NEW LOWER SECONDARY SCHOOL CURRICULUM (NLSC)

PHYSICS QUESTIONS

ITEM 1.

Kilembe farmer's association in Kasese district deals in vegetable growing near R. Nyamwamba for their livelihood. The natives near the river bank have been complaining of health complications that drew the attention of the government under the ministry of health. The ministry of Health sent a nuclear Physicist, Dr. Fredrick to make a survey on the occurring problem in Kasese. Dr. Fredick later surveyed and wrote a report to the Ministry of health on the main cause of the issues in Kasese. In the report, it was reported that the vegetables contained radioactive materials that emit radiations to the grown vegetables coming from water and this was not known to the natives near the river bank.

TASK:

As a physic learner;

i) In the reports, terms such as **radioactivity** and **radioactive decay** were reported. Help the natives to understand these terms. **(2 scores)**

ii) Guide the natives at the river bank using reaction equations to understand the types of radiative decays that their vegetables have been prone to. **(6 scores)**

iii) Advise the natives about the dangers of these radiations and the safety precautions they should take to take against the emitted radiations. **(4 scores)**

ITEM 2.

a) One of the most misunderstood branches of physics for years has been space physics (Astronomy). Some of the examples of such misunderstandings include the following.

- While watching the world cup which took place in Brazil in 2014 at 9:00 pm East African time, the football fans watching the game in E. Africa realized that it was still day time in Brazil, some of them were puzzled by this.
- The NASA (National Aeronautic and Spaced Administration) tells us that the only planet that supports life is earth.

TASK:

a) How can you explain the above statement in **case one** to your classmates, siblings or friends about the astronomical events in order to promote deeper understanding of physics in the school and community at large. **(6scores)**

b) The solar system is composed of big, small and much smaller objects including planets. All planets move around the sun in elliptical paths. The motion is both rotational and revolution. Rotation motion involves the planets spinning about a fixed axis and revolution motion involves planet moving around the sun.

TASK:

i) Identify the other components of the solar system. **(3 scores)**

ii) Which name is given to the path in which planets move. **(1 score)**

iii) Draw diagrams to show rotational motion and revolution motion. **(2 scores)**

ITEM 3.

a) Two people stood in the middle of two cliffs at an unknown distance between them. The woman calls the boy and she hears herself 5 seconds later and the boy hears the second sound after 4 seconds. The two discovered that their sound was clearer at night than during the day. The scenarios left them confused without understanding the magic in the hall.

TASK:

As a physics student;

i) What is the scientific name is given to this second sound? **(1 score)**

ii) Help the two people understand why the sound was clearer at night than that during the day. **(5 scores)**

b) Light from air is made to strike the surface of alcohol of refractive index of **1.36** such that the incident light makes an angle of **20 º** with the normal at the point of incidence.

TASK:

i) What physics term is given to these phenomena and state the laws that govern them.

ii) What is the angle of refraction as light passes the air-alcohol interface. **(3 scores)**

ITEM 4.

Ms. Kobusingye is a new mother who has given birth to a new born child in Katamba village last month of March. The Doctor advised Ms. Kobusingye to bathe the child with water at temperatures ranging from **35 ºC** to **45 ºC** to avoid skin burn of the new born child. When Ms. Kobusingye told her mother-in-law, the mother-in-law boiled **2 liters** of water up to **70 ºC**. If mother-in-law tasked her last born to mix the boiled water with **4 liters** of cold water at **15 ºC** in a basin.

TASK:

i) If you were the last born, help your mother to know if the water has cooled to the required temperature as directed by the doctor to Ms. Kobusingye. **(6 scores)**

ii) When your brother who lives in Kampala heard that his wife Kobusingye gave birth to their first-born baby he traveled to their village where the wife gave birth. When he arrived, everyone run to welcome him from the gate before bathing the child. Advise your mother on how she can keep the boiled water hot. **(3 scores)**

iii) If the building they live in has upper flow and the bath room is in the upper room. Your brother who came want to take his bathe and your mother said the water should not be carried via stair case. As a physics learner, give other ways you use to transport water to the bathroom for your brother in the upper room. **(3 scores)**

HINT:

