SH 403 S.H.S.C.E.
May 2009
PHYSICS 1 & 2
Objective Test and Essay
2½ hours

Name.....

Identification Number.....

THE WEST AFRICAN EXAMINATIONS COUNCIL

Senior High School Certificate Examination

May 2009 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 spaces 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* 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* 1½ *hours.*

PAPER 1

1 hour

OBJECTIVE TEST
[60 MARKS]

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 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 John Khalid GBOTOE. His *identification number* is 001011379, his first entry is in 2009 and he is offering *Physics*.

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TOM JONES HIGH SCHOOL	981001
CENTER NAME	CENTER No.
JOE BLOE HIGH SCHOOL	001011
SCHOOL NAME	SCHOOL No.
GBOTOE JOHN KHALID	379
STUDENT NAME	STUDENT No.
PHYSICS	12TH
SUBJECT	GRADE

IDENTIFICATION NUMBER

	0	1	2	3	4	5	6	7	8	9
0	■									
0	■									
1		■								
0	■									
1		■								
1		■								
3				■						
7								■		
9										■

YEAR OF FIRST ENTRY

	0	1	2	3	4	5	6	7	8	9
2			■							
0	■									
0	■									
9										■

SUBJECT CODE

	0	1	2	3	4	5	6	7	8	9
4					■					
0	■									
3				■						

For Supervisors only
If candidate is absent shade this space ☐

Shade the space marked M (for male) or F (for female) in this box M ■ F ☐

Answer **all** *the questions.*

Paper 1 *consists of* **fifty** *questions.* Each *question is followed by* **four** *options lettered* A *to* D. *Find out 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 **g = 10 m/s²**

An example is given below.

Which of the following physical processes **cannot** be explained by the molecular theory of matter?

A. Evaporation
B. Thermal conduction
C. Radiation of heat
D. Convectional currents in fluids

The correct answer is Radiation of heat, *which is lettered* C, *and therefore answer space* C *would be shaded.*

⊏A⊐ ⊏B⊐ ▬C▬ ⊏D⊐ ⊏E⊐

Think carefully before you shade the answer spaces; erase completely any answer(s) you wish to change.

Do all rough work on this question paper. Now answer the following questions.

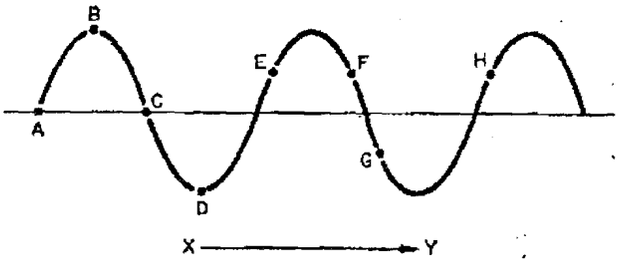
1. The SI unit of mass is
A. pound.
B. dyne.
C. gram.
D. kilogram.

2. Which of the following is a *scalar quantity*?
A. Distance
B. Acceleration
C. Displacement
D. Velocity

3. A single force that has the same effect as two or more concurrent forces is known as
A. parallel force.
B. resultant force.
C. equilibrant force.
D. gravitational force.

4. Which of the following symbols represents an atom of *X* consisting of 42 protons, 42 electrons, and 65 neutrons?
A. $^{65}_{42}X$
B. $^{147}_{84}X$
C. $^{107}_{42}X$
D. $^{107}_{84}X$

The diagram below shows the profile of a transverse wave. Use it to answer Questions **5** *and* **6.**



5. Which two points are in phase?
A. A and C
B. B and D
C. C and F
D. E and H

6. Which distance represents one wavelength?
A. AC
B. BD
C. FG
D. EH

7. Two charges experience a repulsive force of magnitude F. If the charges are each double and the distance between them is reduced by half, the repulsive force will be
   A. $16\,F$
   B. $2\,F$
   C. $\frac{1}{2}F$
   D. $\frac{1}{4}F$

8. The voltage and number of turns on the secondary of a transformer are 240 V and 200 turns respectively. What is the number of turns on the primary if its voltage is 120 V?
   A. 100
   B. 200
   C. 300
   D. 400

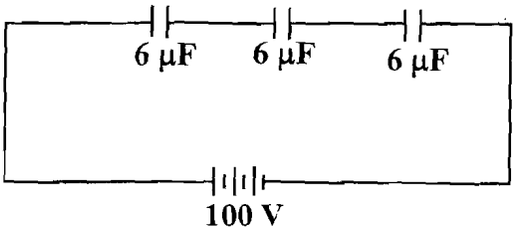
9. A radioactive isotope has a half-life of one week. At the end of two weeks the amount of substance remaining is
   A. one-half.
   B. one-quarter.
   C. one-eighth.
   D. one-sixteenth.

10. The water in a bucket gets warm on a sunny day through a process known as
   A. conduction.
   B. convection.
   C. radiation.
   D. expansion.

11. What is the illuminance on a surface that is 2.0 m from a 1.6 cd source?
   A. 4.00 lm/m^2
   B. 0.04 lm/m^2
   C. 0.40 lm/m^2
   D. 32.00 lm/m^2

12. What is the p.d. across a 2.0 m length wire whose resistivity is $1.8 \times 10^{-8}\ \Omega$ m with area of cross section 9.0×10^{-9} m^2 and a current of 1.5 A passing through it?
   A. 2.5 V
   B. 3.0 V
   C. 4.5 V
   D. 6.0 V

Use the diagram below to answer Questions **13** *and* **14**



13. What is the **effective** capacitance in the circuit?
   A. $2\,\mu F$
   B. $6\,\mu F$
   C. $118\,\mu F$
   D. $216\,\mu F$

14. What is the **total** energy stored by the capacitors?
   A. 9.0×10^{-2}J
   B. 1.0×10^{-2}J
   C. 2.0×10^{-4}J
   D. 1.0×10^{-4}J

15. Which of the following statements is **not** true?
   A. Components in parallel in a circuit have the same voltage.
   B. Conductors provide resistance to the flow of charges.
   C. Components in series in a circuit have the same charge.
   D. The algebraic sum of the currents at a junction is zero.

