10	B	15	C	20	C

SECTION B

21. (a) Computer generation refers to the technological development of computers over the time.
(b) State two characteristics of computers in;
(i) First generation
- Used vacuum tubes in their memory.
- Large in physical size.
- Consumed a lot of power.
- Produced a lot of heat.
- Used magnetic drum memories.

(ii) Second generation
- Used transistors in their memory.
- They consumed less power and produced less heat than the first-generation computers.
- They were relatively faster than the 1st generation computers.
- Used magnetic core memories.
- RAM memory capacity was 32 KB.

(iii) Third generation
- Used integrated circuits in their memory.
- RAM memory capacity was 2GB.
- They used a wide range of peripheral devices.
- Could support remote communication facilities/ more than one user at the same time.
- They used magnetic disks for storage.

(iv) Fourth generation
- Used microprocessors.
- They were small & very fast
- Had storage (memory) capacity

22. (a) A computer is an electronic device that accepts data input, performs processing operations on that data and outputs and stores the results.
(b) A large IT firm owns and sells computers which are capable of weather forecasting. Apart from weather forecasting, which other three suitable activities can these computers perform.
- Sending astronauts into space.
- Controlling missile guidance systems and satellites.
- Exploration of oil.
- Breaking codes.
- Designing and testing new high technological products.

(c) How ICT is being applied in;
(i) Health
- ICT devices, such as computers are used to maintain patient's records in hospitals, clinics and other health centres.
- They are used to monitor patients' vital signs in hospitals, at home and clinics.
- They are used to carry out computer assisted medical tests in clinics and hospitals.
- They are used in diagnosing medical conditions of patients.

(ii) Police
- Police use computers to store databases on security controls, such as fingerprints, which are automatically analysed by computers.
- Traffic police use computer-controlled traffic lights to control traffic flow on the roads.
- ICT devices, such as CCTV cameras are used in monitoring security of a given place.

(iii) Homes
- Use of the Internet at home to look up information.
- Online shopping using internet and smartphones.
- Watch TV and videos, download music and movies for entertainment.
- Paying electricity and water bills online.
- Check news and weather.

23 (a)Warm booting refers to restarting of a computer.
(b) State four conditions under which an individual would restart a computer.

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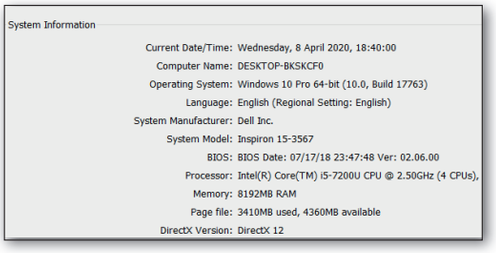
COMPUTER STUDIES

- When computer devices, such as keyboards and mouse, stop responding to commands.
- After installing a new software on your computer.
- After connecting a new hardware, such as a mouse on your computer.
- After scanning for and deleting viruses.
- When the computer freezes.

(c)A computer user checked the specifications of his computer and the following screen was arrived at.



(i) Which system software operates, manages activities, runs Application programs and interfaces with the user on this computer?
Windows 10 Pro 64-bit
(i) Which name would this computer display on a network?
DESKTOP-BKSKCF0
(i) State the size of the working space of this computer.
8192 MB
(i) At what speed does the processor run?
@CPU --→ 2.5GHz
Processor runs at 4 CPUs x2.5
= 10GHz

24. (a) **Primary storage** refers to the memory which is easily and directly accessible by the central processing unit (CPU) while **secondary storage** refers to a memory which is not directly accessed by the CPU.
(b) State three examples of solid-state devices
- Flash disks.
- Memory cards.
- Secure Digital cards (SD cards).

(c) Write the following terms in full.
(i) CPU …… Central Processing Unit
(ii) ALU……..... Arithmetic/Logic Unit
(d) Explain the following basic operations of machine cycle.
(i) **Fetch**
Obtaining an instruction or data item from memory to the processor.
(i) **Decode**
Translating the instruction into commands so the control unit and ALU can understand them.
(ii) **Execute**
The instructions are carried out.

25. Ways in which one can ensure safety of computer users in the laboratory
- Ensure that all wires in the laboratory are insulated.
- Cables should be put in trunking.
- Installation of air conditioners in the laboratory.
- Ensure that computers have anti-glare screens.
- Purchase adjustable seats for the laboratory.

Any 3 points
(a) Ways in which one can ensure safety of computers and other ICT devices in the laboratory.
- Connect computer devices when they are off.
- Limit number of visitors in the laboratory.
- Walls in the computer laboratory should be painted using water paint to avoid fire outbreaks.
- A computer laboratory should be well ventilated.

Any 3 points
(b) Mention four ways how computers are being used in your school.
- Through internet connection, computers are used for academic research.
- Computers, such as smartphones, are used for communication through text messaging.
- Used to keep records about students through school management systems.
- Used for computer-aided assessment.

26. (a) (i) **Word processing** refers to using a computer and software to create, manipulate and print written documents, such as letters, contracts, while a **word processor** is a software that create, manipulate and print written documents.
(ii) Consider the screenshot below.

Identify three formatting features which are used in the text.
- Bold
- Italics
- Underline

(b) (i) State two examples of a word processor.
- Microsoft Word
- Abi word
- Apple iWork-pages
- Corel WordPerfect
- Google docs
- LibreOffice Writer

(ii) Advantages of using a word processing software over an ordinary typewriter.
- Easy and fast to make changes to the document.
- Has many features to create documents that look professional and are visually appealing.
- Documents can be previewed before being printed.
- Documents can be saved for future reference and editing.
- It is possible to move blocks of text to different positions in the same document.
- The layout of the document can be altered before printing.
- All typing mistakes can be corrected.
- The document can be printed many times.
- Text can be added to a document without having to type it again.
- It can be used to mail documents unlike the ordinary typewriter.

SECTION C

27. (a) Differentiate between the following terms as used in information technology.
(i) Hacking and cracking
Hacking refers to using intelligent programmes on a host computer to intercept messages being sent to a computer system or over a network, *while* **cracking** refers to intentionally breaking codes and passwords to gain unauthorised access into the system.
(ii) Unauthorised use and unauthorised access
Unauthorised use refers to using a computing resource for unapproved activities, *while* **unauthorised** access refers to gaining access to a computer, network, file or other computing resource without permission.
(iii) Phishing and pharming
Phishing is the use of spoofed electronic communications (typically e-mail messages) to obtain credit card numbers and other personal data to be used for fraudulent purposes, *while* **pharming** is the use of spoofed domain names to obtain personal information for fraudulent activities.