Specific heat capacity of water, $c_w = 4200 Jkg^{-1}k^{-1}$

Density of water, $c_w = 1000 Jkgm^{-3}$

Specific heat capacity of basin, $c_b = 120 Jkg^{-1}k^{-1}$

Mass of basin $M_b = 6\ kg$

Acceleration due gravity $= 10 ms^{-2}$

Take **1 liter of water = 1 kg**

ITEM 5

In a certain town, it is a must for drivers to be tested with their vehicles for road-worthiness. On a certain day, a car started from rest and accelerated to 50 ms^{-1} in 10 seconds. The driver maintained that velocity for 20 seconds and suddenly decelerated to rest in 2 seconds causing him to crush into windscreen. As a result, the car tyres wore out on the tarmac causing a lot of heat on the ground.

TASK

You have been tasked to write a report to explain the scene. In your report include a motion graph, Find the rate at which the car's velocity reduces and explain why driver crushed into the wind screen. Advise by stating whether the drivers average speed exceeded the speed limit of 8 ms^{-1} and how he would prevent the crushing

ITEM 6.

(a) In your village, among the playmates you grew up with, you are the luckiest one that reached secondary school level. During holidays, you happened to speak to them that you learned about a topic called Magnetism in Physics while at school. This news arose interests of your playmates to understand about this strange thing call magnet. They then asked you to help them make some magnet so that they also see how magnets work.

TASK:

As a senior four student who learned about Magnetism, help your playmates on the different methods they can use to produce their own magnets in their history despite their levels of education. **(6 scores)**

(b). The community members of Kyatega village in Kyegegwa district in Western Uganda have a myth that people are killed by lightning in the village is caused by bad fortunes from their ancestors or wicked people in the village. This has caused fear to the village members always.

TASK:

As a physics student who learned about electrostatics, educate the community on how lightening occurs and ways they can safely guard from the lightening.

ITEM 7.

a) In your neighborhood, a business man wanted to wire his house but he is confused on the different ways on how to make the electrical connections.

TASK:

As a physics student;

i) Advise the businessman the different ways of how to make the above different electrical connections with the help of the diagrams. **(4 scores)**

ii) Give the businessman which one he can take and give the reason to why he could take it. **(2 scores)**

b) You are an electrical engineering student tasked to design a circuit for a project. You have three resistors with values of 5 Ω, 10 Ω and 2 Ω respectively.

TASK:

Explain how you would calculate the total resistance;

When resistors are in series. **(3 scores)**

When 5 Ω resistor is in series with parallel connection of 10 Ω and 2 Ω. **(3 scores)**

ITEM 8

Rita, has just completed her primary seven at heavens primary school and admitted to standard high school . On reaching the school, she was told by her friends that she needs to take 10 books to class each day for the lesson. She was given 20 black books from the bursar's office, each of dimensions 30cm by 21cm by 2cm. And was given a bag that has a volume 10080 cm^3. She is really wondering of how she will be carrying the books to class in the bag every morning.

Task

a) If Rita can only take the books that can fit in the bag, help her determine how many books she can carry at a time.
b) if she sits on a single sitter of the upper deck of dimensions 105cm by 18cm. how many books can she put on the upper deck at a time.
c) If Rita reported late and she found that the teacher had already taught about fundamental and derived quantities, how best can you help her differentiate between the two giving two examples in
each case. (10 SCORES)

ITEM 9

Juliet and Rahman failed to agree in a discussion that was organized towards the end of term one last year. The discussion was whether energy exist in forms or not. Juliet said there can't be forms of energy whereas Rahman said they exist about seven of them. As a S.2 student, write a report guiding them clearly about their argument and include the applications of content in daily life. During holiday of Term 3, the father asked his son to go and join a certain construction site. As he was at work, an engineer lifted a heavy stone of 2,200kg from a deep hole through a vertical height of 7m from the bottom of the hole using crane within 2 minutes. As a physicist, help him to get how much work was done by the crane and its power. (Use g =10 $^{-2}$).

