WUNNA EDUCATIONAL SERVICES

LOWER SECONDARY S.3 LEARNER'S HOLIDAY PACKAGE

SCIENCE SUBJECTS

SCHOOL NAME:

_____

STUDENT'S NAME:

_____

CLASS AND STREAM:

_____

INSTRUCTIONS:

- Complete all the exercises in this Package.
- Submit your work on the first day back after the holiday.
- Ensure all your work is neat and well-organized.
- Make Research but when answering the package ensure that you work independently to ensure that your understanding is reflected.

PHYSICS

SATTELLITES AND COMMUNICATION

1. The Science Club at a Secondary school has initiated a national science literacy campaign. As part of this effort, they are hosting a series of outreaches aimed at primary school students to foster a better understanding of astrophysics and its relevancy to everyday life. The focus of their discussions will include energy production in stars, importance of sun's energy, the variation in stars' colours, the life cycles of stars, and the importance of space exploration.

As, a student of Physics, you have been requested by the school science club to deliver in one of the outreaches to primary school students. Your task is to educate them on:

a) How the sun produces energy needed for live to survive?
b) The variation in colour and brightness of stars in the Milky way in terms of their size and distance from the earth.
c) The different stages in the life cycle of the star.
d) The purpose of the international station and its role in space exploration.

2. An article in the newspaper gave information that on 2nd December 2022, Ugandan engineers with the help of Japanese engineers launched a satellite. The literature teacher who picked interest in the article found new words like artificial and natural satellites. He developed a number of unanswered questions which could be answered by a physics learner like you.

(a) Explain the difference between the two types of satellites in the article.

(b) With reasons, justify why Uganda should spend all that much money to launch its own satellite.

(c) Incase Uganda is to develop a super rocket capable of reaching different planets. List with reasons the planets it can land on and planets it cannot land on.

LIGHT AND WAVES

3. The students in a particular class visited a laboratory with a white bulb and a red one, to observe a glass tank filled with water with a white base at the bottom. Modifications were made to create a shallow end on one side of the tank using glass material. To their surprise, when they struck the water's surface at the shallow end with a long rectangular rod at a frequency of 80 Hz, they noticed that the spacing between successive crests changed from 2.5cm to 5cm. Additionally, they were disturbed by the distortion of ripples as they struck the tank walls. They were also surprised to see the base turning black when it was replaced with a yellow sheet and the red lights switched on.

Hint; the glass tank would break if the velocity of the waves that hit it is greater than 20 ms^{-1}

Use your knowledge of physics to:

a) Determine if the ripple tank will break.

b) Explain the reason for the change in the distance between the ripples and its impact on the velocity of the ripples.

c) Explain what distorted the waves and how it could have been reduced.

d) Explain why the yellow sheet changed color when the red lights were switched on.

4. During the construction of a multipurpose hall of size 70m by 40m in a school, the students have been asked to raise challenges that could arise after the hall's construction. They are listed below;

- There could be a distortion of sound as a result of two sounds being heard.
- The hall could be dimly lit because of the paint color used to paint the walls.
- There could be disturbance of the neighbors in the community. During the day, the neighbors that would be disturbed wouldn't be very far but at night, even those outside the school would be disturbed.
- Complaints could arise from the wrong type of mirrors installed in the bathrooms
- Complaints would have arisen from fears due to insecurity from not checking under cars.

Use your knowledge of Physics to;

a. Identify the cause of the distortion of sound and structural adjustments that can be made to ensure the distortion is minimized.

b. Identify the paint color to use to increase the amount of light in the room.

c. Establish how the sound would reach the community, how it can be reduced, and the difference in the distance that the sound from the hall reaches.

d. Identify the type of mirrors that should be installed in the bathrooms and those that should be used to check under the cars.

5. Workers at a construction site are meant to raise pieces of scrap of mass 6 kg through a height of 15m. Their boss always complains that the workers who carry the pieces of metal do the work slowly, especially in the afternoon when the temperatures are high and in the morning when it is cold. In response, the workers claim their hands are burnt by the hot metals which slows them down. One of the workers suggested they use a pulley of velocity ratio 4 and an efficiency of 80%.