Turn to page II

From page I

OR Phishing refers to sending email seemingly from a reputable organisation in order to convince individuals to reveal personal information, *while* **pharming** refers to illegally redirecting online traffic to another website for personal gain.

(b) Unethical conducts of computer users.

- Selling information to others without the owner's permission.
- Using information without authorisation
- Invasion of privacy.
- Engaging in the stealing of software.

(c) Explain five information communications technology (ICT) jobs available to professionals in Uganda.

- **Webmaster.** Responsible for all technical aspects of a website.
- **Web programmer.** Writes the programme code necessary for a website, such as to provide animation and database connectivity.
- **Database administrator.** Responsible for setting up and managing large databases within an organisation.
- **Network/computer systems administrator.** Responsible for planning and implementing the networks and/or computers within an organisation.
- Web designer/developer. Designs and develops websites.
- Systems analyst. Studies systems in an organisation to determine what changes need to be made and how to best accomplish them.
- **ICT trainer.** Trains users about a particular programme, system or technology.
- **Network technician.** Installs, maintains and upgrades networking hardware and software.
- **Multimedia developer.** Develops multimedia content for websites and applications.
- Computer operations manager. Oversees the computer operations staff and facility.
- Software/application software/systems software engineer. Designs and builds complex software applications.

28. (a)

(i) **Videoconferencing** is the use of networking technology to conduct real-time face-to-face meetings between individuals physically located in different places, *while* **telecommuting** is the use of computers and networking technology to enable an individual work from a remote location.

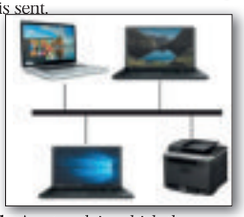
(ii) **Hotspot** refers to a location that provides wireless internet access, *while* **network topology** refers to how the devices in the network are arranged.

(b) (i) Software that can be used for videoconferencing.
Skype, Zoom, Google meet, Microsoft teams, GoToMeeting, ezTalks, etc.

(ii) With illustrations, explain three network topologies which are used in IT firms in Uganda.

Star network is a network that uses a central device to connect all network devices and through which all network data is sent.

Bus network. A network consisting of a central cable to which all network devices are connected and through which all network data is sent.



Mesh network. A network in which there are multiple connections among the devices on the network so that data can take any of several possible paths.

(c) How Global Positioning system (GPS) receivers can be used in our daily lives.

- Used to determine geographic location while hiking and to obtain driving directions while travelling.
- GPS receivers are also commonly used on the job by surveyors, farmers, fishermen and safety personnel.
- GPS can be used to guide vehicles and equipment. For example, to locate and dispatch ambulances, police cars, and other emergency vehicles.
- GPS is used by the military to guide munitions and trucks, as well as to track aircraft and submarines.
- Most smartphones today include GPS capabilities, which allow the use of location-specific services and applications, such as using your location in Web searches, social media activities and other location-aware apps.
- GPS capabilities are also built into consumer devices that are designed for specific purposes, such as wearable fitness devices that use GPS technology to record workout data for runners or bicyclists.

29 (a) (i) **Syntax error**

A programming error that occurs when the programmer has not followed the rules of the programming language.

(ii) **Debugging**

Debugging refers to the process of ensuring a programme is free of errors.

(iii) Assembler

A software used to convert an assembly language program into machine language.

(b) Reasons why programmers prefer using high-level languages to using low level languages.

- They are machine independent and can be used by other computers.
- They are user friendly and problem oriented.
- They are easier to learn, write, correct and revise than assembler and machine languages.

(c) Using a programming language of your choice, write a programme that can allow two integers and subtract them.

Using c programming

```
#include<stdio.h>
main ( )
{
int a, b, c;
printf("enter the first number");
scanf("%d",&a);
printf("enter the second number");
scanf("%d",&b);
c=(a-b);
printf(" the difference is: %d",c);
return 0;
}
```

COMPUTER STUDIES PAPER TWO QUESTIONS (0COMP005)

SECTION A

1 (a) **WORD PROCESSING**

Your school is planning to celebrate the school's foundation day.

(i) Using a word processing software, write a newspaper article that highlights the various activities that take place in the school.
(ii) Include the various academic and non-academic departments, co-curricular activities and all the other activities that happen in the school.
(iii) Clearly indicate your headings and subheadings using numbers and bullets.
(iv) Present your work in two (2) columns and show column numbers.
(v) Make your work professional and insert your name as a header.
(vi) Save your work.

2 (b) SPREADSHEET

You have been the treasurer for the computer club and it is now time to handover. The following transactions were made during your term of office.

Opening balance 100,000Ugx, annual subscription 300,000Ugx, contribution from the school 100,000Ugx, electronic presentation 50,000Ugx, charts 100,000Ugx. handover party 200,000Ugx, CDs 100,000Ugx, stationary 100,000Ugx, certificates 50,000Ugx, entertainment 60,000Ugx.

Using spreadsheet software,

(vii) Prepare an income statement that will be used during the handover.
(viii) In worksheet 2, prepare a template that will be used by the incoming treasurer to make his own income statement. Name the worksheet as template.
(ix) Format your cells such that Ugx appears where necessary.
(i) Indicate the thousand separators.
(ii) Using a formula, show the opening balance in template.

Hint: *This opening balance is equal to the amount of money left during your term of office.*

(iii) Insert your name as a header and automatic date update as a footer.
(iv) Save your work
(v) Print your work.

SECTION B

3. **ELECTRONIC PRESENTATION**

Prepare a six-slide presentation to invite Senior One students to join the computer club.

(x) Design the presentation in an attractive way with varied fonts and backgrounds that will make the young boys and girls desire to join the club.
(xi) Include tables, pictures and banners.
(xii) Include a variety of slide animations and transitions.
(xiii) Your slide show should be set on a mouse click.
(xiv) Include speaker notes.
(xv) Set your slide size to wide.
(xvi) Save and print handouts.

4. **DATABASE MANAGEMENT**

Your school has offered you a job in your vacation as an assistant in the office of the director of studies.

(i) Prepare a database that will be used by the teachers to enter marks for the end of term exams for at least five (5) subjects of your choice.
(ii) Enter at least 10 imaginary student names. The teachers should be able to work in the database using a switchboard and enter teacher's comments for each mark entered.
(iii) Generate a report that will be used to show the performance of each individual student.
(iv) Present the report in landscape with the heading "End of Term"
(v) Prepare a query that will be used to return the average mark per student.
(vi) Insert your name as a footer on all your objects.
(vii) Print the table.