ITEM 10

JOAN bought two oranges and two eggs from a market as they went to the trip after which they went for a boat ride on Lake Victoria. She had feared to sit in the boat because it was made of metals of which she knew that it was denser than water. However looking the other side of the lake, she discovered that it was possible for the boat to float on water even though it is metallic. While on the boat, she peeled one of the oranges and accidentally the peeled and the unpeeled oranges fell in water, she was again amazed by the fact that the peeled one sunk and the unpeeled one floated and was able to get it back. (10SCORES)

ITEM 11

A long time ago, solar eclipses were considered as a message from the gods since the people in that age dwelt so much in the spiritual realm than the scientific world. However, with the development of science and technology, eclipses can now easily be explained scientifically instead of spiritually. Whenever eclipses occur, many people gather out in open places to watch the beautiful view of the heavenly bodies as they align themselves in a beautiful display.

However, in most remote areas of Uganda some people still observe the eclipse directly using naked eyes not aware of the risk they are exposing their eyes to in the long run. The science club of your school has taken an initiative to always once in a while go out into the community and teach the community members about scientific facts. This year you are expected to go out during the day an eclipse is expected to occur to. You are expected to organize for the presentation about eclipses.

TASK

As a student of physics and science club at the school, you are required to organize for the presentation about eclipses that you will use to address the community members on the day the eclipse is expected to occur. Conclude your presentation by recommending the best safe ways to watch an eclipse. (You may include ray diagram illustrations). (20 scores)

ITEM 12

Carpenters in your area have been poorly designing boats with no knowledge of density in relation to sinking. Therefore, water accidents are rampant and people have lost their lives and property. You have been selected to advise a carpenter who is supposed to make a boat of density 580 kgm-3 using the following

materials below.

- 3100 kg of timber whose density is 620 kgm^{-3}
- Volume of Aluminum is 3 m^3

TASK

Prepare an advisory report to the carpenter and the users of the boat on the recommended mass of Aluminium to be used and the maximum load the boat should carry. (20 scores)

ITEM 13

Figure one below shows a uniform metallic rod of length 4.0m pivoted at the centre and it is used at the play resort for children.

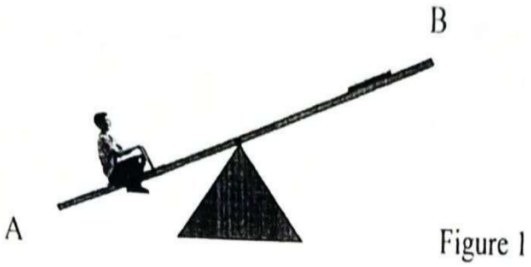


Figure 1

Given that a boy of mas 48 kg sits 1.5m from end A. Help the guide at the play resort to determine if another boy of mass 40 kg will restore equilibrium in the beam if he sits at a distance of 0.6 m from the center.

Identify two other instances in which the knowledge in this scenario would be applicable in real life.

With the boys off the rod, explain what would happen to the beam fi the end B was heated by a considerably hot flame. (12 scores)

ITEM14

New vision

Sad news!!! Sad news!!! Sad news!!!

Today in the morning at Fountain of Hope Junior School, two pupils were found dead in a down tank which is 10 meters long below the ground. The head teacher was arrested immediately and the Vision Group interacted with him and says that, the pupils were fetching water from the tank using a rope tied on the

jerrycan which had a capacity of containing water up to the weight of 10 kg. The government is taking a step of closing the school tomorrow and to arrest all the teachers.

SUPPORT MATERIALS

- A rope.
- The same jerrycan.
- A metallic bar or a long moderate piece of wood.
- Wheel of the bicycle.

TASK

Help the school come up with a simple machine they can use at the moment to protect it from being closed. Show all the necessary steps and illustration of this machine. Also guide the pupils on how to operate the machine using the least possible energy. (20 scores)

ITEM 15

Ibrahim was driving under a light drizzle towards Jinja at 45 kmh-1. 2 km after leaving Mukono town, motorcycle rider suddenly skidded off the road 85 m in front of the car. Ibrahim immediately

applied his brakes but it was a useless move. There was an accident but fortunately enough, no one sustained injuries.

The slammed onto the motorcycle despite the vigorous application of brakes. Soon after the police arrived at the accident scene and carried out their own Observations and measurements.