Use your knowledge of physics to;

a) Explain why the metals are very cold in the morning and hot in the afternoon.
b) Draw a design of the required pulley and explain how it can be used to solve their problem.
c) Determine the minimum force required to ensure an 80% is achieved. The string they used had a mass of 120g and a specific heat capacity of 2510 $JKg^{-1}K^{-1}$, and the work done to lift the load would be converted to heat energy in the string at the contact point of the pulley.

Hint; The string would break if its temperature reaches by 28°C.

d) Determine if the string suggested above would be suitable for the purpose.
e) Suggest ways in which the efficiency of the pulley system can be improved.

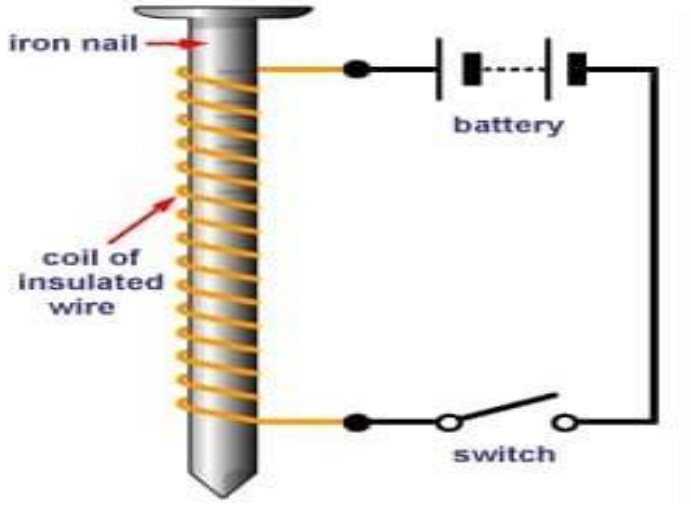
6. During a party, 2 liters of water at 24^{o}C were served to a man and a woman. They complained that it was warm and were given 50g of ice at -10 ^{o}C blocks. They mixed the water and blocks in a wooden container with a negligible specific heat capacity. They were surprised by the ice cubes disappearing in the water. The man put his mixture in a plastic container **(shc = 2800 JKg^{-1}K^{-}1)** while the woman put her mixture in a metallic container **(shc = 800 JKg^{-1}K^{-1})**.
They were surprised to find their water at different temperatures after some time.

Specific Heat capacity of water = 4200 JKg^{-1}K^{-1}
Latent heat of fusion of ice = 340000 JKg^{-1}
Use your knowledge of Physics to;

a) Determine if the water cooled when mixed with ice.
b) Why do the ice cubes disappear when mixed with water?
c) Explain why there was a difference in temperatures in the water kept in the plastic and the metallic container.

ELECTRICITY AND MAGNETISM.

7. An electromagnet as shown in Figure below is constructed by winding a wire around an iron nail of resistance 0.5Ω, connecting it to a battery of four cells of EMF 1.5V each, and then placing it above a tin containing iron fillings, some of which are attracted to the nail. Upon disconnecting the battery, most iron fillings fall off. However, when the iron nail is replaced with an identical steel nail of the same size, the pins are attracted slower. Surprisingly, when the EMF source is disconnected, just a few of the iron fillings fall off.



Use your physics knowledge to:

a) Explain how the electromagnet operates.
b) Use domain theory to explain how the nail becomes a magnet.
c) Elaborate on the difference in the time taken before the steel and iron nails start attracting small pins.
d) Explain what would happen if a battery of 2 cells of the same EMF was used instead of one of 4 cells.
e) Identify other factors that could contribute to an increase in the number of nails being attracted.
f) Suggest ways in which the magnetized nails can be made to lose their magnetism.

CHEMISTRY

NB: ALL ITEMS [CHEMISTRY] SHOULD BE RESPONDED TO ACCORDING TO THE FORMAT OF ASSESMENT GIVEN TO YOU EARLIER DURING YOUR CLASSROOM LESSONS BY YOUR TEACHER.