HINT: *Create individual data entry forms for each subject.*

5. **WEB DESIGNING**

You have started a company that supplies sanitisers.

(i) Design a two-page website that can be used to advertise your product.
(ii) The website should be linked to other websites and the webpages should be linked to each other.
(iii) Include a company logo.
(iv) You should be able to record the number of people that visit your website.
(v) The website visitors should be able to directly contact you and also leave their feedback.
(vi) Include an audio object of yourself as you talk about your product.
(vii) Insert your company name as a moving marquee on all the pages.
(viii) Include pictures and varied backgrounds for your website.
(ix) Save your work as website.
(x) Print your work.

SOLUTIONS FOR MATHEMATICS ISSUE 4 (OM004)

SOLUTIONS

$$1-\left(\frac{1\frac{1}{4}\,of\,\frac{2}{3}+\frac{1}{6}}{\frac{7}{12}\div 3\frac{1}{2}-\frac{1}{3}}\right)$$

$$=1-\left(\frac{\frac{5}{4}\,of\,\frac{2}{5}+\frac{1}{6}}{\frac{7}{12}-\frac{7}{2}-\frac{1}{3}}\right)$$

$$=1-\left(\frac{\frac{5}{4}\times\frac{2}{5}+\frac{1}{6}}{\frac{7}{12}\times\frac{2}{7}-\frac{1}{3}}\right)$$

$$=1-\left(\frac{\frac{1}{2}+\frac{1}{6}}{\frac{1}{6}-\frac{1}{3}}\right)$$

$$=1-\left(\frac{\frac{3+1}{6}}{\frac{1-2}{6}}\right)$$

$$=1-\left(\frac{4}{6}\div\frac{-1}{6}\right)$$

$$=1-\left(\frac{4}{6}\times\frac{6}{-1}\right)$$

$= 1 - (-4)$

$= 1 - \cdot 4 = 1 + 5$

$= 5$

2. 1cm(map) = 250000cm (land)

$(1cm)^2 = (250000cm)^2$

$1cm^2$ (map) $= 6.25 \times 10^{10} cm^2$ (land)

$4.25cm^2$ (map) $= 4.25 \times 6.25 \times 10^2 cm$ (land)

$= 26.5625 \times 10^{10} cm^2$ (land)

In km^2

$100000cm = 1km$

$$1cm = \left(\frac{1}{100000}km\right)^2$$

$$1cm^2 = \frac{1}{1\times10^{10}}km^2$$

$$26.5625 \times 10^{10} cm^2 = \frac{26.5625\times10^{10}}{1\times10^{10}}km$$

∴ $4.25cm^2$ on a map correspond to $26.5625km^2$ on land.

3. $\sqrt{108}+\sqrt{75}-P\sqrt{12}=\sqrt{27}$

$\sqrt{36\times3}+\sqrt{25\times3}-P\sqrt{4\times3}=\sqrt{9\times3}$

$\sqrt{36}\times\sqrt{3}+\sqrt{25}\times\sqrt{3}-P\sqrt{4}\times\sqrt{3}=\sqrt{9}\times\sqrt{3}$

$= 6\sqrt{3}+5\sqrt{3}$ — $2P\sqrt{3}=3\sqrt{3}$

$= 6\sqrt{3}+5\sqrt{3}-2P\sqrt{3}=3\sqrt{3}$

$= 11\sqrt{3}-2P\sqrt{3}=3\sqrt{3}$

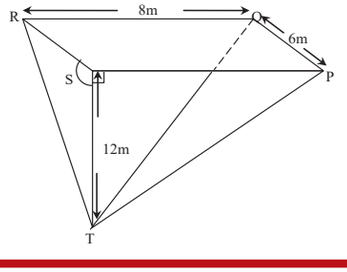
$8\sqrt{3}=2P\sqrt{3}$

$$\frac{8\sqrt{3}}{\sqrt{3}}=\frac{2P\sqrt{3}}{\sqrt{3}}$$

$$\frac{8}{2}=\frac{2P}{2}$$

P = 4

4.



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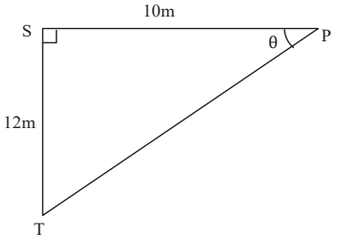
From Pythagoras theorem

$\overline{QS^2} = 8^2 + 6^2$

$\overline{QS} = \sqrt{100}$

$\overline{QS} = 10m$

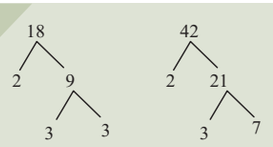


$\overline{QT} = 15.6205$

$\theta = \tan^{-1}\frac{12}{10} = 50.19$

The angle between the line TQ and $\overline{QS}$ is 50.19°

5.



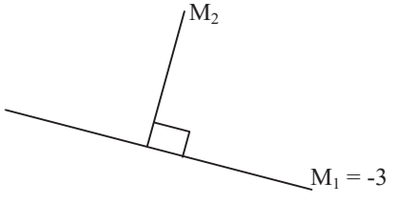
$18 = 2 \times 3 \times 3$ $\quad 42 = 2^1 \times 3^1 \times 7^1$

$18 = 2^1 \times 3^2$

HCF of 18 and 42

$= 2^1 \times 3^1 = 6$

6.



$M_1 \times M_2 = -1$

$-3 \times M_2 = -1$

$M_2 = \frac{1}{3}$

Point B(x , 0) and A(8 , 5)

$$\frac{5-0}{8-x}=\frac{1}{3}$$

$15 = 8 - x$

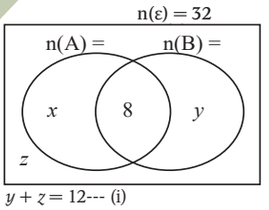
$x = 8 - 15$

$x = -7$

∴The coordinates of B are (-7, 0)

7. $n(A') = 12$ $\quad n(B') = 15$

$n(A \cap B) = 8$ $\quad n(\varepsilon) = 32$



$y + z = 12$--- (i)

$x + z = 15$---- (ii)

$8 + x + z + y = 32$—(iii)

From equation (i) $y = 12 - z$

From (ii) $x = 15 - z$

Substitute x and y in (iii)

