PHYSICS
Date: 29 / 06 /2022

Period: 8:30 am-11:30 am

NESA | NATIONAL EXAMINATION AND SCHOOL INSPECTION AUTHORITY

END OF TERM III EXAMINATIONS

GRADE :   **S 2**
COMBINATION :   **O'LEVEL**

DURATION: **3 HOURS**

MARKS: ...... /100

INSTRUCTIONS

This paper is composed of two Sections **A** and **B**

Section A: Attempt all 15 questions   **(60 marks)**

Section B: Attempt all 5 questions   **(40 marks)**

SECTION A: ATTEMPT ALL QUESTIONS (60 MARKS)

1) a) What is the definition of friction force in physics?   **(1mark)**

b) A car is moving on horizontal road with uniform velocity towards east.
What is the direction of the friction force?   **(1mark)**

c) What are two effects of friction force in everyday life?   **(2 marks)**

2) a) Name the physical quantities on which variation of pressure in liquids depends.   **(2 marks)**

b) State the measuring instrument used to measure the pressure of a liquid or gas   **(1 mark)**

c) In which direction does the pressure act in a liquid ?   **(1 mark)**

3) a)How many number of significant figures are there in the following measured quantities ?

(i) 7.005 kg   **(1mark)**

(ii)0.045 km   **(1mark)**

b) What are the physical quantities whose the dimensions are given below?

(i) $\left[M^1 L^1 T^{-2} \right]$ **(1mark)**

(ii) $\left[M^0 L^1 T^{-1} \right]$ **(1mark)**

4) Read each of the following statements and write true if it is correct and false if it is wrong.

a) Distance and displacement are the same.   **(1mark)**

b) As a ball falls freely, the distance it falls each second is the same.   **(1mark)**

c) For an object thrown upward, the time it takes to reach its peak height is the same as the time it takes to fall from the peak height .   **(1mark)**

d) Uniform rectilinear motion is a rectilinear motion with constant

acceleration.   **(1 mark)**

5) a)State Ohm's law   **(1mark)**

b) State three effects of electric current   **(3 marks)**

6) Identify the choice that best answers the question

a) The size of the image formed by the convex mirror

(i) is always smaller than the size of the object

(ii)is same as the size of the object

(iii) depends on the position of the object

(iv)is always greater than the size of the object

(1mark)

b) A ray of light is reflected by the pole of a convex mirror at an angle of

80°.The angle of incidence is

(i) 160°

(ii) 180°

(iii) 80 °

(iv)10°

(1 mark)

c) A ray of light which is parallel to the principal axis of a concave mirror

after reflection passes through the

(i) centre of curvature

(ii) focal length

(iii)pole of the mirror

(iv)principal focus of the mirror

(1 mark)

d) Enlarged image is formed by concave mirror when object is

(i)) beyond the centre of curvature

(ii)) between the centre of curvature and focal point

(iii)) between focus and pole

(iv) both 2 and 3

(1mark)

7) a)Differentiate between systematic error and random error in

measurement of physical quantities.   **(2 marks)**

b) How can you reduce random error and minimize systematic error?

(2 marks)

8) a) on what factor does the buoyant force acting on an object depend?

(1 mark)

b) What happens to the object if the density of the object placed in a

liquid is equal to the density of the liquid?   **(1mark)**

c) When a solid body is fully immersed in a liquid, what is the volume of

the displaced liquid?   **(1mark)**

d) The same body is immersed in two liquids A and B in succession.

The extent to which the body sinks in liquid B is less than in liquid A.

What is the conclusion that could be derived from such an

observation?   **(1mark)**

9) From the list below, choose the appropriate method to be used either for

making a magnet or demagnetizing it and complete the table that follows.

Given methods: Heating, induction, electric current, hammering,

contact/stroking .

Making a magnet	Demagnetizing a magnet
By…………………	By…………………
By…………………	By…………………

(4 marks)

10) Describe the physical quantities that appear in the

the equation of perfect gas or ideal gas given by $PV = nRT$.

(4 marks)

11) A storage tank 12.0 m deep is filled with water. The top of the tank is

open to the air. Density of water is 1000kg/m³ and acceleration due to

gravity is 9.80m/s². Atmospheric pressure $P_0 = 1atm = 1.01 \times 10^5 Pa$

What is the (a)absolute pressure at the bottom of the tank? **(2 marks)**

(b)The gauge pressure? **(2 marks)**

12)a)A 45 kg box is pushed horizontally with a 100 N force for 5 m.

What is the work done by this force? **(2 marks)**

b) A person weighing 600 N gets on an elevator. The elevator lifts

the person 6 m in 10 s. How much power was used? **(2 marks)**

13) a)Draw electric field lines of force between the two plates below charged

uniformly. **(1 mark)**

b) What is the magnitude and direction of the electric field due to a

point charge of $20\mu C$ at a distance of one meter away from it?

Coulomb constant is k $= 8.99 \times 10^9 Nm^2/C^2$

(3 marks)

14) The initial velocity of a car is 40 m/s and it accelerates uniformly at

5 m/s² for 10 seconds .

a) Calculate the final velocity. **(2 marks)**

b) Find the travelled distance during 10 s**.** **(2 marks)**

15) You are provided with the electric components namely: one ordinary

diode, one resistor, one dry cell and connecting wires.

