

**MARKING SCHEME OF ORDINARY LEVEL PHYSICS
NATIONAL EXAMINATION 2022-2023**

SECTION A: Answer all questions

- 1) (a) → (ii)
(b) → (i)
(c) → (iii)
- 2) a) True
b) False
c) True
d) True
- 3) a) Message source (source of information); transmitter; communication channel; receiver; message user (destination)
b) Two types of signals used in electronics are:
Digital signal and analog signal.
- 4) a) $P = \frac{U^2}{R}$
b) Resistance (R) and time (t)
c) Potential difference (pd)
- 5) Any two types of energy and their sources
- | Types of energy | Corresponding source of energy |
|---------------------|---|
| Thermal energy/heat | Wood, electricity, natural gas, biogas, charcoal, fossil fuels... |
| Light energy | Sun, electricity, wood, candle, biogas |
| Wind energy | Wind |
| Nuclear energy | Uranium, nuclei of an atom |
| Sound energy | Vibrating objects |
- 6) (a) → (iii)
(b) → (ii)
(c) → (iv)
(d) → (i)
- 7) a) Types of simple machines: wheel and axle, pulley, inclined plane, screw, wedge, lever
b) Examples of simple machines: scissor, knife, hoe, chair with wheel.
- 8) A) No. Because magnetic flux does not change.
b) N stands for the number of turns of the coil used.
c) The e.m.f generated can be increased by:
• Increasing the number of turns

- Using a strong magnet
- Increasing the velocity/speed of the coil
- Increasing the area of the coil.

- 9) a) $\vec{F} = m\vec{a}$
 b) Acceleration due to gravity does not depend on the mass being accelerated.
 c) Yes, when the earth exerts a force on you, you also exert an equal but opposite force on the earth.
- 10) The magnification produced by a spherical mirror is -3 (minus 3). The four characteristics of the mirror and the image are:

Characteristics of image	Characteristics of mirror
The image is three times magnifies than the object	The mirror is concave
The image is real	The mirror has a positive focal length.
The image is inverted	The mirror is curved inwards (the reflecting surface is inwards)
The image is formed beyond c	The principal focus is real

- 11) a) Difference between work and power:

Work	Power
Work is the product of force applied and distance in the direction of force.	Power is the rate of doing work
The SI unit if Joule (J) or Newton-meter	The SI unit is Watt (W) or Joule/second (J/s)
$W = F \times d$	$P = \frac{W}{t}$

- b) The cause of greater change in kinetic energy is the change in velocity.

- 12) a) $\delta = 1000 \text{ kg/m}^3$
 $h = 8\text{m}$
 $g = 9.81\text{m/s}^2$

Unknown: Pressure = ?

$$P = \delta gh = 1000 \times 9.81 \times 8 = 78,480 \text{ Pa or N/m}^2$$

- b) $P = 150 \text{ Pa}$
 $A = 0.2 \text{ m}^2$

Unknown: Force = ?

$$F = P \times A = 150 \times 0.2 = 30 \text{ N}$$

13) $m = 4 \text{ kg}$

$$V_i = 4 \text{ m/s}$$

$$V_f = 8 \text{ m/s}$$

Unknown: $I = ?$

$$I = \Delta p = m\Delta V = 10(8 - 4) = 40 \text{ kgm/s or } 40 \text{ Ns}$$

14) a) A circuit breaker is more efficient than a fuse because:

Fuses cannot be reused while a circuit breaker can be reused over and over.

A circuit breaker is used to protect homes and devices against overloading and short-circuit while a fuse is used to protect devices and homes against over loading only.

A circuit breaker responds quickly to the current than a fuse.

A circuit breaker opens the circuit while a fuse melt for over current only.

b) The material used in incandescent light bulbs is **Tungsten** because it has **high melting point**.

15) a) Plants need the following to make their own food: water, carbon dioxide, sunlight energy and chlorophyll.

b) When plants are left in the dark for a long time:

They will stop growing

They will become yellowish (no photosynthesis)

c) If plants are left unwatered (not supplied with water):

The plants will wilt

The plants will die

There will be no photosynthesis.