$8 + 15 - z + z + 12 - z = 32$

$35 - z = 32$

$z = 35 - 32$

$z = 3$

$x = 15 - 3$

$x = 12$

$y = 12 - 3$

$y = 9$

$n(A \cup B)' = z = 3$

8. A = (9, 5) $\overrightarrow{OA} = \begin{pmatrix}9\\5\end{pmatrix}$

B = (3, 2) $\overrightarrow{OB} = \begin{pmatrix}3\\2\end{pmatrix}$

$\overrightarrow{AB} = \overrightarrow{AO} + \overrightarrow{OB}$

$= -\overrightarrow{OA} + \overrightarrow{OB}$

$= \overrightarrow{OB} - \overrightarrow{OA}$

$\begin{pmatrix}3\\2\end{pmatrix} - \begin{pmatrix}9\\5\end{pmatrix} = \begin{pmatrix}-6\\-3\end{pmatrix}$

$\overrightarrow{AB} = \begin{pmatrix}-6\\-3\end{pmatrix}$

$\frac{1}{3}\overrightarrow{AB} + 3\overrightarrow{OA}$

$= \frac{1}{3}\begin{pmatrix}-6\\-3\end{pmatrix} + 3\begin{pmatrix}9\\5\end{pmatrix}$

$= \begin{pmatrix}-6\times\frac{1}{3}\\-3\times\frac{1}{3}\end{pmatrix} + \begin{pmatrix}3\times9\\3\times5\end{pmatrix}$

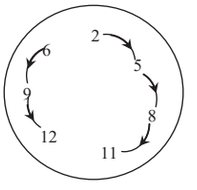
$= \begin{pmatrix}-2\\-1\end{pmatrix} + \begin{pmatrix}27\\15\end{pmatrix}$

$= \begin{pmatrix}25\\14\end{pmatrix}$

9. T = {2, 5, 6, 8, 9, 11, 12}

a) P = {(2, 5), (5, 8), (6, 9), (8, 11), (9, 12)}

b)



Turn to page IV

Continued from page III

10 $\frac{10}{100}\times 150,000$

$= \text{UGX } 15000$

Excess

$= 260,000$

$-150,000$

$110,000$

Commission on 110,000

$= \frac{15}{100}\times 110,000$

$= 16500$

Total commission on UGX 260,000

$= 15000 + 16500$

$= 31500$

∴ Commission on sales worth UGX 260,000 = UGX 31500

11. $0.25^x \times 8^{(x+1)} = 64$

$\left(\frac{25}{100}\right)^x \times 8^{(x+1)} = 64$

$\left(\frac{1}{4}\right)^x \times 8^{(x+1)} = 64$

$4 = 2^2,\ 8 = 2^3,\ 64 = 2^6$

$\left(\frac{1}{2^2}\right)^x \times 2^{3(x+1)} = 2^6$

$(2^{-2})^x \times 2^{3(x+1)} = 2^6$

$2^{-2x} \times 2^{(3x+3)} = 2^6$

Adding indices on the left hand side

$2^{-2x+3x+3} = 2^6$

$2^{(x+3)} = 2^6$

Equating indices

$x + 3 = 6$

$x = 6 - 3$

$x = 3$

b) $\log_{10}^{x} = \bar{3}.216$

$\log_{10}^{y} = 1.732$

$\log_{10}^{(xy)} = \log_{10}^{x} + \log_{10}^{y}$

$= \bar{3}.216 + 1.\dot{7}32$

$= \bar{2}.948$

$\log_{10}^{\frac{\sqrt{x}}{y}}$

$\log_{10}^{\frac{\sqrt{x}}{y}} = \log_{10}^{\sqrt{x}} - \log_{10}^{y}$

$= \log_{10}^{x^{\frac{1}{2}}} - \log_{10}^{y}$

$= \frac{1}{2}\log_{10}^{x} - \log_{10}^{y}$

$= \frac{1}{2}\times \bar{3}.216 - 1.732$

$= \frac{\bar{3}.216}{2} - 1.732$

$= \frac{-3+0.216}{2} - 1.732$

$= \frac{-3-1+1+0.216}{2} - 1.732$

$= \frac{-4+1.216}{2} - 1.732$

$= \frac{-4}{2} + \frac{1216}{2} - 1.732$

$= -2 + 0.608 - 1.732$

$= \bar{2}.608 - 1.732$

$= \bar{4}.876$

$\log_{10}^{10x} = \log_{10}^{10} + \log_{10}^{x}$

$= 1 + \bar{3}.216$

$= \bar{2}.216$

12. $n(\varepsilon) = 50$

$n(G \cup S \cup C)' = 2$

$n(G \cap S' \cap C') = n(G \text{ only}) = 3$

$n(S \text{ only}) = n(G' \cap S \cap C') = 5$

$n(G \cap S' \cap C) = 4$

$n(G \cap S \cap C) = 5$

$n(G \cap S \cap C') = n(G' \cap S \cap C) - 3 = 3n\ n(G' \cap S' \cap C)$

let $n(G \cap S \cap C') = x$

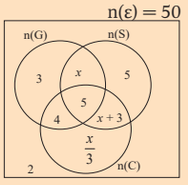
$x = n(G' \cap S \cap C) - 3$

$n(G' \cap S \cap C) = x + 3$

$x = 3n(G' \cap S' \cap C)$

$n(G' \cap S' \cap C) = \frac{x}{3}$

$n(\varepsilon) = 50$



$3 + x + 5 + 4 + 5 + x + 3 + \frac{x}{3} + 2 = 50$

$3 + 5 + 4 + 5 + 3 + 2x + x + \frac{x}{3} = 50$

$22 + 2x + \frac{x}{3} = 50$

$2x + \frac{x}{3} = 50 - 22$

$2x + \frac{x}{3} = 28$

$\frac{7x}{3} = 28$

$\frac{7x}{7} = \frac{84}{7}$

$x = 12$

$n(G) = 3 + x + 5 + 4$

$= 3 + 12 + 5 + 9$

$= 29$

$n(s) = x + 5 + 5 + x + 3$

$= 2x + 5 + 5 + 3$

$= 2 \times 12 + 13$

$= 24 + 13$

$= 37$

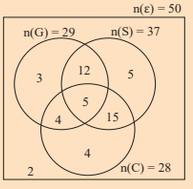
$n(C) = 4 + 5 + x + 3 + \frac{x}{3}$

$= 4 + 5 + 3 + 12 + \frac{12}{3}$

$= 24 + 4 = 28$

(ii) $\frac{12}{3} = 4$

c) Number of those who brought at least two = number of those who brought only two + those who brought all.