Use the symbols of these elements to draw a complete electric circuit such that the ordinary diode is reverse biased.   **(4 marks)**


SECTION B: ATTEMPT ALL QUESTIONS (40 MARKS)

16) Explain the following observations

a) An egg sinks in fresh water, but floats in a strong salt solution.
          (2 marks)

b) A toy balloon filled with hydrogen rises to the ceiling, but if filled with carbon dioxide   sinks to the floor.   **(2 marks)**

c) We cannot walk comfortably on sand but camel can run in a desert

easily.   **(2 marks)**

17) A 10kg object falls from a height of 12 m. Acceleration due to gravity g= 10 m/s^2.Friction force is negligible

a) Provide the formula for potential energy, kinetic energy and mechanical energy.   **(3 marks)**

b) Fill in the blanks with the potential, kinetic and total energy of the object at the given points. Conclude.   **(7 marks)**
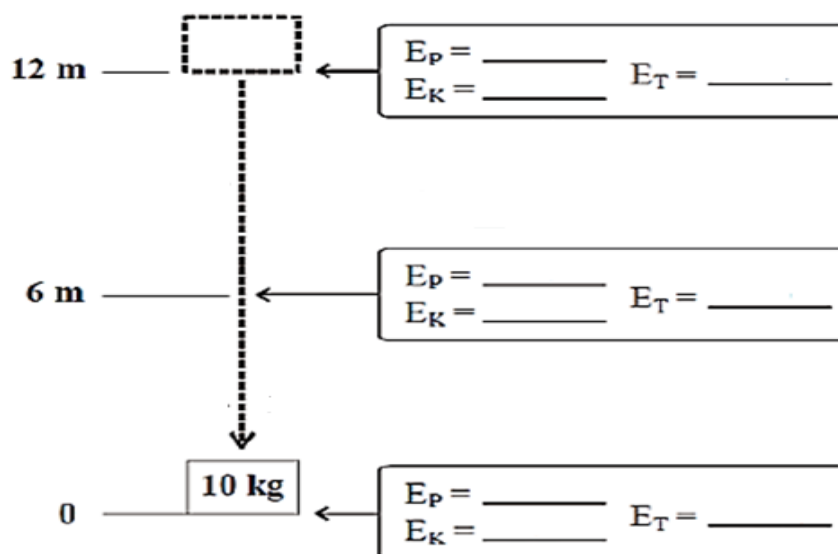
12 m ———
E_P = _____
E_K = _____ E_T = _____

6 m ———
E_P = _____
E_K = _____ E_T = _____

0 ——— 10 kg
E_P = _____
E_K = _____ E_T = _____

18) Use essay form to discuss the three fundamental ideal gas laws.

(8 marks)

19) An object is placed 20 cm from a mirror of focal length 10.0 cm.

The object is 5.0 cm tall.

b) Where is the image located? **(2 marks)**

c) How tall is the image? **(2 marks)**

d) Give any two properties of the image from the obtained results

(2 marks)

20) The electromotive force of a cell of negligible internal resistance is 2 V.

It is connected to the series combination of 2 Ω, 3 Ω and 5 Ω resistors.

a) Draw an electric circuit diagram using the above information.
(4 marks)

b)Find

(i) The total resistance of this circuit. **(2 marks)**

(ii) The electric current flowing through 2 Ω resistor. **(2 marks)**

(iii) The potential difference across 3 Ω resistor. **(2 marks)**

End

END OF TERM III EXAMINATIONS 2021-2022

S2 PHYSICS

MARKING SCHEME

SECTION A

1) a) Friction force is a resistance against the movement of an object as a

result of its contact with another object.**(1mark)**

b) Friction force is directed towards west. **(1mark)**

c) Effects of Friction in everyday life:

It is because of friction that we're able to walk, run, play, etc.

(1mark)

Breaks of vehicles work due to friction force **(1mark)**

It helps to support ladder against a wall

It helps to transfer one form of energy to another

Friction force produces unnecessary heat leading to the wastage of

energy

It produces noise during any kind of operation. Etc.

2) a) Density of the liquid **(1mark),**depth   **(1 mark)**

b) Manometer**(1 mark)**

c)The pressure in a liquid is due to the weight of the column of

water above. Since the particles in a liquid are tightly packed,

this pressure acts in all directions**(1mark)**.

 3)a)(i) 4 **(1 mark)** (ii) 2 **(1mark)**

b)(i) force **(1mark)** (ii) speed/velocity **(1mark)**

4) a) False **(1mark)**

b) False **(1mark)** velocity increases

c) True **(1mark)**

d) False **(1mark)**

5) a) Ohm's law states that the voltage across a conductor is directly proportional to the electric current flowing through it. **(1mark)**

b) Heat effect **(1mark)** magnetic effect **(1mark)** chemical effect **(1mark)**

6)a)(i)**(1 mark)** b)(iii) **(1mark)** c(iv) **(1 mark)** d(iv)**(1mark)**

7) a)Systematic errors: The systematic errors are those errors that tend to be in one direction, either positive or negative due to instrumental errors **i**mperfection in experimental technique or procedure and personal errors**(1mark)**

Random errors: These are the errors which occur irregularly and hence are random with respect to sign and size and they can arise due to random and unpredictable fluctuations in experimental conditions **(1mark).**

b) While you can't eradicate it completely, you can reduce random error by taking repeated measurements**(1mark),** using a large sample, controlling extraneous variables and maintaining good experimental technique (e.g. reading from a correct position)

You can avoid systematic error through checking for zero error before taking readings **(1mark)** careful design of your sampling, data collection, and analysis procedures

8) a)The buoyant force depends directly upon:

The volume of the fluid displaced **(1 mark)** or the volume of the object and the density of the fluid displaced

b) The object will float half immersed **(1mark)**

c) The volume of the displaced water is equal to the volume of the solid **(1mark)**

d)The density of the liquid B is more than the liquid A **(1 mark)** as more up thrust is exerted on the body in liquid B and hence it sinks less.

9)

Making a magnet	Demagnetizing a magnet
by…induction…(1mark)	by…heating…(1mark)
by…contact/stroking…(1mark)	by…hammering…(1mark)
by…electric current…	By…electric current…

10) P is the pressure of the ideal gas (Unit used: atm or Pascal millimeters mercury/torr (mm Hg, torr) **(1 mark)**

- ✓ V is the volume (Unit used: litre, l or m^3) **(1mark)**,
- ✓ n is the number of moles of gas(amount of substance) (Unit used: mol) **(1 mark)**,
- ✓ T is the absolute temperature of the ideal gas (Unit used: Kelvin) **(1mark)**.