(a) By simply looking at the car tyres, why did the Police Officers conclude that the car was in bad mechanical condition, yet the car was fairly new as it was only one year old? (04 scores)

(b) What was the problem between the tyres and the road? (04 scores)

(c) What should the tyres have looked like? (02 scores)

(d) What should have been the case between the tyres and the road for a car in good mechanical condition?

(e) From the above scenario, how is friction useful? (05 scores)

ITEM 16

Senior Two students of Fountain of Hope High School visited a textile industry at Kalangala Island. They used MV Kalangala Ferry to cross the lake to the Island. On the Ferry, they loaded all their cargo including the school bus. They were all amused to see that the ferry could not sink. On reaching the industrial site, they observed the following:

- Sharp knives being used to cut the cotton bales.
- Factory trucks being lifted up on a hydraulic machine for servicing and maintenance.
- Overhead tanks supplying water to the different sections of the factory.
- Sprinklers watering flowers in the backyard of the factory.
- Small aircrafts (helicopters) airlifting cargo and employees to the mainland.
- Workers using vacuum cleaners to remove dust from carpets.

These learners were eager to understand how all these activities were possible and what principles they operate on.

Supposing you are an industry tour guide, write a detailed explanation for each of the above observations including why the ferry did not sink and how the aircraft is able to fly. (20 scores)

ITEM 17

A uniform metallic rod of length 4.0 m pivoted at its Centre is used at a children's play resort. If a boy of mass 48 kg sits 1.5 m from one end. Another boy of mass 40 kg wants to seat at a distance of 0.6 m from the Centre on the other end to balance with the boy at the other end.

TASK

Help the guide at the play resort to direct the learners on how to play the game safely. Also analyze what would happen to the beam if one end of the rod was heated by a considerably hot flame when the boys are off the simple machine so that safety is ensured during plays. (20 scores)

ITEM 18

A musician of mass 60 kg putting on high heels is found to make contact area with the ground of 0.002 2 per heel.

(a) Determine the total pressure she would exert when;

(i) Standing on both feet. (03 scores)

(ii) Walking. (02 scores)

(b)What one danger can you identify concerning the choice of shoes by the musician in (a) above towards;

(i) Herself. (01 score)

(ii) The surface (floor) she walks on. (01 score)

(c) A student pushes a drawing pin into wooden board. The area of contact of pin with the finger is 5.0 ^{2}. The student pushes with a force of 26 N and pin has a very small mass.

(i) Calculate the pressure exerted by the finger on the drawing pin. (02 scores)

(ii) Explain why the drawing pin penetrates into the wooden board but not into the finger. (02 scores)

(d) You are provided with a 1.5-liter mineral water bottle, cello tape, water, sharp pin and basin. Explain how you can demonstrate and conclude the effect of depth on pressure in liquids. (05 scores)

(e) Explain why after sometime a person carrying a heavy parcel using a thin string feels pain. (04 scores)

ITEM 19

The school welfare department is facing a challenge of rain affecting their catering activities due to lack of a kitchen. The school is planning to construct a modern kitchen, which can save energy and reduce on the temperature inside.

TASK

You are appointed as the head of construction committee for this kitchen, conduct a survey and compile a report you will present to the school welfare department showing the kind of cooking utensils required, how to paint the walls to reduce heat inside and outside the kitchen and how to manage air exchange inside the kitchen. (20 scores)

ITEM 20

At a construction site, Milly was tasked to carry bricks from where they were to the masons. The task was tiresome. She applied a lot of energy and would carry a few bricks a day. She asked the foreman for a wheelbarrow. Soon, she had to take the bricks up the building. This time, she asked for a plank of wood which she used to make an inclined plane. But she would be tired by noon! So, the foreman suggested that she makes a single machine that would move the bricks up vertically. When the foreman looked in the vicinity, he

realized that there was a motorcycle wheel, long ropes, straight poles, tall enough to reach the position where the bricks were to be put, and a large hemispherical pan.

TASK

(a) Make a brief explanation why and how each machine was able to simplify work.(08 scores)

(b) Show how Milly could assemble the items to come up with a simple machine and how she would use it to lift the building materials up to the floor in the shortest time possible. (12 scores)

Item 21

During preparation for the function or party at your school, two decorators disagreed on the right position to hang the balloons. One preferred the balloons to be placed in direct sunshine. However, the other insisted that they should be inside the tent.