Number of those who brought only two = 12 + 4 + 15 = 31

Number of those who brought all the three items = 5

Number of those who brought at least two items = 31 + 5 = 36

$\text{Probability} = \frac{\text{number of those who brought atleast two items}}{\text{Total number of students in class}}$

$= \frac{36}{50} = 0.72$

13. (i) Total monthly allowances

Transport = 2500 per day = 2500 × 28

= 70,000

Housing = 150,000

Water = 20,000

Medical = 420,000 per annum

$= \frac{420000}{12}$

= 70,000 + 150,000 + 20,000 + 35000

= 275,000

Total monthly allowance = UGX 275,000/=

(ii) Table income

Let the taxable income by Y

$\frac{10}{100}\times 150,000 = 150000$

$\frac{15}{100}\times (350,000 - 150000)$

$= \frac{15}{100}\times 200,000 = 30,000$

$\frac{20}{100}\times (600,000 - 350,000)$

$= \frac{20}{100}\times 250,000 = 50,000$

$\frac{25}{100}\times (Y - 60,000) = \frac{1}{4}(Y - 600,000)$

$= \frac{Y}{4} - 150,000$

Total income tax = 126250

Then $15000 + 30,000 + 50,000 + \frac{Y}{4} - 150,000$

$= 126250$

$= 95000 - 150000 + \frac{Y}{4} = 126250$

$\frac{Y}{4} - 55000 = 126250$

$Y - 220,000 = 505000$

$Y - 505000 + 220000$

$Y = 725000$

Table income is UGX 725,000

(iii) Gross income = Taxable income + Total allowances

725000

$= +\ 275000$

$1000,000$

The gross income is UGX 1000,000

(iv) Net income = Gross income - tax

= Gross income − tax

= 1,000,000 − 126250

= 873750

Gimadu's Net income is UGX 873750

14. $f(x) = 3x + 5$

$f(-2) = 3 \times (-2) + 5 = a$

$-6 + 5 = a$

$-1 = a$

∴ a = -1

$f(x) = 3x + 5$

$f(b) = 3b + 5 = 5$

$3b = 5 - 5$

$3b = 0$

$b = 0$

$f(x) = 3x + 5$

$f(1) = 3 \times 1 + 5 = c$

$= 3 + 5 = c$

$= 8 = c$

$c = 8$

∴ $a = -1$, $b = 0$ and $c = 8$

b) $f(x) = 2x - 1$ and $g(x) = x^2$

(i) let $f(x) = y$

$y = 2x - 1$

$y + 1 = 2x$

$\frac{y+1}{2} = x$

$x = \frac{y+1}{2}$

$x \to f^{-1}(x)$

$y \to x$

$f^{-1}(x) = \frac{x+1}{2}$

$f^{-1}(5) = \frac{5+1}{2} = \frac{6}{3}$

$= 3$

$f^{1}(5) = 3$

(ii) $fg(x) = f(x^2) = 2x^2 - 1$

$gf(x) = g(2x - 1) = (2x - 1)^2$

$fg(x) = gf(x)$

$(2x - 1)^2 = 2x^2 - 1$

$(2x - 1)(2x - 1) = 2x^2 - 1$

$2x(2x - 1) - 1(2x - 1) = 2x^2 - 1$

$4x^2 - 2x - 2x + 1 = 2x^2 - 1$

$4x^2 - 4x + 1 = 2x^2 - 1$

$4x^2 - 2x^2 - 4x + 1 + 1 = 0$

$2x^2 - 4x + 2 = 0$

$\frac{2x^2}{2} - \frac{4x}{2} + \frac{2}{2} = \frac{0}{2}$

$x^2 - 2x + 1 = 0$

$x^2 - x - x + 1 = 0$

$x(x - 1) - 1(x - 1) = 0$

$(x - 1)(x - 1) = 0$

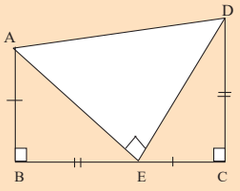
$(x - 1)^2 = 0$

$x = 1$

MATHEMATICS PAPER 1 (OMTC005)

SECTION A

1. Given that $P*Q = \frac{5P+3Q}{2}$.
   Evaluate -2*(3*4)
2. Solve the inequality
   $\frac{1}{3}(2x - 5) \frac{1}{5} < (2x+1)$
3. Given that $M = \begin{pmatrix} 4 & -3 \\ 6 & 1 \end{pmatrix}$ Find M^{-1}
4. The ages in years of six boys are as follows 17,13,15,12,15,8. What would be the age of the seventh boy that would make the mean age of the students to be 13 years.
5. Form a quadratic equation in x whose roots are -2 and $\frac{1}{3}$
6. Factorise completely $5x^4 - 80y^4$.
7.
8. Find the image of 5, -4 under the transformation whose matrix is $\begin{pmatrix} 3 & 1 \\ 1 & 0 \end{pmatrix}$
9. In the figure AB = EC = 5cm, BE = DC = 8CM. Calculate the length of AD



10. Find the two possible valves of θ, if $\sqrt{2}$ (Correct to 1 decimal place).
11. The table below shows the sum of two numbers

+	2	3	4
2	4	_____	_____
3	_____	_____	_____
5	_____	8	_____
7	9	_____	_____

(a). Copy and complete the table
(b). What is the probability that the sum is even.

SECTION B

11. (a). Make R the subject of the expression $P = \sqrt{\frac{3 + 2R}{5R - R}}$, hence find the valve of R when P = 2

(b). Akello bought 5 books and a pen at UGX 2,700 in the month of May. In July, she bought 12 books and two pens at UGX 6,400. What was the price of each item during the two months?

12 (a). Draw a graph of $y = 6 - 2x^2 + 3x$ for valves of ranging from -3 to 4. Use 2cm to represent one unit on the x-axis and 1cm to represent one unit on the y-axis.
(b)(i). On the same graph, draw a line $y = x$.
(ii). Use your graph to solve the equation $2x^2 = 6 + 2x$.

13. Using a ruler, a pencil and a pair of compasses only.
(a) Construct a triangle PQR in which angle QPR = 75°, angle PQR = 60° and PQ = 8.5cm.
(b) Measure and record the length PR and QR.
(c)(i) Draw a circle through the vertices of the triangle in (a).
(ii) Measure and record the radius of the circle, hence calculate the area of the circle (Use π = 3.142).