   R is the Universal gas constant because its value is found experimentally to be the same for all gases. It is not a physical quantity .Its value is R = 8.31447J/(mol. K)

11) a) The absolute pressure is given by

$$P = P_0 + \rho gh \text{ (1mark)}$$

Since the top of the tank is open to the atmosphere, P_0 *equals* $1atm = 1.01 \times 10^5 Pa$, so,

$P =$(1.01 × 10⁵Pa)+(1000kg/m³)(9.80m/s²)(12.0m)

  $= 2.19 \times 10^5 Pa = 2.16 atm$ **(1mark)**

(b)The gauge pressure is $P - P_0 = \rho gh$ **(1mark)**

  $P - P_0 = (2.19 - 1.01) \times 10^5 Pa$
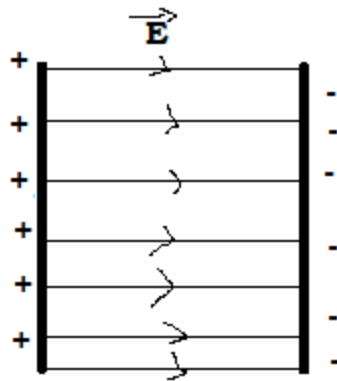
$= 1.18 \times 10^5 Pa = 1.16 atm$ **(1mark)**

12) a) The work done W=Fd **(1mark)**

=100 N x 5 m= 500 Nm or J**(1mark)**

b) The power $P = W_{ork}/t$ **(1mark)** or Fd/t

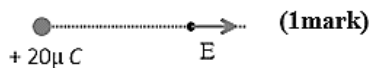P = ((600 x 6)/10) W = 360 W**(1mark)**

13) a) **(1 mark)**

b) The magnitude of the electric field due to a point charge q at a

distance d $E = k\dfrac{q}{d^2}$**(1 mark)**

$$= \frac{(8.99\times10^9)(20\times10^{-6})}{1^2}$$
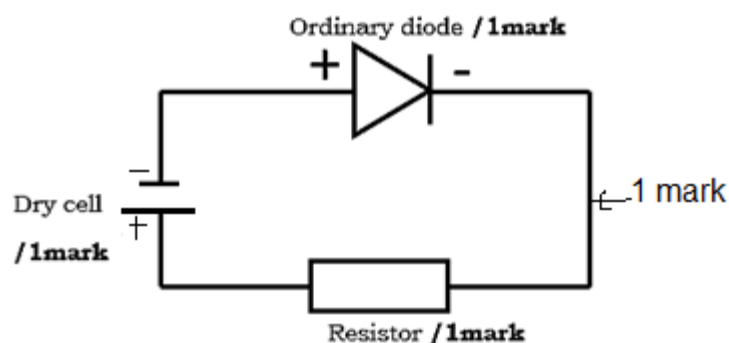
$$= 1.8 \times 10^5 N/C \quad \text{(1mark)}$$

+ 20μ C   E   (1mark)

14) a) The final velocity $v_f = v_0 + at$ **(1mark)**

Therefore, $v_f = (40 + 5x10)m/s = \mathbf{90m/s}$ **(1mark)**

b) The travelled $x = \dfrac{a}{2}t^2 + v_0 t$ **(1mark)**

$$x = (\frac{5}{2}x10^2 + 40x10)m = 650m \textbf{(1 mark)}$$

15)

Ordinary diode / **1mark**

+ ▷| –

Dry cell / **1mark**
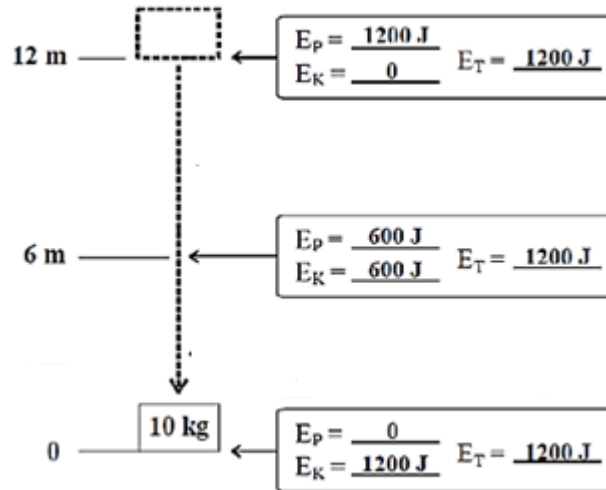
← 1 mark

Resistor / **1mark**

SECTION B

16)a) As the density of strong salt solution is denser than that of fresh water, it exerts more upthrust on the egg **(1mark)** that balances the weight of the egg hence the egg sinks in fresh water but floats on a strong salt solution. **(1mark)**

b) Density of carbon dioxide is much more than the density of hydrogen, hence when a balloon is filled with hydrogen, the weight of the air displaced by an inflated balloon or the up thrust tends to become greater than the weight of the gas balloon that is filled causing it to rise**(1mark)**. But when the balloon is filled with carbon dioxide, the balloon weighs more than the upthrust offered by air causing it to sink to the floor. **(1mark)**

c) The surface area of feet of camel is much more than that of man **(1mark).** When a camel walks/ runs in a desert, the pressure due to his weight is much less. As a result, camel can run easily **(1mark).**

17 a)Ep=mgh **(1mark)** Ek=mv²/2 **(1mark)** ET=Ep+ Ek **(1mark)**

b)

12 m —	$E_P = \underline{1200\ J}$ $E_K = \underline{\quad 0 \quad}$ $E_T = \underline{1200\ J}$
6 m —	$E_P = \underline{600\ J}$ $E_K = \underline{600\ J}$ $E_T = \underline{1200\ J}$
0 — 10 kg	$E_P = \underline{\quad 0 \quad}$ $E_K = \underline{1200\ J}$ $E_T = \underline{1200\ J}$

Ep: **0.5 marks x3 = 1.5 marks**

Ek: **0.5 marks x 3 =1.5 marks**

E: **1mark x 3=3 marks**

Conclusion: When the system is subjected to conservative force ,the total mechanical energy of the system remains constant **(1 mark)**

Or In all energy conversions or transformations, energy is neither created nor destroyed, but it may be converted from one form to another form but

18) Introduction

The four fundamental gas laws discover the relationship of pressure, temperature, volume and amount of gas. These four laws are Boyle's Law Charles' Law, Avogadro's Law and the pressure law. Let us discuss only the three laws **(1 mark)**

1st law: Boyle's law **(1 mark)** states that "The volume of a fixed mass of gas is inversely proportional to the pressure, provided the temperature remains constant." **(1mark)** $V \propto \frac{1}{P}$ or $P \propto \frac{1}{V}$ implies $PV =$ constant.