1. APPLICATION OF CHEMISTRY IN DAILY LIFE

Item one

In one of the towns in Uganda, residents are facing an unexpected challenge of water wasting detergents. The locals are frustrated and do not know what to do. They have been advised to try other alternatives on the market to overcome the challenge but they need more advice on this

Support material

As a concerned chemistry student in the town,

Task: Help the residents,

a) understand the variety and mode of action of the detergents

b) on the consequences of the detergent

Item two

2. DIVERSITY AND INTERACTIONS OF SUBSTANCES AND THEIR IMPORTANCE IN LIFE (Trends in the periodic table, polymers, periodic table, structure and bonds)

A shop attendant wants to use environmentally friendly and sustainable packing materials. He is not having enough information about which packaging materials to use.

He has decided to seek for advice from a person with good knowledge of chemistry. TASK

a) help him appreciate that the packing materials are of different types

b) advise him on the suitability of the materials

Item three

A group of Learners were faced with a unique solid substance, X, which they suspected to be an element. 0.3g of the element could burn in air to form 0.5g of the solid product. One of them picked interest in what could be the chemical formula of the oxide of the element. However, he did not know how to determine the formula. When they contacted the laboratory technician he gave them the atomic number and mass number of X as 12 and 24 respectively, and the symbolic representation of oxygen as $^{16}_{8}O$

As a student of chemistry help the learners to;

(a) understand the nature of substance X

(b) determine the formula of the oxide of X

(c) know the environmental consequences of the element

Item four

A businessman was selling salt mixed with particles of sand, tricking people who couldn't notice the difference between the salt and its mixture with sand. This made it difficult for residents to use the salt. They need your help to prevent future problems and avoid any chemical dangers

Support material

They trust your chemistry knowledge to clarify the situation and prevent further suffering. Task.

Help the residents:

(a) Know the behavior of the substances in the mixture.

(b) Evaluate the problems associated with the use of one of the component in the mixture

SECTION B

PART ONE

Item five

There is high demand of oxygen in referral hospitals in Uganda. An investor was contacted by government to set up an oxygen manufacturing plant at Namanve, one of the swamps near Kampala to tap into the opportunity. However, the residents seem not to understand how the process will occur plus its consequences and are resisting the project. As a senior four candidate with the knowledge of chemistry, you are required to create awareness to the members and provide the necessary information.

TASK:

Write a presentation you will use upon meeting them.

Item six

Many people in villages make a living by manufacturing local waragi (ethanol). However, the government is against the business due to associated challenges. The area Member of Parliament wants to sensitize the community about the large-scale production process and its impact to enable them understand the government position. The area Member of Parliament has contacted you as a student with the knowledge of chemistry in your village to provide relevant information.

Task:

Make a write-up to use upon meeting the community.

Part two

Item seven

Recently, oil deposits were discovered in Western Uganda. A Chinese investor has been contracted by the government to extract the oil but the people around are scared of the outcomes. You have been invited by the LC chairman of that area to attend one of their meetings, and you are the only person who has some knowledge about natural resources, so the chairman has requested you to give a talk about the issue.

As a chemistry learner,

Task:

Make a write up of your speech.

Item eight

Urbanization and industrialization have caused freshwater bodies to suffer from severe pollution. The Ugandan government aims to create public awareness regarding the natural resource through various initiatives.

One of the initiatives is to involve students with good knowledge of chemistry in radio talk shows.

TASK:

Write the presentation you can use.

Sample question and answering criteria

ITEM (air)

"Residents of Kampala are facing severe health risks due to poor air quality," was a headline in one of the recent editions of the New Vision newspaper. With the city's reputation tarnished and residents' health hanging in the balance, urgent action to raise awareness and clean the natural resource is needed, the paper continued to state. The Kampala Capital City Authority (KCCA) is getting ready to improve the situation following the alarming revelation.

