403 S. H. S. C. E.
May 2013
PHYSICS 1 & 2
Objective and Essay Tests
2½ hours

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Index Number: 111002026

THE WEST AFRICAN EXAMINATIONS COUNCIL

Senior High School Certificate Examination

May 2013 PHYSICS **2½ hours**

Do **not** *open this booklet until you are told to do so. While you are waiting, read and observe the following instructions carefully. Write your* **name** *and* **identification number** *in the space provided above.*

This paper consists of **two** *parts: Papers* **1** *and* **2**. *Answer Paper* **1** *on your Objective Test Answer Sheet and Paper* **2** *in your Answer Booklet. Paper* **1** *will last for* **1 hour** *after which the answer sheet will be collected. Do* **not** *start Paper* **2** *until you are told to do so. Paper* **2** *will last for* **1½ hours.**

PAPER 1

OBJECTIVE TEST
[40 marks] **1 hour**

1. Use **2B** pencil throughout.
2. On the objective answer sheet supplied, provide the following details **correctly**:
   (a) Supply the information required in the spaces marked *CENTER NAME, CENTER No, SCHOOL NAME* and *SCHOOL No.*
   (b) In the space marked *STUDENT'S NAME,* write your **surname** followed by your **other names.** Write your *IDENTIFICATION NUMBER* in the space marked *STUDENT No.*
   (c) In the spaces marked *SUBJECT and GRADE,* write PHYSICS AND 12TH in that order.
   (d) In the box marked *IDENTIFICATION NUMBER,* provide your **identification number** vertically in the spaces on the left-hand side and shade each numbered space in line with each digit. This identification number must be the same as the one indicated on your Admission Slip. Repeat the process with the correct information for the box marked *YEAR OF FIRST ENTRY .*
   (e) In the box marked *Subject Code*, write the digits 403 vertically in the spaces on the left-hand side. **Shade** the corresponding numbered spaces as you did for your identification number.
3. An example is given below. This is for a **male** candidate whose name is Sagbeh Bondoe FANIA. His identification number is 101123456; his first entry is in 2013 and he is offering **Physics**.

THE WEST AFRICAN EXAMINATIONS COUNCIL-LIBERIA

PRINT IN BLOCK LETTERS

TOE-BROWNE ACADEMY (CENTER NAME)	500104 (CENTER No.)
WYNNA GAYVOLOR HIGH SCHOOL (SCHOOL NAME)	101123 (SCHOOL No.)
FANIA, Sagbeh Bondoe (STUDENT NAME)	456 (STUDENT No.)
PHYSICS (SUBJECT)	12TH (GRADE)

IDENTIFICATION NUMBER

1									
0	●								
1		●							
2									
3				●					
4									
5					●				
6									

For Supervisors only.
If a candidate is absent shade this space. ▭

YEAR OF FIRST ENTRY

2				
0	●			
1				
3			●	

SUBJECT CODE

4			
0	●		
3			●

Shade the space marked
M (for Male) or F (for Female) M ■ F ▭
In this box

PAPER 1
OBJECTIVE
[40 marks]

Answer **all** *the questions.* **1 hour**

Paper 1 consists of **sixty** *objective questions. Each question is followed by* **four** *options lettered* **A** *to* **D**. *Choose the correct option for each question and shade in pencil on your answer sheet the answer space which bears the same letter as the option you have chosen. Give only* **one** *answer to* **each** *question.*
Where necessary use $\mathbf{g = 10\ m/s^2}$.
An example is given below.

The maximum displacement of a wave is called the
A. amplitude.
B. period.
C. frequency.
D. wavelength.

The correct answer is **amplitude** *which is lettered* **A** *and therefore the answer space* **A** *would be shaded.*

[■] [B] [C] [D]

Think carefully before you shade the answer space on the answer sheet; erase completely any answers you wish to change. Do all rough work on this question paper.

