KIGALI CITY

GASABO DISTRICT

2023-2024 SECOND TERM EXAMINATIONS

SUBJECT NAME: PHYSICS THEORY

LEVEL: SENIOR THREE ORDINARY LEVEL.

EXAMINATION DURATION: 3Hours **DATE: 14 March, 2024**

TOTAL MARK: 100marks

INSTRUCTIONS:

- This paper consists of **THREE** sections: **A, B** and **C.**
  SECTION A: This section is **compulsory**. **(55 marks)**
  SECTION B: Attempt any **three** questions. **(30 marks)**
  SECTION C: This section is **compulsory.** **(15 marks)**

- Calculators and mathematical instruments may be used.
- Use only a **blue** or **black** pen for writing and a **pencil** for drawing.

SECTION A (Attempt all Questions / 55marks)

1. a) Write **TRUE** for the correct statement and **FALSE** for the wrong statement **(2.5marks)**

i. When time increases as the velocity decreases, the moving body is decelerating
ii. Acceleration of a moving body is zero when its velocity remains constant
iii. Displacement, time and acceleration all vector quantities.
iv. Average speed is given by total distance multiplied by the time taken.
v. Initial velocity of a moving body is always $0\ m/s$.

b) Compare The characteristics of uniform rectilinear motion (URM) and uniformly accelerated rectilinear motion (UARM) by completing the table below. **(3marks)**

Parameters	**Characteristics**	
	URM	UARM
Acceleration		
Initial and final velocities		
The distance-time graph		

2. The man in the boat below was trying to jump from the boat to the bench.

a) Will he be able to jump to the bench or he will fall into the water? Explain your answer. **(2marks)**

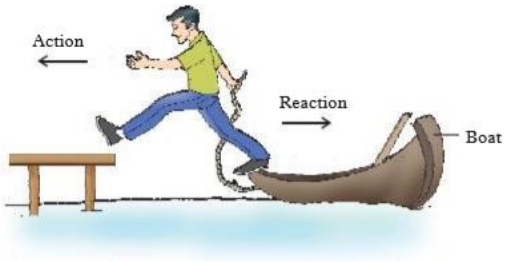


Fig 2.9: A person jumping from a boat

b) Which Newton's law does apply during jumping? **(1mark)**

C) State the Newton's law mentioned above in (b) **(1mark)**

3. a) Why a woman travelling in a bus found herself kicking forward when the bus stopped abruptly. **(1mark)**

b) Which newton's law of motion is related to this situation? **(1mark)**

c) State the newton's law of motion you have mentioned above in(b) **(1mark)**

4. a) Briefly discuss Two applications of atmospheric pressure in our daily lives. **(2marks)**

b) Given a glass full of water and a paper cord. Draw a well labeled diagram showing how atmospheric pressure produces a force. **(2marks)**

c) Some people bleed through their noses when they are at a high mountain. Explain why this problem happens. **(2marks)**

d) Mention any two devices used in everyday life by applying the effect of atmospheric pressure. **(2marks)**

e) The height of a mountain is 2.5 km. the average density of air at that altitude is 1.25 kg/m^3. Calculate The atmospheric pressure at that height. **(2marks)**

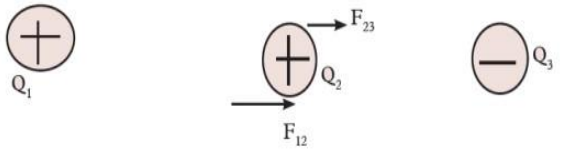
5. (a) Distinguish between renewable and non-renewable sources of energy. **(2marks)**
(b) Give two examples of renewable and non-renewable sources of energy. **(2marks)**

6. a) state coulomb's law **(1marks)**

b) Three charges are arranged as shown in below; Find the force on the charge Q2

given that, $Q_1 = 6.0 \times 10^{-6}$ C, $Q_2 = 3 \times 10^{-6}$ C and $Q_3 = -9 \times 10^{-6}$ C when Q_1 and Q_3 are

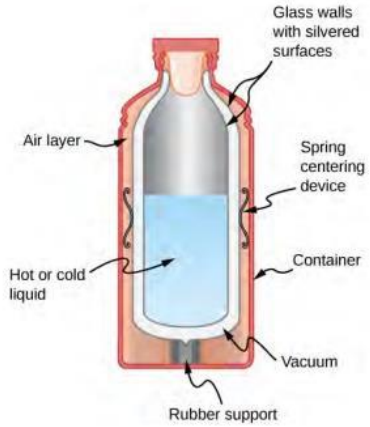
2.0 m from Q_2. **(3marks)**



7. a) Differentiate Between the following terms

(i) Heat and temperature **(2marks)**
(ii) heat capacity and specific heat capacity of a substance. **(2marks)**

b) The diagram below shows a cut-way drawing of a thermos bottle (vacuum flask), which is a device designed specifically to slow down all forms of heat transfer.