It may be written as $P_1 V_1 = P_2 V_2$ this relationship means that pressure increases as volume decreases, and vice versa.

The process where the pressure and volume change at constant temperature is called isothermal process.

2nd law: Charles' law **(1mark)** states that :"The volume of a given amount of gas is directly proportional to absolute temperature when pressure is kept constant." **(1mark)** $V \propto T$ implies $V \propto (constant)T$

It may be written as $\frac{V_1}{T_1} = \frac{V_2}{T_2}$ .The process where the temperature and volume change at constant pressure is called Isobaric process.

3rd law: Pressure law **(1mark)** states that: "At constant volume, the pressure of a gas is directly proportional to the absolute temperature" **(1mark)** $P \propto T$ implies $P = (constant)T$ It may be written as $\frac{P_1}{T_1} = \frac{P_2}{T_2}$

The process where the pressure and temperature change at constant volume is called **Isochoric process**.

Conclusion

The ideal gas law is the combination of the three simple ideal gas laws

$PV = nRT$ or $\dfrac{PV}{T} = \dfrac{P'V'}{T'}$ **(1mark)**

19) a)Position of the image $\dfrac{1}{p'} = \dfrac{1}{f} - \dfrac{1}{p}$ **(1mark)**

$$\frac{1}{p'} = \frac{1}{10} - \frac{1}{20} = \frac{2-1}{20} = \frac{1}{20}$$

Image is at a distance P'=20 cm **(1 mark)**

b)Size of the image $\dfrac{i}{o} = -\dfrac{p'}{p}$ **(1 mark)**

i= -5x20/20 cm=- 5cm **(1mark)**

The image is 5 cm tall

c) In ray optics, a + distance (p, p' or f) means in front of the mirror as the object; a negative distance means behind the mirror.
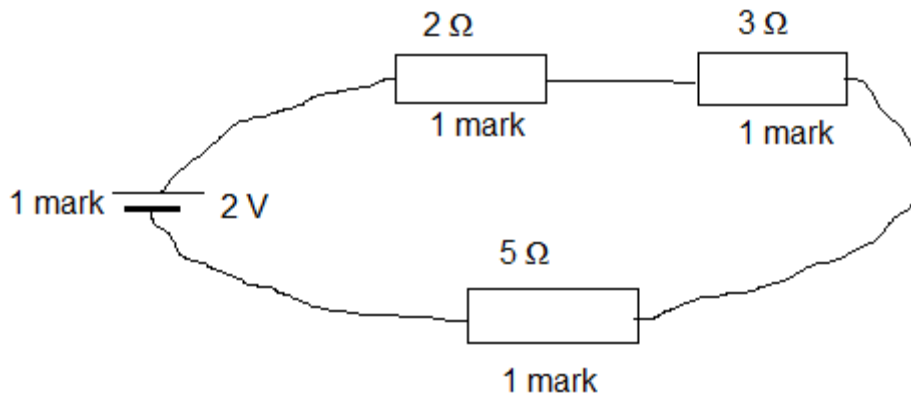
A + height means above the principal axis and a - height means below the principal axis.

p' is positive image is real **(1mark)**

Height of image is negative image is inverted **(1mark)**

Image and object have the same size

20) a)Complete electric circuit

b)(i)The total resistance $R_T = R_1 + R_2 + R_3$ **(1 mark)**

$$= 2\Omega + 3\Omega + 5\Omega = 10\ \Omega\ \textbf{(1mark)}$$

(ii) Electric current $I = V/R$ **(1mark)**

$$= 2V/10\Omega = 0.2\ A\ \textbf{(1 mark)}$$

(iii)Potential difference across 3 Ω resistor $V_{2\Omega} = RI$ **(1mark)**

$$= 3 \times 0.2\ V = 0.6\ V\ \textbf{(1 mark)}$$

<table>
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SECTION A: ATTEMPT ALL QUESTIONS (60 MARKS)

1) a) What is the definition of friction force in physics?   **(1mark)**

 b) A car is moving on horizontal road with uniform velocity towards east.

   What is the direction of the friction force?   **(1mark)**

 c) What are two effects of friction in everyday life?   **(2 marks)**

2) a) Name the physical quantities on which variation of pressure in liquids

   depends.   **(2 marks)**

 b) State the measuring instrument used to measure the pressure of a

    liquid or gas   **(1 mark)**

 c) In which direction does the pressure act in a liquid ?   **(1 mark)**

3) a)How many number of significant figures are there in the following

   measured quantities ?

   (i) 7.005 kg   **(1mark)**

   (ii)0.045 km   **(1mark)**

 b) What are the physical quantities whose the dimensions are given

   below?

   (i) $\left[M^1 L^1 T^{-2}\right]$ **(1mark)**

   (ii) $\left[M^0 L^1 T^{-1}\right]$ **(1mark)**

4) Read each of the following statements and write true if it is correct and

   false if it is wrong.

 a) Distance and displacement are the same.   **(1mark)**

 b) As a ball falls freely, the distance it falls each second is the same.

          (1mark)

 c) For an object thrown upward, the time it takes to reach its peak height

   is the same as the time it takes to fall from the peak height .