TASK

As a Physics Learner, write an advisory message, with reasons, indicating the place where the balloons should be placed. (20 scores)

During a science project, learners are given two devices; a pinhole camera of length 50 cm and a concave mirror of focal length 50 cm. As a learner of Physics, help the students determine which instrument forms a bigger image of the man of height 1.8 m standing 2m away from each of the instruments.

Write a report about the nature of the images formed by each of the devices and what would happen if the size of the pinhole was enlarged. (12 scores)

ITEM 22

A certain family stays near the marram road and a school. Every day, the family receives dust raised by moving vehicles from the road and the bad smell from the school pit latrines. In the morning hours, the dust is not so much and the smell from the pit latrine is not so much either. These conditions worsen around

midday on hot sunny days. The family is disgusted by these conditions. They do not know the cause of these conditions. As a Physics student, write a message to this family explaining what causes the above conditions and possible ways of solving the above problem. (20 scores)

ITEM 23

There has been an outbreak of malaria in your community and your friend is admitted in hospital. You have been delivering a warm meal; however, you are required to deliver a hot meal for her in the hospital.

Without using a food flask, how would you ensure that the food you have prepared remains hot until you reach the hospital?

ITEM 24

A one-day old chicks are vulnerable to extreme temperatures. Patience is rearing chicken on a commercial scale and she has bought 1000 one-day chicks.

(a) Suggest possible causes of extreme coldness and hotness in the chicken house.(12 scores)

(b) Explain what Patience should do to regulate the temperature in the chicken house.(08 scores)

ITEM 25

You all have experienced a force in some way. Forces play a role in everything that we do. It may be kicking a ball, playing games and others. BLUE team and RED team are playing a tag of war. If each person in the blue team pulls the flag with a force of 200N and the team has 5 persons and each person in the red team pulls the flag with force of 100N and team has 6 persons

TASK

By showing your working, which team do you think will win the game? In addition, how many people should be added to the losing team to match the strength of the winning team? (20 scores)

ITEM 26

In a busy downtown neighborhood, a gas leak has triggered a small explosion in a residential building, leading to a fire outbreak. Emergency services rush to the scene, including a fire truck equipped with water hoses. However, firefighters are uncertain about the ideal distance to position the fire truck to effectively withstand the flames. The water jet from the truck's nozzle is positioned 8 meters above the ground and expels water with a velocity of 15 meters per second. Meanwhile, residents who managed to escape the building are gathered nearby, awaiting medical attention. However, they are unsure about administering basic first aid while they await the arrival of ambulances. Additionally, local authorities advise the building owner to install a fire alarm to enhance safety measures and prevent future incidents.

HINT: • Support your explanation with a diagram where necessary

Task: As a student of physics,

a) Calculate the optimal distance the fire truck should be from the burning building to ensure the water jet reaches the flames effectively.(05 scores)
b) Describe the essential first aid measure that individuals can provide to the injured residents to keep them warm while waiting for professional medical assistance. (03 scores)
c) Explain to the house owner how the fire alarm is able to detect fire early and improves overall safety for occupants. (07 scores)

ITEM 24

On April 8, 2024, an eclipse was scheduled to occur, generating excitement worldwide. However, despite preparations and anticipation, observers in Uganda were left disappointed when the eclipse was not visible from their location. Meanwhile, reports emerged from the United States of America

indicating that the eclipse had indeed occurred, causing momentary complete daytime darkness. Additionally, observers in the USA were seen using glasses to enhance their viewing experience.

Hint: • Support your explanation with a diagram where necessary

• Assume the speed of sound in air is approximately 340 $^{-1}$

TASK: As a student of physics, a national television station has requested you to explain to Ugandans:

i) The occurrence of the eclipse and why it was not visible from Uganda. (05 scores)

ii) Why the observers were using glasses for viewing the eclipse? (02 scores)

If an eclipse viewer wants to shout a message to another 500 metres away to share her excitement about the eclipse, how long will it take for her message to reach the friend? (03 scores)