Analyze figure shown above and answer the sub questions below

(i) Which labelled feature of the vacuum flask reduces heat transfer by both conduction and convection? **(1mark)**

(ii) Explain how this feature of the vacuum flask reduces heat transfer by both conduction and convection. **(1mark)**

(iii) Which labelled feature of the vacuum flask reduces heat transfer by radiation? **(1mark)**

(iv) Explain how this feature of the vacuum flask reduces heat transfer by radiation. **(1mark)**

8.a) Water is used to cool car engines and in the radiators of central heating systems. Why is water a better liquid to use in cooling engines? **(1mark)**

b) A shiny object and a black object are left in the sun. Which on the two objects becomes hot? Explain your answer. **(1mark)**

c) Figure below shows the cooling curve for 0.500 kg water put into a cold freezer of a refrigerator.

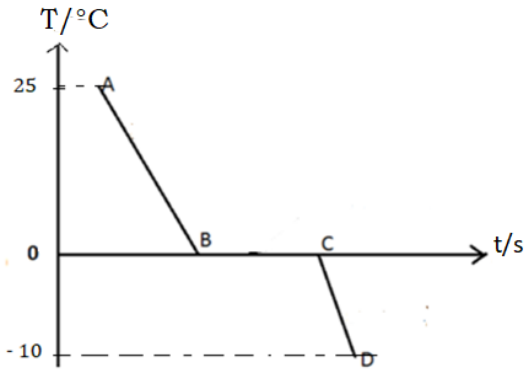


Figure 5

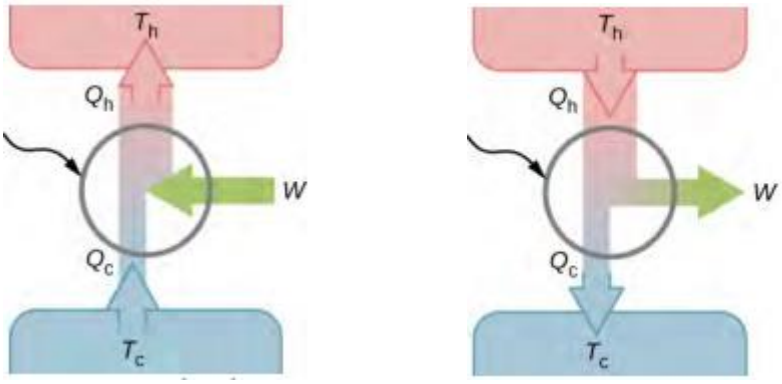
i) Which portion of the cooling curve for water shown above would both liquid and solid water be present? **(0.5marks)**

ii) How much heat energy is required by a refrigerator to cool 0.500 kg of liquid water at 25°C to liquid water at 0°C? *The specific heat capacity of water is 4 200 J/kg °C.* **(2 marks)**

e) Ice at 0°C changes into liquid water at 0°C. Calculate the amount of heat required to melt 0.500kg of ice at 0°C. The specific latent heat of fusion of ice is 334 400 J/kg. **(2 marks)**

9 a) State first law of thermodynamics **(1mark)**

b) State The device illustrated in the diagram below **(1mark)**



(a) (b)

c) Diffentiate between the above illustrated devices in(b) **(1mark)**

d) State the use of each device **(1mark)**

10. An electric field is created in a region of space between two metal plates as shown below (figure3)

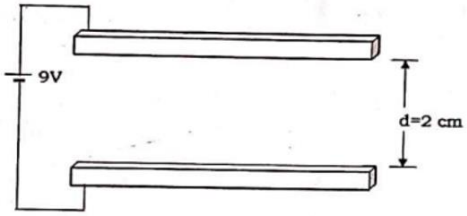


Figure 3

a) Copy the diagram and draw the electric field lines of force between the plates. **(1mark)**

b) How do you know if the electric created between the plates above is uniform or not? **(1mark)**

c) Determine the magnitude of the electric field created between the plates. **(1mark)**

11. a) Brief explain the function of a circuit breaker as an electrical component in an electric circuit**(1mark)**

b) An electric iron rated 240 V, 750 W is to be connected to a 240 V mains supply through a 3 A fuse. Determine whether the fuse is suitable or not. **(2marks)**

SECTION B (Choose only three questions / 30 marks)

12. **(a)** state two types of transformers do you know **(2marks)**
(b) An alternating e.m.f of 240V is applied to a step-up transformer having 200 turns on its primary coil and 4,000 turns on its secondary coil. The secondary current is 0.2A. calculate the:
i. secondary e.m.f (**2marks)**
ii. primary current (**2marks)**
iii. power input **(1mark)**
iv. power output (**1mark)**
v. efficiency (**1mark)**
vi. comment on the answer to **(v)** (**1mark)**

13 a) Differentiate inelastic from elastic collision **(2marks)**

b) A 5kg mass moving with a velocity of 10m/s collides with a 10kg mass moving with a velocity of 4m/s in the same direction along the same line. After collision, the 5kg mass moves with a velocity of 7.0m/s.