(1mark)

d) Uniform rectilinear motion is a rectilinear motion with constant

acceleration. **(1 mark)**

5) a)State Ohm's law **(1mark)**

b) State three effects of electric current **(3 marks)**

6) Identify the choice that best answers the question

a) The size of the image formed by the convex mirror

(i) is always smaller than the size of the object

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(iii) depends on the position of the object

(iv)is always greater than the size of the object

(1mark)

b) A ray of light is reflected by the pole of a convex mirror at an angle of

80°.The angle of incidence is

(i) 160°

(ii) 180°

(iii) 80 °

(iv)10°

(1 mark)

c) A ray of light which is parallel to the principal axis of a concave mirror

after reflection passes through the

(i) centre of curvature

(ii) focal length

(iii)pole of the mirror

(iv)principal focus of the mirror

(1 mark)

d) Enlarged image is formed by concave mirror when object is

(i)) beyond the centre of curvature

(ii)) between the centre of curvature and focal point

(iii)) between focus and pole

(iv) both 2 and 3

(1mark)

7) a)Differentiate between systematic error and random error in

measurement of physical quantities. **(2 marks)**

b) How can you reduce random error and minimize systematic error?

(2 marks)

8) a) on what factor does the buoyant force acting on an object depend?

(1 mark)

b) What happens to the object if the density of the object placed in a

liquid is equal to the density of the liquid? **(1mark)**

c) When a solid body is fully immersed in a liquid, what is the volume of

the displaced liquid? **(1mark)**

d) The same body is immersed in two liquids A and B in succession.

The extent to which the body sinks in liquid B is less than in liquid A.

What is the conclusion that could be derived from such an

observation? **(1mark)**

9) From the list below, choose the appropriate method to be used either for

making a magnet or demagnetizing it and complete the table that follow.

Given methods: Heating, induction, electric current, hammering,

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Making a magnet	Demagnetizing a magnet
By…………………	By…………………
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(4 marks)

10) Describe the physical quantities that appear in the

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11) A storage tank 12.0 m deep is filled with water. The top of the tank is

open to the air.Density of water is 1000kg/m^3 and acceleration due to

gravity is 9.80m/s^2.Atmospheric pressure $P_0 = 1atm = 1.01 \times 10^5 Pa$

What is the

a)the absolute pressure at the bottom of the tank? **(2 marks)**

b)the gauge pressure? **(2 marks)**

12) a) A 45 kg box is pushed horizontally with a 100 N force for 5 m.

What is the work done by this force? **(2 marks)**

b) A person weighing 600 N gets on an elevator. The elevator lifts

the person 6 m in 10 s. How much power was used? **(2 marks)**

13) a) Complete the following statements

(i)Unlike electric charges …………………………………………..**(1mark)**

(ii)Like electric charges ……………………………………… **(1mark)**

b) What is the magnitude and direction of the electric field due to a

point charge of $20\mu C$ at a distance of one meter away from it?

Coulomb constant whose exact value is $k = 8.99 \times 10^9 Nm^2/C^2$

(2 marks)

14) The initial velocity of a car is 40 m/s and it accelerates uniformly at

5 m/s^2 for 10 seconds.

a) Calculate the final velocity. **(2 marks)**

b) Find the travelled distance during 10 s**.** **(2 marks)**

15) Explain any four benefits of mobile phone in our daily life. **(4 marks)**

SECTION B: ATTEMPT ALL QUESTIONS (40 MARKS)

16) Explain the following observations

a) An egg sinks in fresh water, but floats in a strong salt solution.

(2 marks)

b) A toy balloon filled with hydrogen rises to the ceiling, but if filled with

carbon dioxide sinks to the floor. **(2marks)**

c) An iron nail sinks in water while an iron ship floats on water.

(2 marks)

d) We cannot walk comfortably on sand but camel can run in a desert

easily. **(2 marks)**

17) A 10 kg object falls from a height of 12 m. Acceleration due to gravity

g= 10 m/s^2.Friction force is negligible

a) Provide the formula for potential energy, kinetic energy and

mechanical energy. **(3 marks)**

b) For each of the following locations of the object, find the potential

energy, the kinetic energy and the total energy.

(i) The object is at 12 m from the ground. **(3 marks)**

(ii)The object is at 0 m just when it reaches the ground. **(3 marks)**

(iii)Conclude. **(1 mark)**

18) Use essay form to discuss the three fundamental ideal gas laws.

(8 marks)

19) An object is placed 20 cm from a mirror of focal length 10.0 cm.

The object is 5.0 cm tall.

a) Identify the type of this mirror. Give reason **(2 marks)**

b) Where is the image located? **(2 marks)**

c) How tall is the image? **(2 marks)**

d) Give any two properties of the image from the obtained results

(2 marks)

20) The electromotive force of a cell of negligible internal resistance is 2 V. It is connected to the series combination of 2 Ω, 3 Ω and 5 Ω resistors. Find

a) The total resistance of this circuit. **(2 marks)**

b) The electric current flowing through 2 Ω resistor. **(2 marks)**

c) The potential difference across 3 Ω resistor. **(2 marks)**

End

END OF TERM III EXAMINATIONS 2021-2022

S2 PHYSICS FOR BLIND STUDENTS

MARKING SCHEME

1) a) Friction force is a resistance against the movement of an object as a result of its contact with another object.**(1mark)**

b) Friction force is directed towards west. **(1mark)**

c) Effects of Friction in everyday life:

It is because of friction that we're able to walk, run, play, etc.

(1mark)

Breaks of vehicles work due to friction force **(1mark)**

It helps to support ladder against a wall

It helps to transfer one form of energy to another

Friction force produces unnecessary heat leading to the wastage of energy

It produces noise during any kind of operation. Etc.

2) a) Density **(1mark),**depth **(1 mark)**

b) Manometer**(1 mark)**

c)The pressure in a liquid is due to the weight of the column of water above. Since the particles in a liquid are tightly packed, this pressure acts in all directions**(1mark)**.

