Candidate's Name:...

Signature: ....

Random No.	Personal No.

(Do not write your School/Centre Name or Number anywhere on this booklet.)

535/1
PHYSICS
Paper 1
Oct./Nov. 2023
2¼ hours

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

PHYSICS

Paper 1

2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

*Section A contains **40** objective type questions. You are required to write the correct answer **A, B, C** or **D** in **blue** or **black** ink against each question in the box on the right hand side.*

*Section B contains **10** structured questions. Answers are to be written in the spaces provided on the question paper.*

*Do **not** use pencil **except** for drawings. Any work done in pencil will **not** be marked.*

Mathematical tables and silent non-programmable scientific calculators may be used.
Acceleration due to gravity, g = 10 ms⁻².
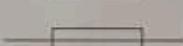
Specific heat capacity of water = 4200 J kg⁻¹ K⁻¹.

For Examiners' Use Only

Q.41	Q.42	Q.43	Q.44	Q.45	Q.46	Q.47	Q.48	Q.49	Q.50	MCQ	Total

Turn Over

SECTION A (40 MARKS)

*Answer **all** questions in this section.*

1. Which one of the following is the S.I unit of length?

   A. mm.
   B. cm.
   C. m.
   D. m^2.

2. Metals are good conductors of heat because

   A. their molecules vibrate faster.
   B. they have free mobile electrons.
   C. their atoms contain many protons.
   D. they have mobile atoms.

3. Which one of the following is a symbol for a fixed resistor?

   A.
   B.
   C.
   D.

4. Which one of the following electromagnetic waves causes sun burn?

   A. Ultra-violet rays.
   B. Infra-red rays.
   C. Gamma rays.
   D. X - rays.

5. Which one of the following characteristics is associated with images formed by the plane mirror?

   A. Virtual.
   B. Real.
   C. Magnified.
   D. Upside down.

6. The function of a lead shield on an X - ray tube is to

   A. absorb excess heat from the tube.
   B. keep the anode temperature low.
   C. enclose the vacuum.
   D. absorb strong X - rays.

2

7. Which one of the following instruments operates on the principle of transmission of pressure in liquids?

A. Hydraulic brakes and car braking systems.
B. Barometer and Bourdon gauge.
C. Manometer and crashing can.
D. Siphon and water tank.

8. The energy possessed by a glass of water placed on a table is

A. kinetic energy.
B. internal energy.
C. sound energy.
D. potential energy.

9. What will be the appearance of a house painted green and blue when viewed through a magenta filter?

A. Black.
B. Black and blue.
C. Green and black.
D. Green and blue.

10. A galvanometer can be converted into a voltmeter by connecting a

A. resistor of low resistance in series with it.
B. resistor of low resistance in parallel with it.
C. resistor of high resistance in parallel with it.
D. resistor of high resistance in series with it.

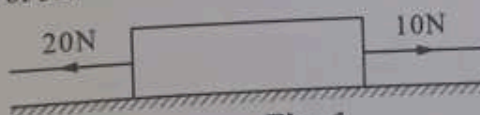11. Figure 1 shows two forces of 20 N and 10 N acting on a body against a frictional force of 5N.

Fig. 1

Find the resultant force.

A. 5 N.
B. 15 N.
C. 25 N.
D. 35 N.

12. The cores of electromagnets are made of iron and not steel because

    A.   permanent magnets are made of iron.
    B.   iron is good for magnetic shielding.
    C.   steel is a ferromagnetic material.
    D.   steel does **not** lose magnetism easily.

13. Which one of the following patterns is associated with waves when incident parallel wavefront hit a concave reflector?

    A.   Reflected waves are straight.
    B.   There is interference of waves.
    C.   There is diffraction of waves.
    D.   Reflected waves are circular.

14. A power of 2 W is developed when a force of 4 N moves through a distance of 5 m. Find the time for which the force acts.

    A.   1.6 s.   B.   2.5 s.
    C.   10.0 s.   D.   40.0 s.

15. An atom $^{56}_{27}Q$ loses two neutrons to become S as represented by the nuclear equation below:

$$^{56}_{27}Q \rightarrow 2\,^{1}_{0}n + S$$
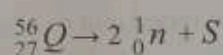
    Find the number of neutrons in S.