As a student of Chemistry who has learned about air as a natural resources

TASK

Write an article KCCA would use in response to the paper to sensitize the community of Kampala.

Response

Category: Air is a renewable natural resource because it can be replaced/replenished in man's life time.

Composition: Nitrogen gas, oxygen gas, carbon dioxide gas, rare gases, water vapour and dust.

Impact: Burning of fossil fuels, increases amount of carbon dioxide gas thus trapping a lot of heat in the atmosphere thereby causing global warming and consequently desertification. Mitigated by increased afforestation to absorb carbon dioxide from the atmosphere as quickly as it is formed

Importance Air contains oxygen which is used for respiration and carbon dioxide which is used for photosynthesis

Note: students are encouraged to follow the above format but providing a more detailed information in their assay.

REMEMBER NOTHING BEATS PASSION AND DETERMINATION. HARD WORK PLUS PRAYER IS EVERYTHING.

BIOLOGY

1. After a morning heavy carbohydrate meal, Nagenda, a male athlete started to warm up in preparation for the competition in long races. He competed favourably, but towards the end, he developed muscle cramps and was breathing heavily. Nonetheless he endured and finally won the race. After finishing, his heavy breathing continued, while the muscle crump progressively receded. He even managed to walk back home from where he took another meal.

Task

Explain how Nagenda's body utilized the morning meal to enable him win the competition, analyse the challenges his body encountered during the race and how it overcame them to enable him walk back home.

2. A sixty-year-old woman instructed her grandson to watch over a saucepan of milk on fire until it boils.
At boiling, the old woman rushed to lift the saucepan, but in the event, she immediately released it, slipped off and fractured her leg in additions to burns and scalds sustained. When rushed to the hospital, the orthopaedic doctor diagnosed her with Osteoporosis.

TASK:

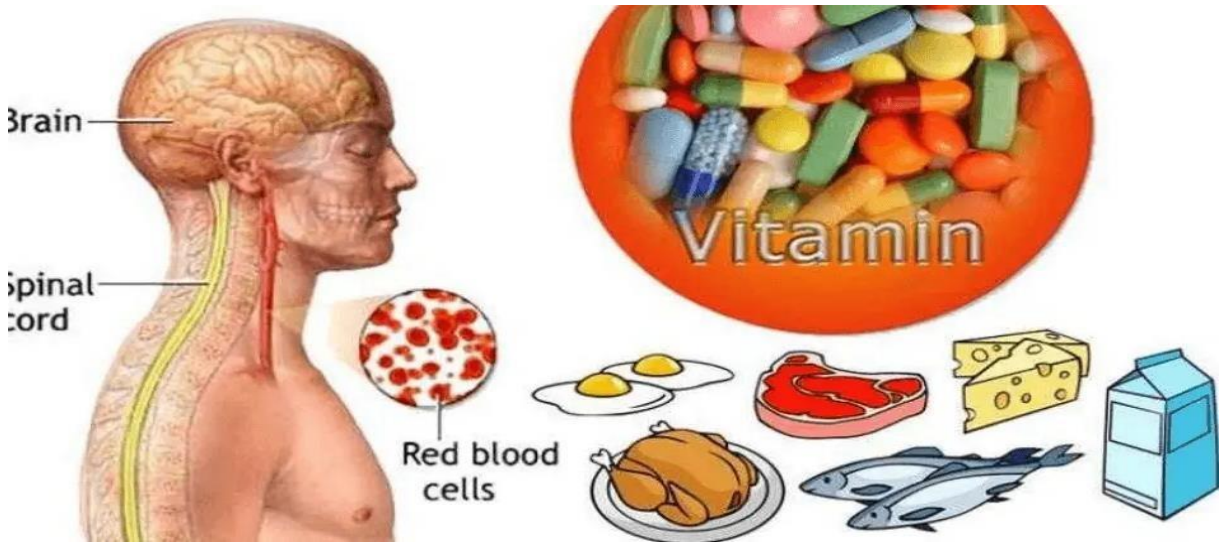
a) Expound on the events that took place in her body from the time she touched the saucepan until she released it.

b) What symptoms did the orthopaedic doctor base on to diagnose the woman as such?

c) Advise the old woman on how she can manage and improve her health condition as stated by the doctor.