14. The Vertices of triangle R are (0,0), (4,0) and (0,3).
(a) Obtain the vertices of R' the image of R, under the transformation defined by $\begin{pmatrix} 1 & 0 \\ 0 & 2 \end{pmatrix}$
(b) R'' is the image of R' under the transformation defined by $\begin{pmatrix} 2 & 0 \\ 0 & 1 \end{pmatrix}$.
Find the vertices of R"
(c) Draw R, R' and R" on the same diagram and find a single matrix N that maps R onto R".
(d) Describe fully the transformation given by N.

15. A bag contains 5 red balls, 3 green balls and 4 blue balls. A ball is drawn at random and not replaced, a second ball is drawn. Find the probability of drawing;
(i) Two balls of the same colour.
(ii) The second ball red.
(iii) Two balls of different colours.

16 (a). Using matrix methods, solve the following simultaneous equations.
$2x = \frac{5}{2} + 3y$
$2y = -x - \frac{1}{2}$

(b). If the matrices $P = \begin{pmatrix} 3 & -1 \\ 4 & 5 \end{pmatrix}$ and $Q = \begin{pmatrix} 3 & 1 \\ 0 & 2 \end{pmatrix}$
Find (a) PQ – QP
(b). $(P + Q)^2$

17. A parking lot is to be constructed for x lorries and y buses. Lorries are allowed 10 square metres of space and buses 20 square metres and there is only 500 square metres available. Not more than 42 vehicles are allowed at a time. There are always both types of vehicles parked and, atmost, 16 buses are allowed at a time. The parking charge for the lorry is UGX5,000 and for the bus, UGX20,000 per day.
(a). Write down all the inequalities from the above information.

(b). Draw appropriate straight lines to find the region in which the point (x,y) must lie if the inequalities are to be satisfied.
(c). Find how many vehicles of each type should be parked on the lot in order to obtain maximum income and calculate this maximum income.

ANSWERS TO CHEMISTRY (OC004)

MUGOGO MOSES,
SEETA HIGH SCHOOL

ANDREW HANNINGTON NSEREKO,
BISHOP'S SENIOR SCHOOL, MUKONO

1. The set-up was used to investigate the products of burning biogas (methane).
   a) Water
   b) i) White precipitate
   ii) $CO_2(g) + Ca(OH)_2(aq) \rightarrow CaCO_3(s) + H_2O(l)$
   iii) The white precipitate is due to formation of $CaCO_3$, which is insoluble in water.
   c. From decomposing plant or animal materials.

2 a) i) Q and U
ii) Difference in the number of neutrons.
b) Element R has a low melting point, while element S has a high melting point.
c) Because element T has eight valence electrons, which fill its outer energy level. This is the most stable arrangement of electrons, so the noble gas rarely reacts with other elements and forms compounds.

3. a) Is the existence of an element in more than one physical form without change in matter state.
b) i) Graphite is soft because the bonding between its layers of carbon atoms is weak; thus, the layers detach easily from one another, whereas in a diamond, every carbon electron bonds with all the electrons from its adjacent carbon atom.
ii) Graphite is used as a lubricant due to its slippery nature.
c) Because each carbon atom can form four chemical bonds to other atoms and because the carbon atom is just the right, small size to fit in comfortably as parts of very large molecules. They can even join "head-to-tail" to make rings of carbon atoms.

4. The figure can be used to prepare oxygen gas in the laboratory.
a) Water
b) It is slightly soluble in water.
c) $2Na_2O_2(s) + 2H_2O(l) \longrightarrow 4NaOH(aq) + O_2(g)$
d) i) Both plants and animals use oxygen for respiration.
ii) It is used for breathing by astronauts and to oxidise fuel in rockets.

5 a) i) Aluminium chloride and Iron (III) chloride.
ii) $Fe(s) + Cl_2(g) \longrightarrow FeCl_3(s)$.
or $Al(s) + Cl_2(g) \longrightarrow AlCl_3(s)$.
b. Sodium metal is highly reactive, the reaction with chlorine generates a lot of heat and explodes.

6 a) i) White precipitate.
ii) Brown solids turned black.
$Mg(s) + N_2(g) \longrightarrow Mg_3N_2(s)$.
b i) Water.
ii) Filters out vapour and impurities like dust.
c) Are used in lamps, such as neon lights and krypton headlamps, and in lasers.

7 a) The solubility of the salt refers to the mass of the salt which will dissolve per 100g of solvent (water) at a particular temperature.
b) Mass of empty evaporating dish = 26.2g.
Mass of evaporating dish + saturated solution = 42.4g.
Mass of evaporating dish + dry solid Y = 30.4g.
Use this data to calculate the solubility of Y at 30°C.
Mass of solution = (42.4 – 26.2)g = 16.2g.
Mass of solute = (30.4 – 26.2)g = 4.2g.
16.2 g of solvent are saturated by 4.2 g of solute at 30°C.
1g of solvent is saturated by $\frac{4.2}{16.2}$ g of solute at 30°C.
1000g of solvent is saturated by $\frac{4.2 \times 1000}{16.2}$ g of solute at 30°C.
= 259.3 g of solute at 30°C.

8. a) i) The water turned greenish yellow
ii) This is because chlorine gas reacts with water to

Turn to page VI

Continued from page V

form chlorine water.

$Cl_2(g) + H_2O(l) \longrightarrow HCl(g) + HOCl(aq)$

b. The red litmus paper will gradually get bleached.

9. a) i) an Acid
ii) Dilute Hydrochloric acid.
iii) $Zn(s) + HCl(aq) \longrightarrow ZnCl_2(aq) + H_2(g)$
b. i) Concentrated sulphuric acid.
ii) To dry the gas.
c. The method of gas collection should be upward delivery/downward displacement of air.
A flat-bottomed flask should be used instead of a round bottomed one.

10. a) Effervescence occurred and a colourless gas that turned lime water milky was evolved.

$CaCO_3(s) + 2HCl(aq) \longrightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$

$1000cm^3$ of solution contain 0.1moles of acid

$1cm^3$ of solution contains $\frac{0.1}{1000}$ moles of acid.

$25cm^3$ of solution contains $\times$ moles of acid.

$= 0.0025$ moles of acid.

From equation,
2 moles of acid react with 1 mole of calcium carbonate
0.0025moles react with $\times$ ½ $\times$ 0.0025 moles of calcium carbonate.
$= 0.00125$ moles of calcium carbonate.
Mass of calcium carbonate = moles $\times$ molecular mass
$= 0.00125 \times 100$
$= 0.125g$
Mass of excess calcium carbonate = 5 – 0.125
4.875 g.