    A.   27.   B.   28.

    C.   29.   D.   31.

16. Light incident on rear reflectors of bicycles is totally internally reflected because

    A.   all the light is absorbed by the reflectors.
    B.   all the light hits them at a very small angle of incidence.
    C.   the light hits them at an angle less than the critical angle.
    D.   the light hits them at an angle greater than the critical angle.

17. Which one of the following statements explains why alpha particles form straight short thick tracks in air? They

    A.   have high penetrating power and cause great ionisation of air.
    B.   are heavy, have greater charge and cause more ionisation of air.
    C.   are light and have high penetrating power.
    D.   are heavy with great charge and cause less ionisation of air.

4

18. For a musical note to be described as loud, low-pitched sound, the amplitude and frequency **must** respectively be

	Amplitude	Frequency
A.	small	high
B.	small	low
C.	large	high
D	large	low

19. In an electric bell, the hammer strikes the gong continuously because

    A. of the attraction of the soft iron armature by the electromagnet.
    B. the contact between the spring and the screw is broken.
    C. of intermittent current in the electromagnet.
    D. the iron armature has varying current.

20. Find the power of a diverging lens whose focal length is 25 cm.

    A. − 4.00 D.
    B. − 0.04 D.
    C. 0.04 D.
    D. 4.00 D.

21. Rockets and jets are designed with their exhaust pipes pointing behind to

    A. reduce on the viscous drag between the air and the rocket.
    B. give the rocket streamline shape.
    C. give the rocket a forward reaction due to the action of the exhaust.
    D. protect the occupants from the exhaust gases.

22. A white cloth and black cloth are put in a hot sun for the same period of time. Which one of the following statements explains which cloth will feel hotter?

    A. Black cloth, because black is a good absorber of heat.
    B. White cloth, because white is a good emitter of heat.
    C. Black cloth, because black is a good reflector of heat.
    D. White cloth, because white is a good absorber of heat.

23. A cylindrical tank holds 18 m³ of water. If its base radius is 2 m, find the height of the tank. (*Take* $\pi = 3.14$)

    A. $\dfrac{18 \times 4}{3.14}$.

    B. $\dfrac{18 \times 2}{3.14}$.

    C. $\dfrac{18}{3.14 \times 4}$.

    D. $\dfrac{18}{3.14 \times 2}$.

Turn Over

24. Figure 2 shows a mercury barometer.
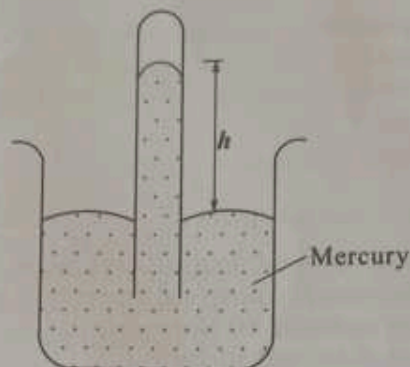
Fig. 2

Which one of the following statements explains what happens to the height, h, when the barometer is taken to a higher altitude? It

A. decreases because atmospheric pressure increases with height.
B. decreases because atmospheric pressure decreases with height.
C. increases because atmospheric pressure increases with height.
D. increases because atmospheric pressure decreases with height.

25. Which one of the following is correct about a four-stroke internal combustion engine?

A. Fuel is ignited during the power stroke.
B. Both the inlet and outlet valves open during induction stroke.
C. Both inlet and outlet valves close during compression stoke.
D. The starter motor provides the energy required for subsequent inlet and compression strikes.

26. A bulb rated 60 W, 240 V runs for 8 hours. If the cost of electrical energy is Shs500 per unit, find the cost of using the bulb.