3. The people in your community have a challenge of deficiency diseases. You have been selected by your class teacher to represent your class on a sensitization campaign to help those people overcome the diseases.

SUPPORT MATERIAL



Task.

Prepare a poster you will use to sensitize the people in your community on how to overcome the deficiency diseases.

4. Having been in a company of chain smokers for two years, Daniel, an teenager developed dry cough and serious chest pain and got hospitalized after coughing blood. The medical report suggested that Daniel was a smoker, which he utterly denied, and so the doctor put him on serious medication. In the course of the treatment, it was also discovered that Daniels' blood could no longer load enough oxygen, a reason why he was always very weak.

Task

Mention Daniel's Health problem and clearly explain how his body contracted it. Advise Daniel on how he can recover from the problem discovered later in the course of the treatment.

1. Mary and Peter had been married for 10 years and have produced five Girls. Peter is very bitter and
blames his wife for denying him boys, so he started engaging in extra-marital affairs. After some
time, Peter developed an ailment, went to a healthy facility, which after some tests were carried out,
it was discovered that he was HIV positive.

Task

a) Convince Peter, that he is also responsible for the kind of children they have in their marriage.

b) Identify the likely symptoms possessed by Peter, Mary's husband as a result of his health status

c) How can Peter manage life with his health status?

2. Jane is a secondary school girl, studying in a day school near her home. As a result of bad peer groups, she started drinking alcohol and dodging school. When the school authority tried to trace why Jane was dodging school, they found out that she had a boyfriend in the nearby village, where she would stay, without reaching school. A few months later, Jane started feeling sickly and vomiting. When her parents carried out an HCG urine test, it turned out positive and they were very bitter with her.
She was forced into teenage marriage by her parents; however she continued with her habits
and did not attend antenatal care.

Task

(a) Explain the events that resulted into the changes in Jane's body from the time she met her
boyfriend up to when she started feeling sickly and vomiting
(b) What are the likely consequences of Jane's lifestyle?
(c) Advise Jane on how she can improve her living conditions.

3. Moses is a tall boy, who is bright in class. He however as a result of his friends started taking alcohol and marijuana which prompted him to always escape from school. One day as the class Teacher was organising the class, Moses refused to sit at the back, stating that he cannot see clearly on the chalk board when at the back of the class, so he insisted on sitting on the first row of the class.

TASK:

a) Explain Moses' problem to the teacher that is making him insist on sitting on the first row of the class, clearly pointing out its cause.

b) State the likely effects of Moses' lifestyle

c) Advise Moses on how he can improve his lifestyle and be a good child.

4. Jane is a thirteen-year-old P.6 pupil was discovered to be pregnant at school during the routine pregnancy checks. She was sent out of school and her parents decided to keep her at home until she delivers. In the course of the pregnancy, she faced many challenges and did not go for antenatal care. She finally delivered her girl child, though with a lot of difficulty. After about one year, her child presented frequent fevers, had sharp pains in the body and was generally weak. The medical personnel informed Jane that her child had a genetic condition that was responsible for her health.

Jane and her boyfriend did not believe the personnel's information since for them they had never had such a problem.

Task

a) Help Jane and her boyfriend to believe the medical personnel's information.

b) Point out the likely consequences of Jane's decisions and actions responsible for her current state.

c) How can Jane better her life despite prevailing conditions?

MATHEMATICS

SECTION A

NUMBERS

Iganga Progressive School bought 25 Baroque learner's books and 35 Longhorn learner's books for Ugsh 1350,000 from Jinja bookshop. From the same bookshop, Jinja Modern SS bought 21 Baroque learner's books and 38 Longhorn learner's books from spent Ug sh 130,000 less than Iganga Progressive. But at online bookshop the cost of a Baroque learner's book and longhorn learner's books were 2% less than that at Jinja bookshop. Eden High School purchased their books from online bookshop and purchased the same number of Baroque and Longhorn learner's books as Iganga Progressive School.