Now answer **all** *the following questions.*

1. In general, sound is conducted **fastest** through
A. gases.
B. liquids.
C. solids.
D. a vacuum.

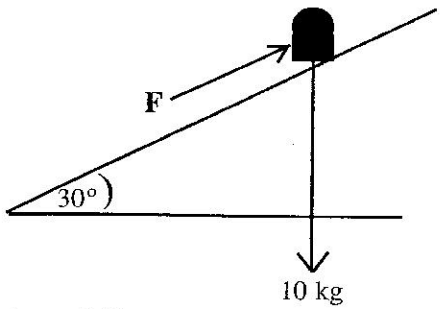
2. The electron-volt is the unit of
A. voltage.
B. electric current.
C. power.
D. energy.

3. If the voltage across a circuit of constant resistance is doubled, the power dissipated by the circuit will
A. increase by a factor of two.
B. increase by a factor of four.
C. decrease to one-half the original value.
D. decrease to one-fourth the original value.

4. A galvanometer can be converted to an ammeter by the addition of
A. small resistance in parallel to it.
B. large resistance in parallel to it.
C. small resistance in series with it.
D. large resistance in series with it.

5. The general definition of elastic modulus is
A. strain/stress.
B. stress/ strain.
C. strain x stress.
D. $\sqrt{\text{stress}}$/strain.

6. A load of mass 10 kg is pushed up a smooth inclined plane by a horizontal force **F** as shown below. What is the magnitude of the force?



A. 5 N
B. 50 N
C. 87 N
D. 100 N

7. A ray of light is incident on a plane mirror that is rotated through an angle of 30°. What is the angle of rotation of the reflected ray?
A. 90°
B. 60°
C. 45°
D. 30°

8. A 3.0 kg car moving at 5 m/s is brought to rest in 0.02 second. Calculate the average force exerted on the car.
A. 30 N
B. 150 N
C. 500 N
D. 750 N

9. A block and tackle system has 2 fixed pulleys and 4 movable pulleys and it is used to raise a load of 400 N. What is the velocity ratio of the system?
A. 3
B. 6
C. 8
D. 10

10. A motor does 3 kJ of work in 2 minutes. What is its power output?
A. 25 W
B. 150 W
C. 250 W
D. 2500 W

11. The reading on the scale of a simple hydrometer will always be
A. smaller at the top of the scale.
B. larger at the top of the scale.
C. the same at the top of the scale.
D. smaller at the bottom of the scale.

12. A capacitor holds 7.5×10^{-4} C of charge and the potential difference across it is 30 V. What is the capacitance of the capacitor?
A. 0.25 μF
B. 4.0 μF
C. 25 μF
D. 40 μF

13. A cell of emf 1.5 V and internal resistance 2.5 Ω is connected to a resistor of resistance 3.5 Ω. What is the current in the circuit?
A. 0.25 A
B. 0.43 A
C. 0.50 A
D. 0.60 A

14. A quarter of a revolution turned in 2 seconds is an angular velocity of
A. $\pi/4$ radian per second.
B. $\pi/2$ radian per second.
C. 2π radian per second.
D. 4π radian per second.

15. Which of the following types of motion does a body undergo when acted upon by a couple?
A. Circular motion
B. Rotational motion
C. Random motion
D. Translational motion

16. The efficiency and velocity ratio of a pulley system are 80% and 6 respectively. How much effort is needed for the system to lift a load of 120 N?
A. 25 N
B. 90 N
C. 96 N
D. 250 N

17. Which of the following is **not** a product of nuclear fission?
A. X-rays
B. Alpha particle
C. Beta particle
D. Gamma rays

18. Which of the following is a stringed instrument?
A. Flute
B. Trumpet
C. Piano
D. Drum

19. The distance between a node and an antinode of a transverse wave is equal to
A. the wavelength .
B. one-fourth the wavelength.
C. one-half the wavelength.
D. thrice the length.

