

ST. CLISK SCIENCE DEPARTMENT TERM ONE

S.5 HOLIDAY PACKAGE 2026

BIOLOGY ITEMS

1. David, a key player for his school's football team, suffers from a painful ankle injury during a match, which results in significant swelling. To manage his condition, the school nurse provides him with diclofenac. The nurse explains that the swelling and pain are triggered by signaling molecules produced by an enzyme in the body called Cyclo-oxygenase-2 (COX-2). According to the pharmacological notes, diclofenac works by binding to a location on the COX-2 enzyme that is completely separate from where the normal substrate binds, altering the enzyme's overall shape.

Task

- Analyze how the drug provided by the school nurse biologically relieves David's symptoms.
- Evaluate the effect of naturally increasing the concentration of the enzyme's normal substrate in David's body on the efficacy of the drug.
- Propose an evidenced-based biological strategy the school nurse could use alongside medication to further manage the condition and accelerate tissue recovery.

2. The immune system relies on proteins and lipids to detect and respond to pathogens like those causing malaria (*Plasmodium spp*).

Macrophage type	Membrane protein receptor density (relative units)	Membrane cholesterol level (relative units)	Percentage of parasites engulfed in 30 min
1 (Normal)	100	100	85%
2 (Low protein)	40	100	38%
3 (Low lipid)	100	35	41%
4 (Low both)	40	35	12%

Figure 1.0: A table showing the effect of proteins and lipids on phagocytosis of *Plasmodium*-infected red blood cell by macrophages.

Task:

- Explain the role of cell membrane of immune cells in recognizing and engulfing malarial parasites.
- Describe how deficiency of cholesterol may affect the response of immune cells to malarial parasites.
- What other attributes may improve effectiveness of the membranes of the immune cells in combating the parasites.

CHEMISTRY ITEMS

- During a chemistry lesson on gaseous reactions, learners were asked to investigate an unknown gaseous hydrocarbon, X. Sharon conducted an experiment where she exploded 20 cm³ of hydrocarbon X with 100 cm³ of excess oxygen. After cooling, the total gas volume was 90 cm³, and after passing the mixture through aqueous potassium hydroxide, the volume reduced to 50 cm³. Hydrocarbon X burns in oxygen according to the following equation: -



Sharon is unsure how to use these results to identify hydrocarbon X. She presents her findings to the class for interpretation.

Task

As a chemistry student, Help Sharon to;

- Understand what caused the drop in volume after explosion, and why did it reduce further after treatment with potassium hydroxide?
- Calculate the volumes of carbon dioxide and oxygen that reacted.
- Deduce the molecular formula and molecular mass of hydrocarbon X.
- Help Sharon to understand the impact of the gaseous product produced and how it can be mitigated.

- A group of forensic chemists are investigating organic substances they found at certain suspected illegal chemical dump. Analysis gave them the molecular formula of the two compounds as M(C₃H₆) and N(CH₄). To gather more information about the compounds they also need to know the nature of the two compounds and their chemical reactivity. They are aware that you have some knowledge on organic chemistry and have come to you for advice.

Task: As a chemistry student help them to;

i) Write the structural formulae and state the functional groups present in the organic compounds.

ii) Predict the reaction and write the mechanisms for the reaction of;

a) M with hydrogen gas

a) N with chlorine in presence of UV light

b) N with concentrated nitric acid at (150-400) °C

(iii) Help the students to analyze the impacts of one of the compounds to the environment.

PHYSICS ITEM

A fisherman on lake Albert pulls a fishing net with a force of 300N at an angle of 30° to the horizontal. The net has a mass of 50kg and experiences a water resistance of 100N. The fisherman needs to calculate the acceleration of the net and whether he can lift it into the boat without resistance.

Task

As a learner of physics;

a) Resolve the pulling force into horizontal and vertical components

b) Calculate the net force acting on the fishing net

c) Determine the acceleration of the net

d) Apply Newton's third law to describe the force pairs involved.

MATHS ITEM

The academics department of Luwero S S has decided to compare the physics and mathematics results of S.5 students in the of term examinations to establish the relationship. The table below show a sample of the results;

PHY	35	65	55	25	45	75	20	90	51	60
MATH	86	70	84	92	79	68	96	58	86	77

Task

- (a) Use the graphical method obtain the marks of in physics for a student who scored 64 in mathematics and also the marks in mathematics for a student who scored 32 in physics. From your graph, what is the relations between mathematics and physics scores.
- (b) By means of Spearman's method, calculate the correlation coefficient and comment on the result you get.

AGRICULTURE ITEMS

- a) Paul a cattle farmer recently bought a farm with a variety of breeds of cattle, but he opted to have uniformity in production by having only black and white animals, he culled off all brown, red and grey coloured animals to remain with only black, white or black and white coated animals. Paul crossed a white cow and a black bull and all the F1 offsprings where black and white, he would like to continue carrying out a genetic cross to produce the desired characters in the F2 generation on the farm

Task.

As an agriculture student write a manual to Paul instructing him on how to carry out a self-cross to achieve his dream

- b) A senior two student conducted an experiment to observe water movement in plant cells, he obtained a tissue of Irish potato at 65% sugar concentration, and he placed the tissues in solutions of different sugar concentrations of 60%, 65%, 67% and 70% respectively. He observed that cells behaved differently

Task.

As a student at advanced level try to describe the osmotic concept of water movement of the cells in the solutions of different sugar concentrations respectively

END