Task

a) As a student of mathematics help Iganga Progressive and Jinja Modern SS to find out the price of each learner's book at Jinja bookshop.

b) What is the difference in the amount spent by Eden High school and Iganga Progressive School?

PATTERNS AND SEQUENCIES

ITEM 1

Jinja Modern SS hired a bus and a minibus to transport students to a study tour. Each trip by the bus costs Shs. 40,000 and that of the minibus costs Shs. 25,000. The bus has a capacity of 42 students and the minibus 14 students.

All the 126 students contributed a total of Shs. 200.000. The minibus had to make more trips than the bus. If x and y represent the number of trips made by the bus and the minibus respectively:

Task

a) Write down five inequalities representing the above.

b) (i) Plot the inequalities on the same axes

(ii) By shading the unwanted region, show the region satisfying all the inequalities

c) Use the graph to find the number of trips each vehicle should make so as to send the least amount of money.

ITEM 2

In a Physics practical attempted by a senior four class, The force Y needed to move the load X by a machine is determined by a law $Y = aX + b$, where a and b are constants. The table below shows results which were obtained by one of the students.

Load (X)	1	2	3	4	5
Force (Y)	4	4.8	5.5	6.7	7.2

(a) Plot the scatter diagram from the table above i.e Force (y) against the Load (x)

(b) Draw the line of best fit and use it to find;

(i) The Force corresponding to a Load of 3.5

(ii) The load corresponding to a force of 6.2

(iii) The Force corresponding to the load of 0 (zero)

(c) Take any two points on the graph and use them to find the slope/gradient of the line of best fit.

(d) Compare your findings with the equation of the form $y = mx +$, hence find the law connecting Y and X, where $a = m$ and $b = c$ and state $Y = aX + b$.

ITEM 3

During football training, the coach marked three points on the ground forming a triangle OPQ, he labelled displacement OP as vector **p**, and displacement OQ as vector **q**. He further marked point R on OQ such that $OR: RQ = 3: 1$, and S on OP such that $OS: SP = 1: 2$. He stationed point T as the point of intersection of PR and SQ.

(e) Using the knowledge of vectors, express PR and QS in terms of vectors **p** and **q**.

(f) Given that $\boldsymbol{PT} = \boldsymbol{\lambda PR}$ and $\boldsymbol{QT} = \boldsymbol{\beta QS}$, express OT in terms of ;

(i) $\boldsymbol{\lambda}$, $\boldsymbol{p}$ and $\boldsymbol{q}$

$\boldsymbol{q}$

(ii) $\boldsymbol{\beta}$, $\boldsymbol{p}$ and

Hence find the value of $\boldsymbol{\lambda}$ and $\boldsymbol{\beta}$

Determine the ratios in which T divides SQ and PR.

SECTION B

Part 1 (DATA PROBABILITY)

ITEM 1

The headteacher of Jinja Modern SS is thinking of how he can boost the mathematics department of your school. He can either add another teacher or buy more books or both. He has decided that he will do both if the average performance of this year's performance for the 50 students is lower than that of the previous which was 64. He asked the department to give a test and these were the student's marks.

86	30	26	64	87	47	49	26	43	25
45	38	44	56	59	52	76	27	89	46
90	57	73	48	58	89	51	32	56	88
66	62	52	67	69	68	49	92	66	95
54	74	32	39	35	36	69	50	71	92

He also visited the library and found out that previous candidates used three books for their revision; Longhorn, Baroque or Math Clinic. From the Librarian's records it is clear that those who did not use any books failed the subjects greatly. Out of the 50 candidates this year 13 used Longhorn, 20 used Baroque and 17 used Math Clinic. 9 used Longhorn and Math Clinic, 3 used Longhorn and Baroque while 8 used Baroque and Math Clinic only. The records show that 2 used all the three books.

He observed that he should replace one book type of the three with Fountain Publisher since no student read it only alone.