A. Shs240.
B. Shs960.
C. Shs1000.
D. Shs240,000.

27. Figure 3 shows a metal rod placed in a magnetic field which acts perpendicularly into the plane of the paper.

Fig. 3

Which one of the following actions on the rod makes current to flow from Q to P? Moving the rod

A. upwards from Q to P.
B. downwards from P to Q.
C. to the right.
D. to the left.

28. An experimenter standing at a distance from a mountain makes a loud sound and hears an echo after one second. If the velocity of sound in air is 340 ms^{-1}, how far is the mountain from the experimenter?

A. 1.7×10^{-2} m.   B. 1.7×10^2 m.
C. 3.4×10^2 m.   D. 6.8×10^2 m.

29. Which one of the following graphs describes a body moving with uniform acceleration?
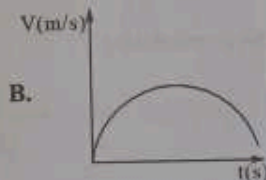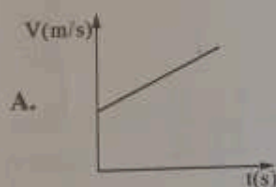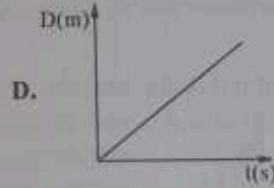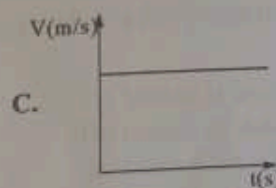
30. A stone is released from a height of 20 m above the ground. Find its height above the ground when its speed is 10 ms^{-1}.

A. 4 m.   B. 5 m.
C. 10 m.   D. 15 m.

7   **Turn Over**

31. Figure 4 shows a bar X being brought near a south pole of a suspended magnet.

Plastic thread

X | S | N

Fig. 4

If X is attracted to the south pole, then X is a

(i)   north pole of a magnet.
(ii)   south pole of a magnet.
(iii) ferromagnetic material.

A.   (i) only.   B.   (ii) only.
C.   (i) and (iii) only.   D.   (ii) and (iii) only.

32. Figure 5 shows two resistors of resistances 2 Ω and 4 Ω connected in parallel.

2Ω

4Ω
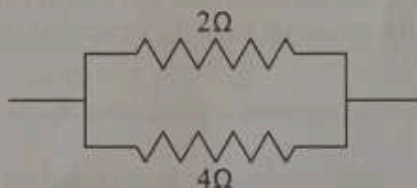
Fig. 5

Find the effective resistance.

A.   6.00 Ω.   B.   8.00 Ω.

C.   1.33 Ω.   D.   0.50 Ω.

33. A cathode ray tube is used to study the trace on its screen when the input signal is fed between the Y- plates. A stationary spot in the upper part is seen when

A.   the input p.d is d.c. and the time base is turned on.
B.   the input p.d is d.c. and the time base is turned off.
C.   the input p.d is a.c. and the time base is turned on.
D.   the input p.d is a.c. and the time base is turned off.

34. When a 2.0 kg block of metal at 600 °C is immersed in water at its boiling point (100 °C), 0.4 kg of steam is produced. If the specific latent heat of vaporisation of water is 2.3×10^6 J kg⁻¹, find the specific heat capacity of the metal in J kg⁻¹ K⁻¹.

A. $\dfrac{0.4 \times 2.3 \times 10^6}{2 \times 500}$

B. $\dfrac{0.4 \times 2.3 \times 10^6}{2 \times 600}$

C. $\dfrac{0.4 \times 2.3 \times 10^6}{2 \times 700}$

D. $\dfrac{2.3 \times 10^6 \times 2}{0.4 \times 500}$

35. When a neutral rod rubbed with fur is brought near the cap of a positively charged electroscope, the divergence increases.

Which of the following shows the correct charge on the rod and fur?

	Rod	Fur
A.	Negative	Negative
B.	Positive	Positive
C.	Negative	Positive
D.	Positive	Negative

36. A current I is maintained in a conductor of resistance 5 Ω for 3 s. If the total charge that passed is 10 C, find the p.d across the conductor.