SECTION B:

11. a) i) Sodium hydroxide solution.
ii) $Cu^{2+}(aq) + OH(aq) \longrightarrow Cu(OH)_2(s)$
b) i) nitrogen dioxide gas.
ii) Copper is oxidised by concentrated nitric acid, HNO_3, to produce Cu^{2+} ions; the nitric acid is reduced to nitrogen dioxide.

$4\,HNO_3(l) + Cu(s) \longrightarrow Cu(NO_3)_2(aq) + 2\,NO_2(g) + 2\,H_2O(l)$

c) i) Displacement reaction.
ii) Cu^{2+} ions in the solution are replaced with Fe^{2+} ions which forms a pale green solution.
iii) $Cu(NO_3)_2(aq) + Fe(s) \longrightarrow Fe(NO_3)_2(aq) + Cu(s)$

d. i) Iron(III) nitrate
ii) Warming catalyses the oxidation of iron(II) to iron(III)

12 a) A chemical cell is an electrochemical cell that derives electrical energy from spontaneous redox reactions taking place within the cell.
b) i) The Daniell cell consists of a zinc rod dipping in a solution of zinc sulphate, connected by a wire to a copper rod dipping in a copper sulphate (II) solution. Spontaneous oxidation and reduction reactions generate electric current, with electrons passing from the zinc rod to the wire and from it to the copper rod, originating a current along the wire.

ii) Cathode; Anode:

$Zn(s) \longrightarrow Zn^{2+}(aq) + 2e^-$ $Cu^{2+}(aq) + 2e^- \longrightarrow Cu(s)$

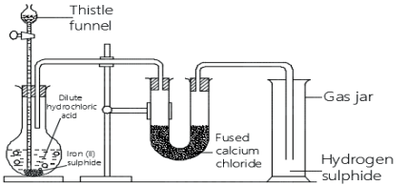
iii) $Zn(s) + Cu^{2+}(aq) \longrightarrow Cu(s) + Zn^{2+}(aq)$

iv) $Zn(s)/\ Zn^{2+}(aq)//\ Cu^{2+}(aq)/\ Cu(s)$

c) i)

ii) Cathode: $Ag^+(aq) + e^- \longrightarrow Ag(s)$ Anode: $Ag(s) \longrightarrow Ag^+(aq) + e^-$

13 a)



b) i) brown solution turns pale green with yellow deposits.
ii) Evolution of brown fumes and deposits of a yellow solid.

d. i) Rhombic sulphur and monoclinic sulphur

ii)

Rhombic	Monoclinic
stable at room temperature	Stable above about 95°C
Bright yellow solid	Pale yellow solid
Octahedral structure	Needle –like structure

iii) Briefly describe how you can prove that the substances named in d (i) are allotropes of sulphur.(amended) for the same amount of sulphur allotrope burnt in oxygen, the same volume of sulphur dioxide gas is formed.

14. a) i)

Element	Electron configuration
Hydrogen	1
Oxygen	2:6
Sodium	2:8:1
Chlorine	2:8:7

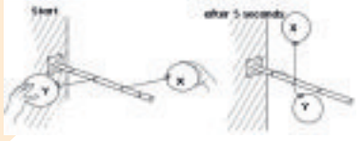
b) i)

Element	Class of oxide
Sodium	Basic
Aluminium	Amphoteric
Phosphorous	Acidic
Sulphur	acidic

ii) Metallic character increases form left to right because melting points of their oxides increase left to right since there is increasing strength of the metal-oxygen bonds.
c) i) Reagent: sodium hydroxide solution
ii) $Al^{3+}(aq)$: white precipitate soluble in excess
$Mg^{2+}(aq)$:white precipitate insoluble in excess.

CHEMISTRY QUESTIONS OCHEM005

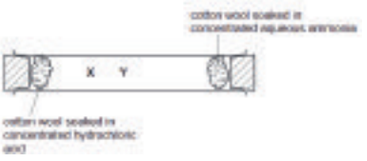
1. Balloons filled with gases X and Y were tied to a bar. They were held horizontally at the same height and then released. The position of the two balloons 5 seconds after release is as shown in the diagram.



a) Which physical property of gases is demonstrated?
b) Explain the positions of the balloon and hydrogen after 5 seconds.
c) Which gas collection method is suitable for each gas basing on your observation.
d) Suggest one use of gas X.

2. Explain the principle behind separation of the following mixtures.
a) i) Ethanol and water
ii) Dyes in food colour
b) Air is described as a mixture. What qualities does air have to be qualified a mixture?

3. A student set up the apparatus shown below.



a) i) State what was observed after a few seconds.
ii) Write an equation of reaction.
b) use the kinetic of matter to explain the observation in (a) (i)

4. Tritium is an isotope of hydrogen. The anion of tritium has the following structure.

a) What is an Isotope?
b) Complete the following table to show the names and charges of the particles in this tritium ion.

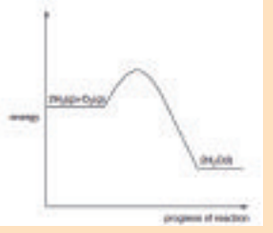
Symbol	Name	Charge
●		
⊕		+1
⊖		-1

b) Using the symbol T to represent tritium, give the formulae of
(i) the ion shown above
(ii) the compound formed between tritium and sodium.

5. Hydrogen engine-powered vehicles burn hydrogen gas in presence of oxygen as shown in the equation below.

$2H_2(g) + O_2(g) \longrightarrow 2H_2O(l)$

The energy profile diagram/graph for the reaction was plotted as shown below.



a) Label on the diagram the activation energy of the reaction.
b) The reaction was slow, until a catalyst was added. Draw a second curve on the diagram to show the energy profile for the catalysed reaction.
c) Explain the nature of this reaction basing on the diagram.

6. Iron is manufactured in the blast furnace from haematite in a blast furnace. A redox reaction takes place between haematite and carbon monoxide.
a) What do you understand by the term 'redox reaction'

b) Explain how the reaction between haematite and carbon monoxide is a redox reaction.
c) Write the equation of reaction between haematite and carbon monoxide.

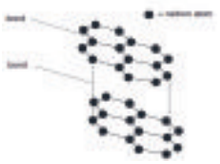
7. In the laboratory, two experiments were set up using zinc metal.
a) i) State what is observed in each case.
ii) Write an equation of reaction for each case.
b) State two uses of the gaseous product between zinc metal and hydrochloric acid.

8. There are many plastic materials or polymers in use. The table below gives some information about five important polymers.