ITEM 27

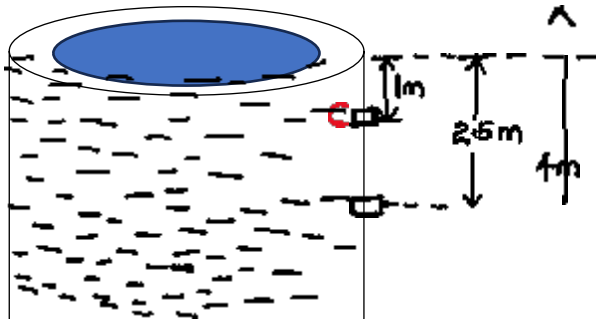
Over the past 100 years, the average temperature of the world has been steadily rising. This is demonstrated by the fact that certain regions of the country are currently experiencing high temperatures of up to 35ºC and the public seems to know very little about the cause.

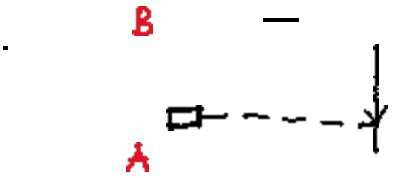
Jack, a farmer in a certain village with about an acre of land fully covered with maize and beans is one of the people affected by these climatic changes as he realizes that his crops are drying up. He immediately tries to locate a water source and lucky enough, he finds a well in a valley located about 100m from his farm making it hard for him to transfer it to the farm. He then decides to consult his engineer on how to go about the situation. After a careful examination, the engineer presents to him a list of some of the key equipment needed which included:

- An electric water pump
- A reservoir (water tank) with a height of **4m** resting on a metallic stand and located at the farm
- Water pipes of about **2cm** diameter each.

The engineer further informed Jack that the pump would have a power input (rating) of **240W** and water would move to the reservoir at a rate of **180W**. All this left Jack puzzled and with very many unanswered questions.

HINT:





TASK:

Using your knowledge of physics, help Jack clearly understand;

a) The phenomenon and the causes leading to the over whelming temperature rise. (05 marks)
b) Why the engineer preferred using pipes of diameter **2cm** to using the ones of **10cm** (01 marks)
c) The best position (A, B or C) on the water tank to place the pipes for watering. (*support your answer with appropriate calculations*) (03 marks)
d) The efficiency of this water pump. (03 marks)
(*density of water = **1000kgm**$^{-3}$*)

ITEM 28

Ochen was moving on a rainy day and his umbrella was blown away by a strong wind. On picking it up, he realized that its spring had gone missing and its plastic handle had also flown off. He so much liked his umbrella that he didn't want to buy a new one but to repair it. On picking it, he touched its metallic flame and he felt much coldness than before the wind had blown the umbrella. On taking it to a specialist, he was told to buy a spring of force constant 50Nm^{-1} from the neighboring shop. He was given a spring but was doubtful whether it was the required spring or not. He decided to measure the length and diameter of the spring and found them to be 10cm and 4cm respectively. He then applied a force of 2N onto the spring and it was stretched to 15cm.

TASK

i) What was the tensile strain and stress caused in the spring? (05marks)

ii) Did Ochen buy the required spring for the umbrella? (support your answer with the necessary calculations) (03marks)

Iii explain to Ochen why was there a difference in the coldness felt before the plastic handle of the umbrella had flown off and after when the hand is missing.

ITEM 29

Conrad is required to prepare a bath for his younger brother Alex. According to the advice got from his mother, the bath should be between 40° C and 42°C. He (Conrad), however, has 2 liters of hot water at 100° C and 6 liters of cold water at 20° C. All that Conrad has to do is mixing it in a cylindrical aluminum pan of mass 3.5 kg and specific heat capacity 650 J/kg/K. As a learner of Physics, help Conrad to establish and inform his mother whether the water is warm enough for Alex to bathe given

that he first poured the cold water into the pan. In what ways would you prevent the water from cooling very fast and why would water be used as a coolant in engines.

If each volume of $0.002m^3$ rises to a height of $0.06m$, find the amount of pressure that will be exerted at the bottom of the pan when all of water that has to be mixed by Conrad is poured into pan.

ITEM 30

In a certain town, people are concerned about the waste disposal from the factory into the nearby lake which is their source of water for home use. They raised this issue to the chairperson Local Council 1 (LC1) who directed the management of the factory to stop disposing waste into the lake. A scientist was contacted to investigate the presence of radioactive material in the water. The scientist found out that the water was indeed radioactive as shown in Table 1.