3)a)(i) 4 **(1 mark)** (ii) 2 **(1mark)**

b)(i) force **(1mark)** (ii) speed/velocity **(1mark)**

4) a) False **(1mark)**

b) False **(1mark)** velocity increases

c) True**(1mark)**

d) False **(1mark)**

5) a) Ohm's law states that the voltage across a conductor is directly

proportional to the electric current flowing through it. **(1mark)**

b) Heat effect **(1mark)** magnetic effect **(1mark)** chemical effect **(1mark)**

6)a)(i)**(1 mark)** b)(iii) **(1mark)** c(iv) **(1 mark)** d(iv)**(1mark)**

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in one direction, either positive or negative due to instrumental errors
imperfection in experimental technique or procedure and personal
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are random with respect to sign and size and they can arise due to
random and unpredictable fluctuations in experimental conditions
(1mark).

b) While you can't eradicate it completely, you can reduce random error
by taking repeated measurements**(1mark),** using a large sample,
controlling extraneous variables and maintaining good experimental
technique (e.g. reading from a correct position)
You can avoid systematic error through checking for zero error before
taking readings **(1mark)** careful design of your sampling, data
collection, and analysis procedures

8) a)The buoyant force depends directly upon:

The volume of the fluid displaced **(1 mark)** or the volume of the

object and the density of the fluid displaced

b) The object will float half immersed **(1mark)**

c) The volume of the displaced water is equal to the volume of the

solid **(1mark)**

d)The density of the liquid B is more than the liquid A **(1 mark)** as more up thrust is exerted on the body in liquid B and hence it sinks less.

9)

Making a magnet	Demagnetizing a magnet
by…induction…**(1mark)**	by…heating…**(1mark)**
by…contact/stroking…**(1mark)**	by…hammering…**(1mark)**
by…electric current..	By…electric current..

10) P is the pressure of the ideal gas (Unit used: atm or Pascal millimeters mercury/torr (mm Hg, torr) **(1 mark)**

✓ V is the volume (Unit used: litre, l or m^3) **(1mark)**,

✓ n is the number of moles of gas(amount of substance) (Unit used: mol) **(1 mark)**,

✓ T is the absolute temperature of the ideal gas (Unit used: Kelvin) **(1mark)**.

R is the Universal gas constant because its value is found experimentally to be the same for all gases. It is not a physical quantity .Its value is R = 8.31447J/(mol. K)

11) a) The absolute pressure is given by

$$P = P_0 + \rho g h \text{ (1mark)}$$

Since the top of the tank is open to the atmosphere, P_0 equals $1 atm = 1.01 \times 10^5 Pa$, so,

$P =$(1.01 × 10^5Pa)+(1000kg/m³)(9.80m/s²)(12.0m)

$= 2.19 \times 10^5 Pa = 2.16 atm$ **(1mark)**

(b)The gauge pressure is $P - P_0 = \rho g h$ **(1mark)**

$P - P_0 = (2.19 - 1.01) \times 10^5 Pa$

$= 1.18 \times 10^5 Pa = 1.16 atm$ **(1mark)**

12) a)The work done W=Fd **(1mark)**

$$=100 \text{ N x } 5 \text{ m}= 500 \text{ Nm or J}\textbf{(1mark)}$$

b)The power P = Work/t   **(1mark)** or Fd/t

$$P = ((600 \text{ x } 6)/10) \text{ W} = 360 \text{ W}\textbf{(1mark)}$$

13) a)(i)Unlike electric charges attract each other **(1mark)**

(ii)Like electric charges repel each other **(1mark)**

b)The magnitude of the electric field due to a point charge q at a

distance d $E = k\dfrac{q}{d^2}$**(1 mark)**

$$= \frac{(8.99\times10^9)(20\times10^{-6})}{1^2}$$

$$= 1.8 \times 10^5 N/C \text{ (1mark)}$$

14: a) The final velocity $v_f = v_0 + at$ **(1mark)**

Therefore, $v_f = (40 + 5x10)m/s = \boldsymbol{90m/s}$ **(1mark)**

b)The travelled $x = \dfrac{a}{2}t^2 + v_0 t$ **(1mark)**

$$x = (\frac{5}{2}x10^2 + 40x10)m = 650m \textbf{(1 mark)}$$

15)

Constant contact with friends and families – Information technology has improved the mobile phones to a great level. Today, with the help of internet, we are able to access various social media sites and apps that help us stay connected with our friends, family and the entire world. Mobile phones have made communication easier with quick placing of calls and SMS. Mobile phones are of great help at the time of emergencies when we need to call the police, ambulance or other emergency services.**(1mark)**

2. Entertain us and keep us informed too – Who needs a television or a music system when there are mobile phones around! Mobile phones come

with FM radio, inbuilt games and various other apps that entertain us. Moreover, you can download apps of your choice like news apps, health apps, and music apps, etc. that will entertain and inform you. You can also watch videos and movies in your mobile phones.**(1mark)**

3. Daily Utilities – Mobile phones help us a lot in our daily life. With an internet enabled mobile phone, you can book a cab with the help of various relevant apps. You can also pay your bills with the help of your phone. Also, you can click pictures and use your phone like a camera. Your mobile phone also acts like a compass and navigates you. Such uses of mobile phones are extremely helpful as they help us save our time and money.**(1mark)**

4. It helps us become more organized – Today, mobile phones are equipped with important features like documents, alarm, calendars, memo, stop-watch, etc. which help us become more organized**(1mark).**

5. Ensures safety– This is one of the most important benefits of using a mobile phone. Mobile phones ensure safety. Also, you can talk to your children and confirm that they have reached safely at their friend's place or other destination. At the time of emergencies or difficult situations, the mobile phone can be used quickly to get help.

Etc.