20. Two colors are said to be complementary when their combination produces
A. white.
B. green.
C. red.
D. cyan

Turn over

21. An object is placed 15 cm from the pole of a converging mirror of focal length 10 cm. The image formed is
A. real and located 60 cm from the mirror.
B. virtual and located 30 cm from the mirror.
C. real and located 30 cm from the mirror.
D. virtual and located 60 cm from the mirror.

22. 2,500,000 grams can be expressed in compact form as
A. 2.5 ng.
B. 2.5 mg.
C. 2.5 Mg.
D. 2.5 Gg.

23. The combination of two or more cells forms
A. a battery.
B. an electric motor.
C. an accumulator.
D. a generator.

24. Object **A** is dropped from rest from the top of a building and object **B** is thrown horizontally from the top of the same building at the same time. In the absence of air resistance, compare the time it takes for each object to hit the ground below.
A. Object A will strike the ground first.
B. Object B will strike the ground first.
C. Both objects will fall at the same time.
D. Both objects will remain in the air.

25. A mass **m** slides down a friction-free inclined plane of inclination angle ϕ. The force pulling the mass down the plane is
A. mg.
B. $mg\sin\phi$.
C. $mg\cos\phi$.
D. zero.

26. The total linear momentum of a system of objects is constant if
A. friction can be ignored.
B. gravity can be ignored.
C. only external forces are acting.
D. only internal forces are acting.

27. The center of gravity and the center of mass coincide
A. if the object is uniform.
B. in all circumstances.
C. if the acceleration of free fall varies over the object.
D. if the acceleration of free fall does not vary.

28. In order to use a substance to make a thermometer, the substance must ..... with a temperature change.
A. expand
B. contract
C. change linearly
D. change

29. A periodic wave is produced on a plucked string. Which of the following will influence the speed of the wave?
I. Frequency
II. Wavelength
III. Tension
IV. Linear density of the string

A. I only
B. I and II only
C. I, II and IV only
D. I, II, III and IV

30. An intensity level of zero decibel (0 dB) corresponds to a sound intensity of
A. $0\ W/m^2$.
B. $1.0\ W/m^2$.
C. $1.0 \times 10^{-12}\ W/m^2$.
D. $1.0 \times 10^{-16}\ W/m^2$.

31. Standing waves are produced by the superposition of
A. identical waves travelling in opposite directions.
B. identical waves travelling in the same direction.
C. otherwise identical waves of slightly different frequencies.
D. waves which travel at different speeds.

32. Electric field lines
A. circle clockwise around positive point charges.
B. circles counter-clockwise around positive point charges.
C. radiate outward from negative point charges.
D. radiate inward toward negative point charges.

33. An external force does 6.4 μJ of work in moving a 2.0 μC charge at a constant speed from one point to another in an electric field. What is the potential difference between the points?
A. 2.3 V
B. 3.2 V
C. 5.4 V
D. 6.2 V

34. How many grams of zinc would be deposited by the same number of coulombs that deposited 2 grams of silver? [**Equivalent weights of silver and zinc are 107.88 and 32.69 respectively**]
A. 0.061 g
B. 0.61 g
C. 6.1 g
D. 61.0 g

35. The parts of a bar magnet at which the magnetic field is **strongest** are called
A. poles.
B. neutral points.
C. magnetic declinations.
D. magnetic meridians.

36. Which of the following is able to perform sublimation?
A. Camphor ball
B. Gasoline
C. Alcohol
D. Grease

37. The spectrum of colors usually seen in gasoline spilled on a wet street is primarily the result of
A. interference.
B. reflection.
C. refraction.
D. diffraction.

38. A 3 Ω resistor is connected in parallel to a 4 Ω resistor. If the current in the 3 Ω resistor is 8 A, what current flows through the 4 Ω resistor?
A. 2 A
B. 6 A
C. 8 A
D. 10 A

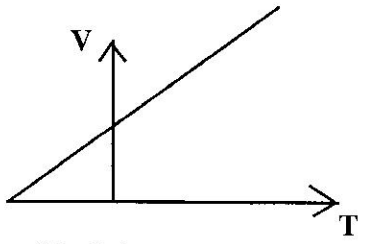
39. A body is freely suspended and is pulled to one side and left to oscillate about the point of suspension. The body oscillates because of
A. its weight.
B. the acceleration due to gravity.
C. moments of the weight about the point of suspension.
D. instability of the body.