SECTION B: ATTEMPT ONLY THREE QUESTIONS (30 MARKS)

16) a) Materials required:

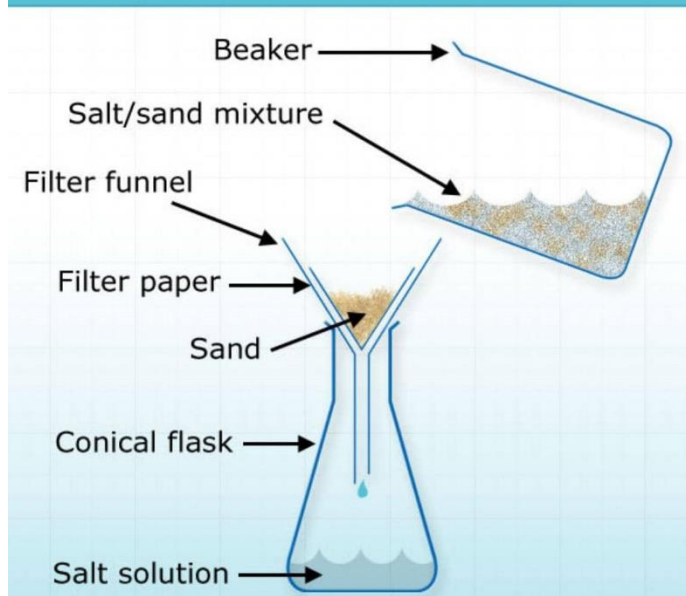
- Small beaker
- Electronic balance
- Graduated cylinder
- Stirring rod
- Filter paper
- Flask

- Filter funnel
- Bunsen burner
- Conical cylinder

b) Procedures:

- Place a small beaker on the balance. Measure the mass of sand and salt.
- Measure 150 ml of water by using the graduated cylinder.
- Carefully pour water into a beaker containing salt.
- Gently stir until salt is dissolved
- Pour sand into salt solution
- Use a piece of filter paper and clean, dry conical flask and filter the mixture.
- Make sure all the sand stays inside the filter paper (sand is removed by filtration because it does not dissolve in water).

Filtering the salt-sand-water mixture



c) Safe precautions:

- Be careful not to heat too long or too intensely
- Do not eat obtained salt
- Use carefully the Bunsen burner (source of heat) in order to avoid fire.
- Use a protective suit.

17) a)

Stage	Description
B	The learner is moving with constant velocity / speed of 5 m/s or uniform rectilinear motion or the acceleration is zero.

D	The learner is at rest or velocity is zero or the learner stops moving or the learner is stationary.
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b) The acceleration for stage A = $\frac{\Delta V}{\Delta t} = \frac{5-0}{7-0} = \frac{5 \text{ m}}{7 \text{ s}^2} = 0.71 \text{ m/s}^2$

c) Distance travelled by the learner in the first 10 seconds = distance travelled in stage A plus the distance travelled in stage B.
For state A, $t_1 = 7 \text{ seconds}$ and $a = 0.71 \text{ m/s}^2$

$$D_A = \frac{1}{2}at^2 = \frac{1}{2} \times 0.71 \times 7^2 = 17.4 \text{ m}$$

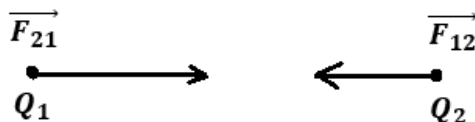
$$D_B = V \times t_2 = 5 \times 3 = 15 \text{ m}$$

Distance travelled by the learner in the first 10 seconds
= $17.4 \text{ m} + 15 \text{ m} = 32.4 \text{ m}$

d) Average speed = $\frac{\text{Total distance}}{\text{Total time taken}} = \frac{106.5 \text{ m}}{27 \text{ s}} = 3.94 \frac{\text{m}}{\text{s}} = 4 \text{ m/s}$

- 18) a) The balloons **repel** each other because they have the same **electric charge/negative**. The cloth is left with a **positive** electric charge. The charged particles that are transferred from the cloth to the balloons are called **electrons**. The balloons are charged by **friction**.
If somebody touches one of the balls, it becomes discharged and the balls will **attract** each other.

b) (i)



(ii) $46 \text{ nC} = 4.6 \times 10^{-8} \text{ C}$

(iii) $F = k \frac{Q_1 Q_2}{r^2} = \frac{9 \times 10^9 \times 4.8 \times 10^{-8} \times -2.5 \times 10^{-8}}{(0.8)^2} = -168.75 \times 10^{-7} \text{ N}$
 $= -1.6875 \times 10^{-5} \text{ N}$

(iv) The electric potential $V = \frac{kQ}{d} = \frac{9 \times 10^9 \times (-2.5 \times 10^{-8})}{9 \times 10^{-2}} = -2500 \text{ V}$