SECTION B

16)a) As the density of strong salt solution is denser than that of fresh water, it exerts more upthrust on the egg **(1mark)** that balances the weight of the egg hence the egg sinks in fresh water but floats on a strong salt solution.   **(1mark)**

b) Density of carbon dioxide is much more than the density of hydrogen, hence when a balloon is filled with hydrogen, the weight of the air displaced by an inflated balloon or the upthrust tends to become greater than the weight of the gas balloon that is filled causing it to rise**(1mark)**. But when the balloon is filled with carbon dioxide, the balloon weighs more than the upthrust offered by air causing it to sink to the floor. **(1mark)**

c) It is because the density of iron is more than the density of water. Hence the weight of the nail is comparatively greater than the upthrust that acts

on water **(1mark).** Ships are made of iron yet they do not sink as ships are hollow and the empty space in it contains air making the average density lesser than that of water. Consequently, even with a smaller

portion of ship immersed in water, the weight of water displaced by the immersed part of the ship becomes equivalent to the net weight of the ship causing it to floats. **(1mark)**

d) The surface area of feet of camel is much more than that of man **(1mark).** When a camel walks/ runs in a desert, the pressure due to his weight is much less. As a result, camel can run easily **(1mark).**

17 a)Ep=mgh **(1mark)**   Ek=mv^2/2 **(1mark)**   ET=Ep+ Ek **(1mark)**

b) (i) at 12 m from the ground

Ep= 10x12x10J=1 200 J **(1mark)**

Ek=0 **(1mark)**

ET= Ep+Ek=1200 J+0J=1 200J **(1mark)**

(ii)Ep=0 **(1mark)**

The speed of the object at 0 m

$$h = \frac{1}{2}g\,t^{2}\qquad \text{and V=gt then } v = \sqrt{2gh}$$

Ek= (1/2) m v^2= (1/2) mx2gh=mgh = 1200 J **(1 mark)**

ET= 0 J+1200J =1200 J**(1 mark)**

(iii) Conclusion the total energy of the object is conserved **(1mark)**

Or When the system is subjected to conservative force ,the total mechanical energy of the system remains constant

Or In all energy conversions or transformations, energy is neither created nor destroyed, but it may be converted from one form to another form but

18: Introduction

The four fundamental gas laws discover the relationship of pressure, temperature, volume and amount of gas. These four laws are Boyle's Law Charles' Law, Avogadro's Law and the pressure law. Let us discuss only the three laws **(1 mark)**

1ˢᵗ law: Boyle's law **(1 mark)** states that "The volume of a fixed mass of gas is inversely proportional to the pressure, provided the temperature remains constant." **(1mark)** V $\propto \frac{1}{P}$ or P $\propto \frac{1}{V}$ implies PV = constant.

It may be written as $P_1V_1 = P_2V_2$ this relationship means that pressure increases as volume decreases, and vice versa.

The process where the pressure and volume change at constant temperature is called isothermal process.

2ⁿᵈ law: Charles' law **(1mark)** states that :"The volume of a given amount of gas is directly proportional to absolute temperature when pressure is kept constant." **(1mark)** V $\propto$ T implies V $\propto$ (constant)T

It may be written as $\frac{V_1}{T_1} = \frac{V_2}{T_2}$ .The process where the temperature and volume change at constant pressure is called Isobaric process.

3ʳᵈ law: Pressure law **(1mark)** states that: "At constant volume, the pressure of a gas is directly proportional to the absolute temperature" **(1mark)** P $\propto$ T implies P = (constant)T It may be written as $\frac{P_1}{T_1} = \frac{P_2}{T_2}$

The process where the pressure and temperature change at constant volume is called **Isochoric process**.

Conclusion

The ideal gas law is the combination of the three simple ideal gas laws

PV = nRT or $\dfrac{PV}{T} = \dfrac{P'V'}{T'}$ **(1mark)**

19) a) Position of the image $\dfrac{1}{p'} = \dfrac{1}{f} - \dfrac{1}{p}$ **(1mark)**

$$\frac{1}{p'} = \frac{1}{10} - \frac{1}{20} = \frac{2-1}{20} = \frac{1}{20}$$

Image is at a distance P'=20 cm **(1 mark)**

b) Size of the image $\dfrac{i}{o} = -\dfrac{p'}{p}$ **(1 mark)**

i= -5x20/20 cm=- 5cm **(1mark)**

The image is 5 cm tall

c) In ray optics, a + distance (p, p' or f) means in front of the mirror

as the object; a negative distance means behind the mirror.

A + height means above the principal axis and a - height means below the principal axis.