40. The movement of a body such that it is always at a fixed distance from a given point describes a/an
A. rectilinear motion.
B. circular motion.
C. simple harmonic motion.
D. oscillatory motion.

41. From the top of a building 5 m tall, a body is thrown horizontally with a velocity of 50 m/s. With what speed will the body hit the ground?
A. 45 m/s
B. 51 m/s
C. 68 m/s
D. 100 m/s

42. According to Pascal's principle, the pressure exerted on a fluid
A. increases with depth.
B. is equal to the upthrust of the fluid on the body.
C. is equal in all directions.
D. depends on the density of the fluid.

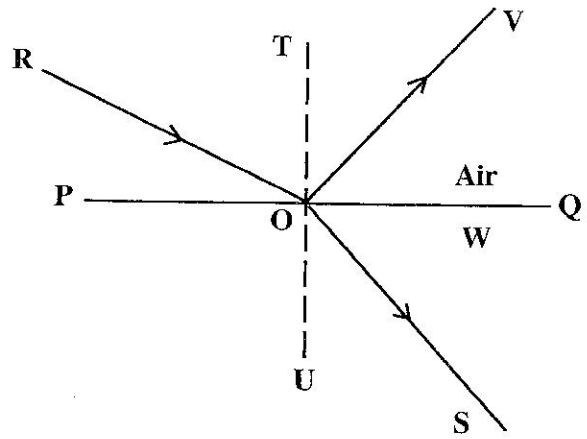
43. The graph below represents the behavior of a gas which obeys



A. Ohm's law.
B. Boyle's law.
C. Charles's law.
D. Pascal's law.

Turn over

Use the diagram of a ray of light travelling from **air** *to medium* **W** *shown below, to answer questions* **44** *to* **46**. *The angles,* **ROT = 57°** *and* **VOS = 90°**.



44. What is the refractive index of the medium **W**?

A. 1.3
B. 1.5
C. 1.6
D. 1.8

45. The angle, **SOU**, is called the

A. critical angle.
B. angle of incidence.
C. angle of reflection.
D. angle of refraction.

46. The angle of incidence is the angle

A. POR.
B. ROT.
C. SOU.
D. VOQ.

47. The average velocity of a body in linear motion can be represented graphically by a

A. position-time graph.
B. velocity-time graph.
C. displacement- time graph.
D. speed-time graph.

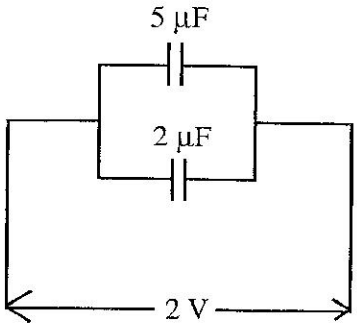
48. Two identical cars travelling at 100 m/s collide head-on. The impact force on each car is the same as hitting a concrete wall at

A. 50 m/s.
B. 100 m/s.
C. 150 m/s.
D. 200 m/s.

49. For a converging lens to act as a simple microscope, the object to be viewed must be placed at

A. infinity.
B. the focus.
C. the least distance of distinct vision.
D. a distance less than the focal length of the lens.

Study the diagram below to answer question **50**.



50. What is the total energy stored by the capacitors?

A. 1.4×10^{-6} J
B. 2.8×10^{-6} J
C. 1.4×10^{-5} J
D. 2.8×10^{-5} J

END OF OBJECTIVE TEST

DO NOT TURN OVER THIS PAGE
UNTIL YOU ARE TOLD TO DO SO.

YOU WILL BE SEVERELY PENALIZED IF YOU ARE FOUND LOOKING AT THE NEXT PAGE BEFORE YOU ARE TOLD TO DO SO.