A. $\left(\dfrac{10 \times 5}{3}\right)$ V.

B. $\left(\dfrac{10 \times 3}{5}\right)$ V.

C. $\left(\dfrac{5 \times 3}{10}\right)$ V.

D. $\left(\dfrac{10}{5 \times 3}\right)$ V.

37. Which one of the following diagrams shows the correct path of light through a glass prism?
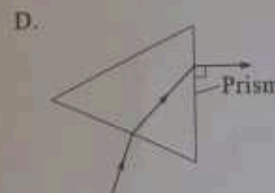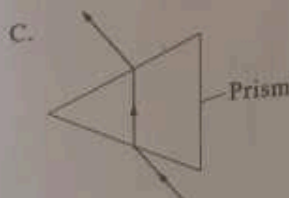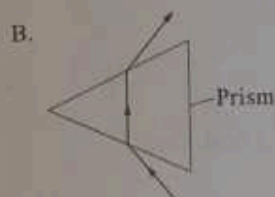
38. The velocity of a body of mass 3 kg increases from 4 ms⁻¹ to 7 ms⁻¹. Find the change in momentum of the body.

   A.   5.3.
   B.   9.0.
   C.   12.0.
   D.   21.0.
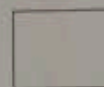
39. Figure 6 shows interference fringes formed by water waves from sources S_1 and S_2.

L_1 L_2 L_3
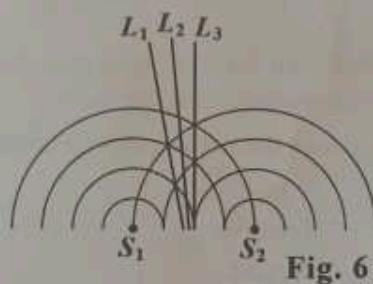
S_1 S_2 Fig. 6

   Which one of the lines L_1, L_2 and L_3, represents the line of constructive interference?

   A. L_1 and L_2.
   B. L_2 and L_3.
   C. L_1 and L_3.
   D. L_1, L_2 and L_3.

40. Figure 7 shows a wheel of radius 8 cm which is turned by force T about its axis.

8cm   —Wheel
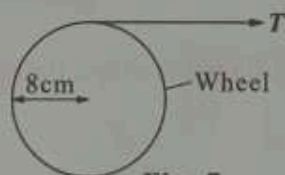
Fig. 7

   If the moment of T is 1.2 Nm, find T.

   A. $\left(\dfrac{1.2\times100}{8}\right)$ N.

   B. $\left(\dfrac{1.2\times8}{100}\right)$ N.

   C. $\left(\dfrac{8\times100}{1.2}\right)$ N.

   D. $\left(\dfrac{1.2}{8\times100}\right)$ N.

SECTION B (40 MARKS)

Answer all the questions in this section.
All working must be shown clearly in the spaces provided.

41. (a) What is meant by **Gravitational force**? (01 mark)

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....

(b) Why does the weight of a body on earth change from place to place? (01 mark)

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(c) A person of mass 40 kg climbs a hill 750 m high in 30 s. Calculate the power expended by the person. (02 marks)

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42. (a) List in order of occurrence, the energy changes that take place when a bicycle dynamo lights a bicycle lamp. (02 marks)

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(b) Differentiate between renewable and non-renewable sources of energy giving an example of each. (02 marks)

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Turn Over

43. (a) Explain how;
    (i) electrons are produced in a cathode ray oscilloscope (C.R.O).
        (02 marks)

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    (ii) the electron beam in the C. R. O is made visible.   *(01 mark)*

....

    (b) State **one** use of a C.R.O.   *(01 mark)*

....

44. (a) What is meant by **saturated vapour**?   *(01 mark)*

....

    (b) Define:
        (i) Evaporation.   *(01 mark)*

....