p' is positive image is real **(1mark)**

Height of image is negative image is inverted **(1mark)**

Image and object have the same size

20) a)The total resistance $R_T=R_1+R_2+R_3$ **(1 mark)**

$$=2\Omega+3\Omega+5\Omega =10\ \Omega\ \textbf{(1mark)}$$

b) Electric current I=V/R **(1mark)**

$$=2V/10\Omega=0.2\ A\ \textbf{(1 mark)}$$

c)Potential difference across 3 Ω resistor $V_{2\Omega}$= RI **(1mark)**

$$=3x0.2\ V=0.6\ V\ \textbf{(1 mark)}$$

ALTERNATIVE TO PHYSICS PRACTICAL
Date: 28 / 06 /2022

Period: 8:30 am-11:30 am

NESA | NATIONAL EXAMINATION AND SCHOOL INSPECTION AUTHORITY

END OF TERM III EXAMINATIONS

GRADE :   S 2
COMBINATION :   O'LEVEL

DURATION: 1 H 30 MIN

MARKS: ...... /20

INSTRUCTIONS

This paper is composed of **ONE** compulsory question

Non programmable calculator and mathematical instruments
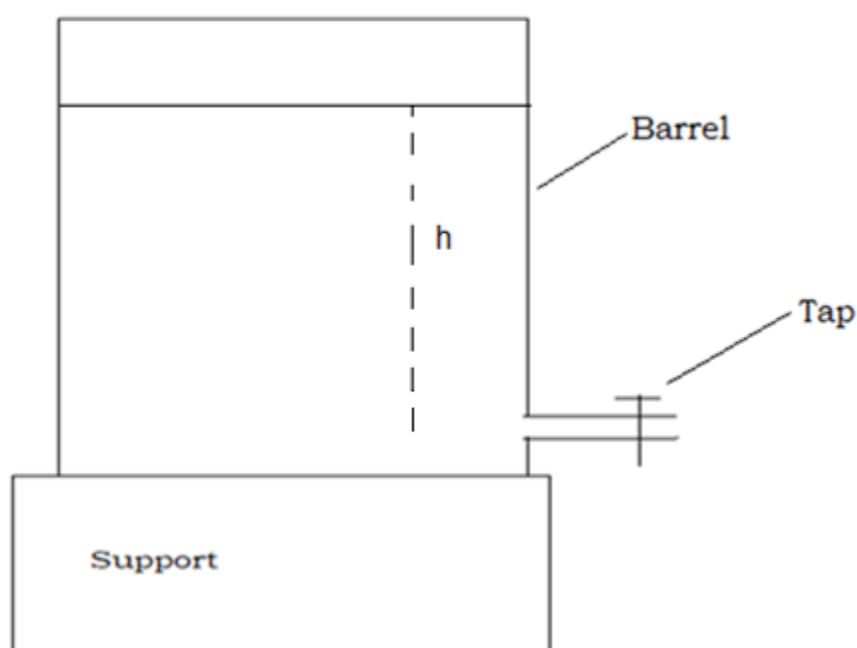
 may be used.

Use only a blue or black pen.

Use pencil for drawing.

ATTEMPT ALL SUB QUESTIONS /20 MARKS

A student is investigating the variation of the water depth h with time t
when the tap is open.

Procedures

The following is a transparent barrel containing water with a tap.

He/she measures the depth and then opens the tap.

As water flows out of the barrel, she/he measures the depth every minute.

The table shows his/her results.

t/min	h/ cm
0	96
1	52
2	31
3	18
4	11
5	7
6	4

Questions

a) Which two measuring instruments does the student use in his/her

investigation? **(2 marks)**

b) (i)Use graph paper to plot a graph of h(y-axis) against t (x-axis) to show

how the depth changes with time.

Draw the curve of the best fit. **(12 marks)**

(ii)Describe the relationship between depth and time. **(2 marks)**

c) The student notices that the water flows out less quickly as time passes.

Suggest the reason for the decrease in flow. **(2 marks)**

d) Find the depth when the time t is 2min 30s **(2 marks)**

End

END OF TERM III EXAMINATIONS 2021-2022

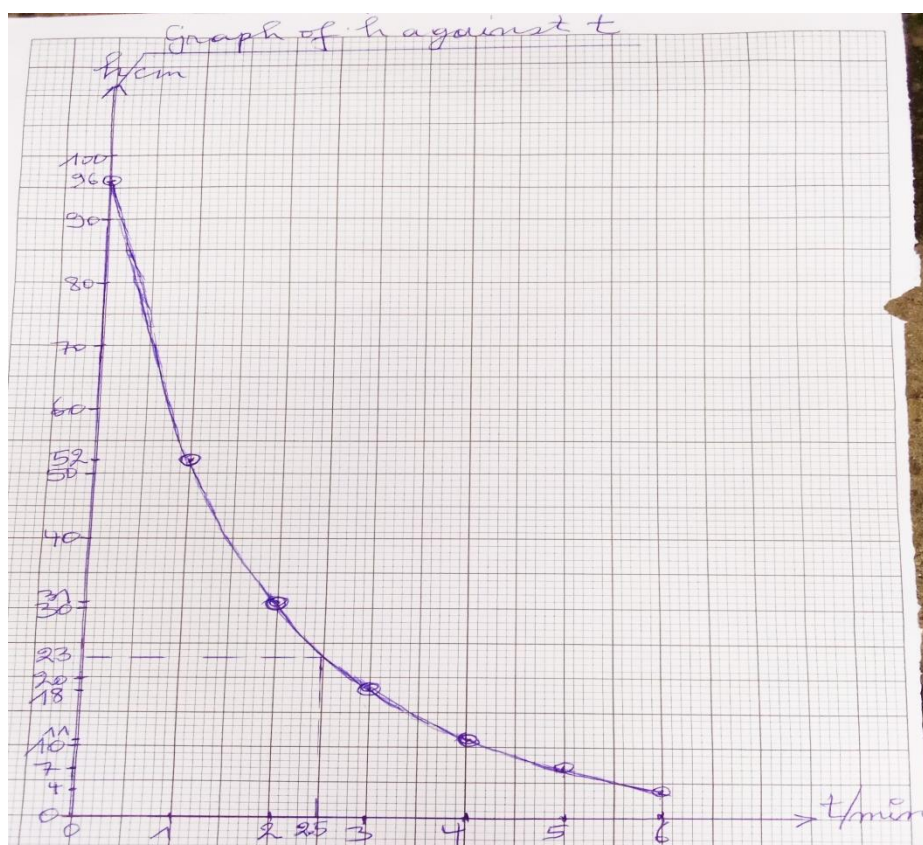**S2 ALTERNATIVE TO PHYSICS PRACTICAL**

MARKING SCHEME

a) The measuring instruments used:

   (i)Metre rule **(1mark)** to measure depth

   (ii) Stop clock **(1mark)** to determine the time

b)(i)Graph of h against t

   Students must use sharp pencils.

   Two labelled axes: 1 mark x2 =**2 marks**

   Two uniform scales: 1mark x2 =**2 marks**

   Seven plotted points: 7 x1 mark=**7 marks**

   Best fit curve: **1 mark**

  (ii)When t increases **(1mark)** h decreases **(1mark)** but not linearly

t and h are not proportional

c) The pressure in the liquid is given by P= ρgh **(1mark)**

When the depth decreases, the pressure in the liquid decreases, reason

why the water flows out slowly **(1 mark)**

d)The time t=2min 30 s=2.5 min **(1mark)**

The corresponding depth h=23 cm **(1mark)**(see the graph)