PAPER 2
ESSAY
[60 marks] **1½ hours**

Paper **2** *consists of* **two** *sections,* **A** *and* **B**. *Section* **A** *consists of* **three** *compulsory questions and section* **B** *consists of* **four** *questions of which you are required to answer any* **two**.
Write your answers in ink (**blue** *or* **black**).

For **each** *question, all necessary details of working including rough work and diagrams* **must** *be shown with the answer.*
Credit will be given for clarity of expression and orderly presentation of materials.

SECTION A
[Compulsory]
[24 marks]

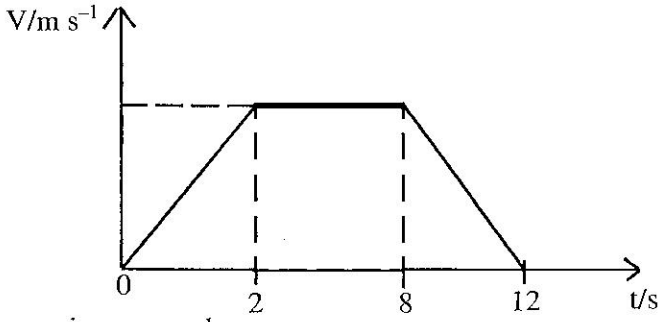
Answer **all** *questions in this section.*

1. (*a*) A student in a large classroom can read from the board clearly but requires a pair of spectacles to read from a book before him.
(i) What eye defect has this student?
(ii) What type of lens is needed to correct this defect?
(iii) If the lens used to correct the defect has a focal length of 10 cm, calculate the power of the lens.

(*b*) In a tabular form, outline **three** similarities between the human eye and the lens of a camera.

(*c*) The mass and volume of a rectangular block resting on a horizontal flat surface are 480 kg and 48 m^3 respectively. If the sides of the block are in the ratio of 3:2:1, calculate the minimum and maximum pressure it will exert on the surface.

2. (*a*) The graph below represents the motion of a police highway patrol car starting from rest and covered a total distance of 108 m. Calculate its



(i) maximum speed;
(ii) average speed;
(iii) acceleration;
(iv) distance covered during retardation.

(*b*) Give an interpretation of the graph to explain the nature of the car's motion.

(*c*) With the aid of a suitable diagram, explain the phrase "moment of a force".

(*d*) Distinguish between a stable equilibrium and an unstable equilibrium.

(*e*) What is a *couple*?

3. (*a*) What is *specific latent heat of fusion*?

(*b*) A 10 kg piece of lead in a container at 40 °C was placed in an electric furnace rated 10 kW. Given the melting point of lead 320 °C, calculate the
(i) quantity of heat required to heat the lead to its melting point;
(ii) additional heat energy required to melt the lead;
(iii) time taken to supply this additional energy.

SECTION B
[36 marks]

Answer any **two** *questions in this section.*

4. (*a*) How would you connect the plates of a set of capacitors such that they are in
(i) parallel;
(ii) series.

(*b*) How much work must a 1.5 V battery do if it is connected to move 0.25 °C per second through a wire for 10 minutes?

(*c*) Two capacitors of capacitances 2 μF and 6 μF are connected in a circuit.
(i) What is their equivalent capacitance when connected in series?
(ii) Calculate the total charge when they are connected to a 9 V-battery.

5. (*a*) Explain the following thermal processes:
(i) adiabatic process;
(ii) endothermic process;
(iii) exothermic process.

(*b*) What is *triple point temperature*?

6. (*a*) Explain the phenomenon "Doppler effect".

(*b*) A taxi cab moving at 72 km/h is sounding its horn as it approaches a check-point. If the actual frequency of the horn is 5,500 Hz, what frequency will a listener at the check-point hear at 25 °C?
[*Assume the speed of sound in air* = 350 m/s]

7. (*a*) Distinguish between the intensity and loudness of sound.

(*b*) What is an *ultrasonic sound*?

(*c*) Give **four** uses of ultrasonic waves.

END OF PAPER