Polymer	Density in Kg/M^3	Maximum usable temperature /^{o}C	Solubility in organic solvents
Low density polyethene	920	85	Soluble above 80^{o}C
High density polythene	960	120	Soluble above 80^{o}C
Polyphenylethene	1050	65	Soluble
Polychloroethene	1390	60	Soluble
Polypropene	900	150	Insoluble

a) Which polymer would be most suited for making a pipe to carry lubricating oil at 100 °C? Give two reasons for your answer.
b) From the table state the danger of carrying hot fatty foods in a polychloroethene bag.
c) i) State two uses of polyethene.
ii) Explain how disposal of polyethene can be a problem to the environment.

9. The structures of graphite is drawn below.



a) Explain how the bonds in the structure of graphite make graphite;
i) have a high melting point.
ii) slippery.
b) State two uses of graphite.

10. Ethene can also be converted into a compound X that contains carbon, hydrogen and oxygen. A sample of the compound was analysed and found to contain 0.72 g of carbon, 0.18 g of hydrogen and 0.96 g of oxygen.
a) Work out the empirical formula of the compound of X.
b) Describe how ethene can be converted into ethanol.
c) Ethene reacts with hot acidified potassium dichromate (VI) to form ethanoic acid. State what was observed.

SECTION B

11. Ammonia is used to manufacture nitric acid, by a two-stage process.

Stage 1: Ammonia is converted to nitrogen monoxide.

$4NH_3(g) + 5O_2(g) \longrightarrow 4NO(g) + 6H_2O(g) \Delta H = -950$ kJ/mol

(a) (i) State and explain how the rate changes when the temperature is increased.
(ii) State and explain how the yield changes when the pressure is increased.
(b) During the reaction, ammonia and oxygen are passed through a powdered catalyst.
(i) Name the catalyst used.
(ii) Explain why a powdered catalyst is used.
(iii) How does addition of a catalyst change the rate of reaction?

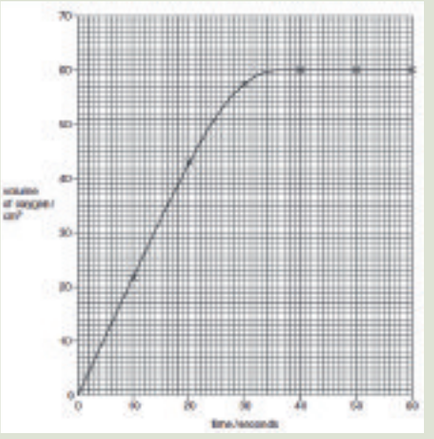
Stage 2: Nitrogen dioxide is converted to nitric acid.

$4NO(g) + 2H_2O(g) + 3O_2(g) \longrightarrow 4HNO_3(aq)$

(c) Calculate the maximum mass of nitric acid which can be made from 720 dm^3 of nitrogen monoxide at standard temperature and pressure.

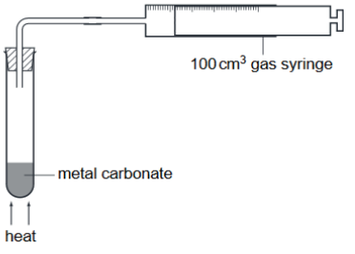
(d) Use the two equations to construct an overall equation for the conversion of ammonia to nitric acid.

12. a) With chemical equations, explain how oxygen reacts with;
i) carbon in limited air.
ii) ammonia in the presence of a catalyst.
b) Manganese(IV) oxide catalyses the decomposition of aqueous hydrogen peroxide. In an experiment, 50.0 cm^{3}of aqueous hydrogen peroxide was mixed with 0.50 g of manganese(IV) oxide. The total volume of oxygen formed was measured every 10 seconds. The results of the experiment are shown in the graph.



a) i) Determine the time taken for the reaction to finish.
ii) Explain the shape of the graph.
b) Calculate;
i) The volume of oxygen produced at STP (1 mole occupies 22.4dm^3).
ii) The concentration, in mol/dm^3, of the 50.0 cm^{3}of aqueous hydrogen peroxide used in the experiment.

13. The carbonates of many metallic elements decompose when heated.
(a) State what is observed when metal carbonates decompose.
(b) Calcium oxide is manufactured by the decomposition of calcium carbonate.
i) Write the equation for this decomposition.
ii) State one use of calcium oxide.
c) A student investigates the decomposition of five different metal carbonates. The diagram shows the apparatus the student uses.



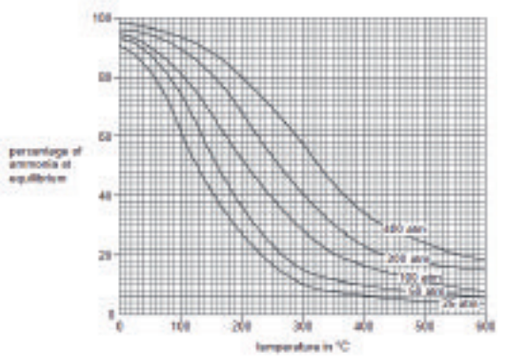
The student heats a 0.010 mole sample of each carbonate U, V, X, Y and Z. The time taken for 100 cm^3 of gas to be collected in the gas syringe was recorded in the table below.

Metal carbonate	Time taken /s
U	25
V	100
X	300
Y	No gas given out
Z	50

i) Identify the metal carbonate
ii) Explain the basis for identification of the metals.

d) Calcium nitrate decomposes when heated.
i) Write equation of reaction.
ii) 0.10g sample of calcium nitrate is heated. Calculate the number of moles of gas produced when this sample is completely decomposed.

14. a) Show the laboratory preparation of a sample of ammonia gas
b) Industrially, ammonia is manufactured by the Haber process. The graphs below give information about the percentage of ammonia present in the equilibrium mixture at different temperatures and pressures.



i) Name the catalyst used in the Haber process.
ii) Write a balanced equation for the formation of ammonia in the Haber process.
iii) State the conditions of temperature and pressure which give the highest percentage of ammonia at equilibrium.
c) After spreading a fertiliser containing ammonium nitrate onto his land, a farmer then spreads calcium hydroxide on his land. However, the nitrogen content in soil remains low.
i) Write an equation for the reaction between ammonium nitrate and calcium hydroxide.
ii) Calculate the percentage of nitrogen in both the fertiliser and the nitrogen containing product in c(i) above.
iii) Explain why the nitrogen content of soil remained low even after adding ammonium nitrate.
d) Ammonium solution is a common laboratory reagent. State what is observed and write an equation of reaction when excess reagent is added to
i) Copper (II) ions in solution
ii) Lead ions and zinc ions