- 19) a) i) Condenser/condensing coil
Evaporator / evaporating coil
Compressor
Thermal expansion valve

ii) In the evaporator, the refrigerant absorbs heat from the indoor air.

b) i) Portion BC.

$$\begin{aligned}\text{ii) } m &= 0.500 \text{ kg} \\ c &= 4200 \text{ J/Kg}^\circ\text{C} \\ t_1 &= 25^\circ\text{C} \\ t_f &= 0^\circ\text{C}\end{aligned}$$

$$Q = mc\Delta t = 0.5 \times 4200 \times (0 - 25) = -52,500 \text{ J}$$

c) $Q = mL_f$

$$m = 0.500 \text{ g} = 0.5 \times 10^{-3} \text{ kg}$$

$$L = 334,400 \text{ J/Kg}$$

$$Q = 0.5 \times 10^{-3} \times 334,400 = 167.2 \text{ J}$$

20) a) i) Equivalent resistance

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} \quad R = \frac{60 \times 30}{60 + 30} = 20 \Omega$$

$$\text{ii) } I = \frac{E}{R} = \frac{3}{20} = 0.15 \text{ A}$$

$$\text{iii) Electric current } I_1 = \frac{E}{R_1} = \frac{3}{60} = 0.05 \text{ A}$$

$$\text{iv) Electric current } I_2 = \frac{E}{R_2} = \frac{3}{30} = 0.10 \text{ A}$$

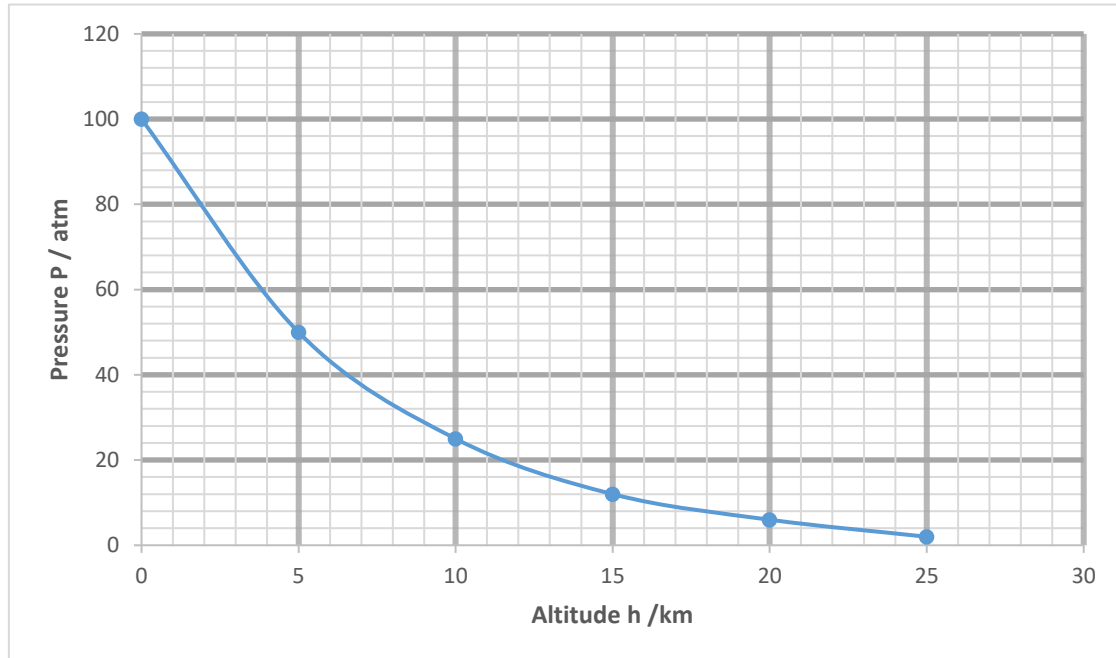
b) Total current is greater than individual current. $I > I_1$ and $I > I_2$.

As the resistances R_1 and R_2 are connected in parallel, the total current in the circuit is equal to the sum of individual currents in each branch.

$$I = I_1 + I_2$$

SECTION C: THIS QUESTION IS COMPULSORY.

21) a)



b) $(2 \leq h \leq 2.5) \text{ km}$

c) i) False because atmospheric pressure is measured using a barometer.

ii) True. According to the data in the table, when the altitude increases, the atmospheric pressure decreases.

iii) False. The SI unit of altitude is meter (m).

d) Yes, because there are many applications of atmospheric pressure such as:

- Drinking straw
- Siphon
- Vacuum pump
- Lift pump