Tasks

a) (i) Help the head teacher group the marks to make an informed decision on the fate of the department and defend it.

(ii) Display the students' marks in groups on a simple statistics diagram.

b) (i) Help the head teacher identify the book he should replace and explain why

(ii) Find the probability that a student selected from the class failed.

ITEM 2

Kelan Supplies Limited, A company that supplies food stuffs supplied food items to three schools as follows;

First week;

Jinja SS; 3 bags of posho, 1 bag of rice and 3 bags of cassava Jin

Jinja Modern SS College; 1 bag of posho, 2 bags of rice and 2 bags of cassava

Second week;

Jinja SS; 3 bags of posho and 2 bags of cassava
Jinja College; 1 bag of posho, 2 bags of rice and 1 bag of cassava
Jinja Modern SS; 3 bags of posho and 1 bag of cassava

The price of posho, rice and cassava is Shs. 20,000, Shs. 30,000 and Shs. 10,000 per bag respectively.

After the two weeks, he wanted to improve his mode of supply, that is to say, supplying what is preferred more by the students in the schools. Therefore, he decided to make a random survey among a selected number of students from all the three schools. All students sampled liked at least one of the foodstuffs. 47 liked cassava (C), 53 liked posho, 23 liked posho only, 10 liked cassava only and 15 liked all the three food stuffs. Forty-five liked rice and 5 liked only rice.

Task

(a) Arrange the amount of foodstuffs bought for each week and the prices using suitable arrays of rows and columns and use them to determine which school spent most in the first two weeks.

(b) (i) Arrange the results of a survey using a suitable statistical diagram.

(ii) Use it to determine the number of students that prefer at least two food stuffs.

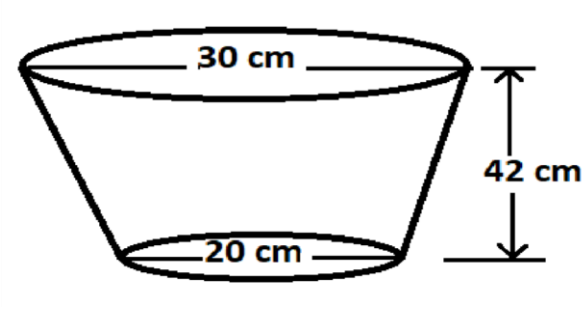
(iii)How many students were randomly picked for this survey?

(iv)What is the chance that a student picked at random prefers rice? What conclusion can he draw from this value as per requirements of his survey?

Part II (GEOMETRY AND MEASURES)

ITEM 1

Brenda's bucket is in the shape of a frustrum with an open end of diameter 30 cm and a bottom diameter of 20 cm. The bucket which is 42 cm deep is used to fill an empty cylindrical tank of diameter 1.8 m and height 1.2 m



Taking $\pi = \frac{22}{7}$

Brenda has two other similar cans that have different heights, one 6 cm and the other one 9 cm. if the surface area of the larger can is 840 cm^2. **Task**

(a) Determine;

i. The capacity of the bucket in litres correct to 3d.p.
ii. The capacity of the tank in litres correct to 2 d.p. iii. The number of buckets that must be drawn to fill the tank

(b) Find the surface area of the smaller can correct to 3 d.p.

ITEM 4

(a) A senior four student, was given three points A(4,0), B(0,3) and C(4,3) of a triangle ABC and asked to enlarge by both a scale factor 2 and a scale factor -2 on the same axes with the center as the origin, the learner could not distinguish between a positive and negative scale factor! Guide the learner through and state the images;

(i) Of triangle $A_1B_1C_1$, scale factor 2

(ii) Of triangle $A_2B_2C_2$, scale factor -2

If triangle $A_1B_1C_1$ is an image of triangle $A_2B_2C_2$ under enlargement, state the center and scale factor of enlargement.

(b) You are given two cylinders one of length 12cm and volume 630cm^3, another with length 14cm and volume 420cm^3. State with reasons whether the cylinders are geometrically similar. What would have been the volume of the smaller one for the cylinders to be similar?

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