TABLE 1:

Time (days)	0	5	10	15	20	25	30
Activity (counts per minute)	1200	740	440	260	160	90	60

Although the water from the lake remains radioactive for a long time, the scientist recommended that water will be safe for use again when the activity is less than 38 counts per minutes.

TASK:

As a student of physics;

(a) Advise the chairperson LC1 about the time the community will wait for the water to be safe for use again.

(b) Sensitize the members of the community about the risks associated with the materials contained in the water from the above mentioned lake and how such materials should be handled.

ITEM 31

Small pieces of metal which are unsafe to be eaten by chicken were found in feeds that had just been bought from a milling company by a poultry farmer. The small pieces of metal were later identified as iron. The farmer thought of disposing off the feeds but remembered that the pieces of metals could be sorted with a magnet which he did not have.

HINT:

A nail, connecting wires of resistance 0.5 Ω, two dry cells each of 1.5 V were available to the farmer.

TASK:

As a student of physics;

(a) Help the farmer to remove the pieces of iron from the feeds.

(b) Comment on the effectiveness of what you have designed, given that current of 4 A is enough to create a strong magnet

ITEM 32

A group of hunters are told that the distant hill in the north of their village has very many wild animals which they can kill for meat. The hunters agree to meet and set off at nightfall so that they reach the hill by morning. They started off the journey with some holding solar bulbs and the others hand torches. When they had grouped together to start the journey, some feared that the distance might be longer than

expected. Their leader resolved that if the distance is more than 12Km then it is not safe to go but the problem is that no one in the group was sure of the distance. One of the hunters decides makes a loud sound and they are surprised to hear a loud and clear sound come back later after 30s.
When the hunters who had solar bulbs switched them on, they could not the distant hill but those who switched on their torches could see part of the hill and this puzzled the hunters.
Hint: speed of sound in air = $330ms^{-1}$

Task:
As a student of Physics, help the hunters to clearly understand;
a) whether it was safe to go or not.
b) why a clear and loud sound came back after some time.
c) why hunters who used the solar bulbs couldn't see the hill while those who used the torch light could see part of the hill.

ITEM 33

Tom went to the laboratory in the morning to carry out an experiment to determine the spring constant of a spring of natural length 30.0cm with a pan at its lower end of unknown mass. When he put a stone of mass 100g on the pan, the length of the spring became 36.0cm and on adding another mass of 200g, the length of the spring became 40.0cm. he left the setup upon being informed about the urgent meeting with the class teacher and went back to the laboratory during afternoon hours. On the reaching the setup, he observed that the pointer on the spring was reading 41.0cm and wondered what had caused an increase in the length of the spring.
As a student of physics, help Tom;
a) Determine the mass of the pan at the end of the helical spring

b) The spring constant of the spring
c) Understand the cause of the increase in length of the spring after leaving the setup for sometime.

ITEM 34

Peter and his friend were drilling holes into pieces of timber using a screw of pitch 5mm with 10 threads in order to fix them together and make a strong beam he would use as an inclined plane to push some load to a raised
ground. After drilling a hole, he removed the screw from timber and found out that it was hot. He asked his friends why the screw was hot and didn't get a convincing response.

As a student of physics;
a) Explain the energy changes that occur during the process so that Peter is convinced about the cause of heat in the screw.
b) Help Peter determine the energy used to drill a hole if he used a force of 10N to drive all the threads of the screw in timber.
c) Help Peter determine the quantity of heat generated in timber

ITEM 35

A septic tank is to be dug in the ground for a community toilet. In an effort to scop soil from the ground, a pulley system and a wheel and axle were constructed both to be operated by hand. A pulley system of 4 pulleys is constructed to lift a weight of soil of 250N using an effort of 100N. Then a wheel of radius of 18cm and an axle of 6cm is constructed to use the same effort and carry the same load as the pulley system. Using the knowledge of physics;
a) Determine the more efficient machine to use for the task?
b) Explain how the inefficient machine can be improved in productivity basing on structure.
c) When the more efficient machine was used, it was found to be hot. Explain the observation