(i) Calculate the velocity of the 10kg mass. **(3marks)**

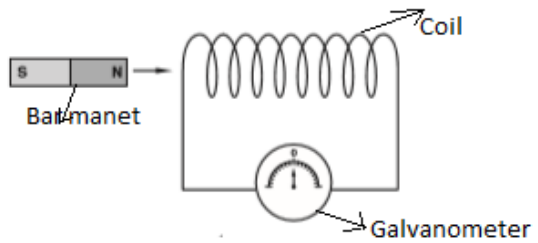
(ii)If the two masses join on impact, find their common velocity after impact. **(3marks)**

(iii) If the 10kg mass was initially moving to the left and that the two joined on impact, find their common velocity after impact. **(2marks)**

14. a) State Faraday's law **(2mark)**

b) Calculate the emf induced in a 250turn coil with a cross-section of 0.18 m^2 if the magnetic field through the coil changes from 0.10 Wbm^{-3} to 0.60 Wbm^{-3} at a uniform rate over a period of 0.02 second. **(3marks)**

c) A long bar magnet is pushed into a coil with many turns as shown in the figure below



What happens to the needle of the centre-zero-galvanometer when the magnet;

i) Slowly enters the coil **(1mark)**

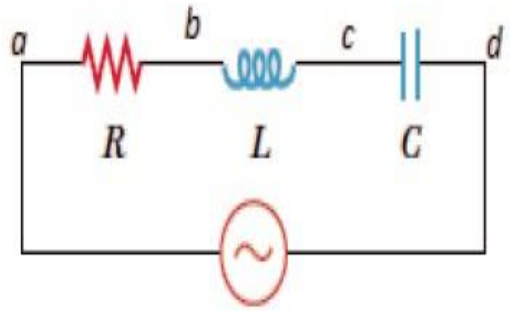
ii) Remains at rest inside the coil **(1mark)**

iii) Is rapidly withdrawn **(1mark)**

iv) Why the magnet has to be long **(1mark)**

V) Why the coil has to have many turns. **(1mark)**

15.An a.c generator with $V(t) = 150\sin\omega t$ is connected to a series *RLC* circuit with R = 40.0 Ω, L = 80.0 mH, C = 50.0 μF, and ω = 100 rad/s.



a) Calculate *VR*, *VL* and *VC* , the maximum of the voltage drops across each circuit element. **(8marks)**

b) Calculate the total potential difference across the three components between points *a* and *d*. **(2marks)**

16. The circuit below (***figure 9***) Comprises two identical dry cells of 2.0V each and negligible internal resistances. The voltmeter across R reads 2.4 V.

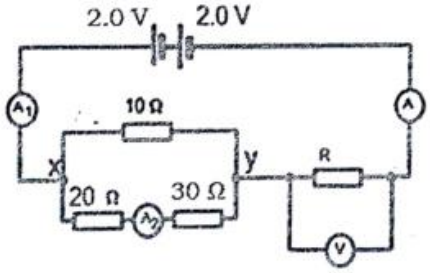


Figure 9

a) How are the following resistors connected?

(i) The 10 Ω resistor and the 20 Ω resistor **(1mark)**

(ii) The 20 Ω resistor and the 30 Ω resistor **(1marks**

b) Find

(i) The equivalent electromotive force of the two dry cells arranged as shown above. **(1mark)**

(ii) The Voltage V_{XY} across the 10 Ω resistor. **(2marks)**

c) Determine

(i) The current through the 10 Ω resistor. **(2marks)**

(ii) The reading on the ammeter A_2 **(2marks)**

(iii) The reading on the ammeter A **(1mark)**

SECTION C (The question is compulsory /15marks)

17. a) What is meant by 'impulse of a force'? **(1mark)**

b) What is the relationship between impulse and the change in momentum? **(1mark)**

c) Table below shows the values of force, *F*, and the acceleration, a, for the motion of a trolley on a friction compensated runway.

Force (N)	0.2	0.4	0.6	0.8	1.2
Acceleration(m/s^2)	0.90	1.8	2.7	3.6	5.4

i)Plot a graph of force, *F* against acceleration, *a*.**(10marks)**

ii)Use your graph to determine the force when the acceleration is 4.0 m/s^2 (**1mark)**

iii)Calculate the mass of the trolley, in grams, from your answer in (ii). **(2marks)**