        (ii) Melting.   *(01 mark)*

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    (c) Figure **8** shows a graph of saturated vapour pressure (S.V.P) against temperature for a liquid
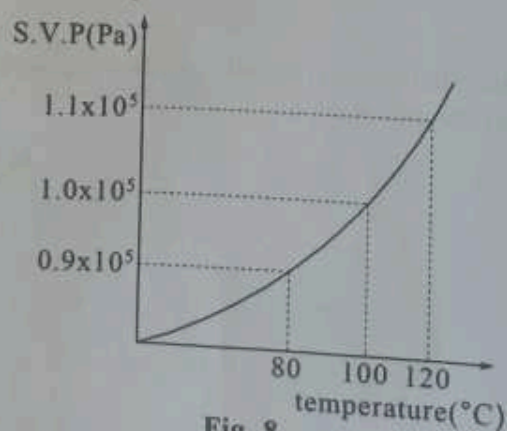
Fig. 8

If the atmospheric pressure is 1.1×10^5 Pa, identify the boiling point of the liquid. Give a reason for your answer. *(01 mark)*

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45. (a) Differentiate between **scalar** and **vector** quantities and give an example of each. *(02 marks)*

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(b) A body of mass 5 kg at rest, is acted on by a force of 10 N. Find its acceleration. *(02 marks)*

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46. (a) What is meant by a **fuse**? *(01 mark)*

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(b) What is the importance of an earth wire? *(01 mark)*

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Turn Over

(c) Determine whether a 5 A fuse would work on an appliance of 24 V, 200 W or not. *(02 marks)*

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47. (a) State the **laws of refraction of light**. *(02 marks)*

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(b) Figure **9** shows a ray PO incident at point O on a glass block. It is refracted along OX and emerges out of the glass block at X undeviated.
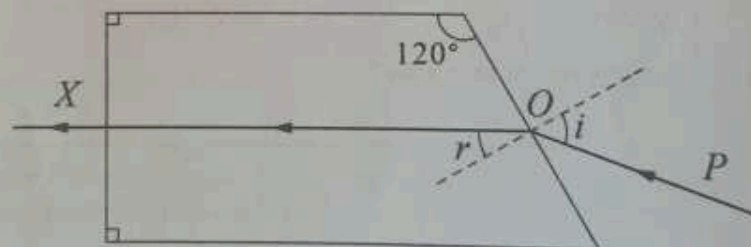
Fig. 9

If the refractive index of the material of the glass is 1.52, calculate the angle of incidence, i, at O. *(02 marks)*

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48. Figure **10** shows a beaker placed on top of a little water on a wooden block and some liquid ether then poured into the beaker.
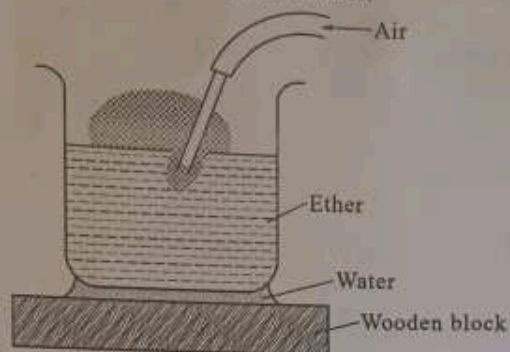
Fig. 11

Air is blown through the ether.

(a) Why does the beaker get stuck to the wooden block after sometime.

(02 marks)

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....

(b) Calculate the amount of heat needed to change 20 g of ice at 0 °C to water at 100 °C. (*Specific latent heat of fusion of ice* = 3.4 × 10⁵ J kg⁻¹; *Specific heat capacity of water* = 4200 J kg⁻¹ K⁻¹) (02 marks)

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Turn Over

49. (a) In the resonance tube experiment, first loud sound is heard at a length of 54.0 cm and the second loud sound is heard at a length of 106.5 cm. Find the frequency of the tuning fork used.
(*Speed of sound in air = 330 ms^{-1}*) (*03 marks*)

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(b) Why is sound considered a mechanical wave? (*01 mark*)

....

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50. (a) (i) What is an **electrical generator**? (*01 mark*)

....

....

(ii) State **two** factors that affect the output of an electrical generator. (*01 mark*)

....

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(b) A transformer connected to a 240 V a.c. mains delivers 5.0 A at 144 V at the secondary coil. If the transformer is 100 % efficient, find the input current. (*02 marks*)

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END