16. A charge moving at 2.4×10^3 m/s in a magnetic field of 2000 T experiences a force whose magnitude is 0.2 N. What is the magnitude of the charge?
   A. 41 nC
   B. 24 MC
   C. 0.41 C
   D. 0.24 C

17. What is the atomic number of an element if its mass number is 28 and the number of neutrons is 7?
   A. 196
   B. 35
   C. 21
   D. 4

Turn over

18. The spontaneous, uncontrollable decay of an atomic nucleus with the emission of particles and rays is known as

A. half life.
B. radioactivity.
C. fission.
D. fusion.

19. A car of mass 80 kg moves in a circular track of radius 100 m. If the velocity of the car is 20 m/s, calculate the centripetal force acting on the car.

A. 420 N
B. 320 N
C. 300 N
D. 250 N

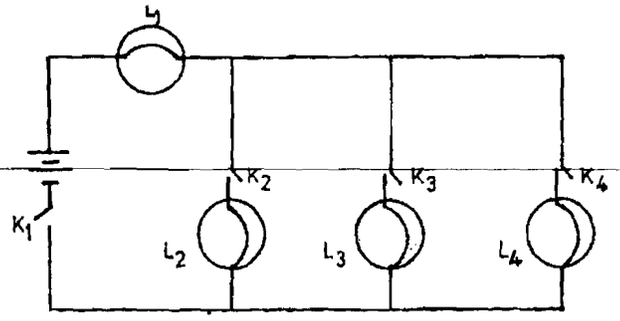
20. The temperature of a brass rod 60 cm increases by 70° C. Calculate the new length of the rod. [Take the coefficient of linear expansion of brass as 19.0×10^{-6}/K]

A. 0.08 cm
B. 0.25 cm
C. 59.92 cm
D. 60.08 cm

21. The apparent weight of a body fully immersed in water is 32 N and its weight in air is 96 N. Determine the volume of the body. [Density of water is 1000 Kg/m^3]

A. 6.4×10^{-3} m^3
B. 6.3×10^{-3} m^3
C. 3.2×10^{-3} m^3
D. 3.1×10^{-3} m^3

22. In the diagram below, K_1, K_2, K_3 *and* K_4 are switches. L_1, L_2, L_3 and L_4 are electric bulbs. If K_1 and K_3 are closed and K_2 and K_4 opened, then



A. only L_1, L_2, and L_3 will be lit.
B. only L_1, and L_3 will be lit.
C. no lamp will be lit.
D. only L_3 will be lit.

23. A bucket being drawn out of a well appears to become heavier as it leaves the water in the well because the

A. upthrust of the air on the bucket decreases.
B. upthrust of the air on the bucket increases.
C. upthrust of the water on the bucket decreases.
D. upthrust of the water on the rope increases.

24. Which of the following are reasons for using mercury in preference to alcohol as a thermometric liquid?

I. Mercury does not wet glass
II. Mercury has a lower expansivity than alcohol
III. Mercury is a better heat conductor than alcohol
IV. Mercury is opaque

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

25. A man pushes a 20 kg body on which a force of friction of 20N acts giving it an acceleration of 1 m/s^2. What is the magnitude of his push?

A. 500 N
B. 200 N
C. 60 N
D. 40 N

26. The ability of an object to return to its original size or shape when external forces are removed is called

A. elasticity.
B. ductility.
C. elastic limit.
D. malleability.

27. What mass of water will give off 4200J of heat as it cools from 90° C to 80° C if the specific heat capacity of water is 4.2 J/kg°C?

A. 10 kg
B. 50 kg
C. 100 kg
D. 420 kg

28. A woman pushes down a baby carriage at an angle of 60° from the horizontal. If she does 4.00×10^2 J of work on the carriage while it moves 20.0 m, how much force does she exert?

A. 4 N
B. 40 N
C. 8 N
D. 80 N

29. Which of the following affects the resistance of a wire?

I. The length of the wire
II. The wire's temperature
III. The material the wire is made of
IV. The color of the wire

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

30. Which of the following statements about friction is **not** correct?

A. Friction always opposes motion.
B. Walking is impossible without friction.
C. Sliding friction is less than static friction.
D. A pendulum would swing more slowly if there were no friction.

31. Which of the following statements about *elastic collision* is **correct**?

A. Momentum is lost due to the sound produced.
B. Both kinetic energy and momentum are conserved.
C. Gained in momentum is equal to gained in kinetic energy.
D. Kinetic energy is lost while momentum is conserved.

32. A feather floats when it is put in water while a rock sinks in water because

A. the feather is denser than the rock.
B. the buoyant force on the feather is greater than that on the rock.
C. the density of the water is greater than the density of the rock.
D. The density of the feather is less than the density of the water.

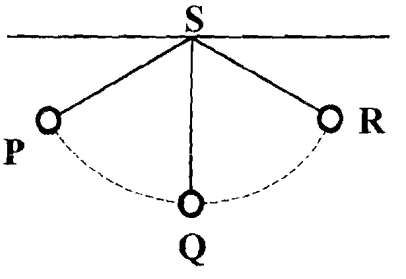
33. Which of the following will **not** change if a body is taken from the earth to the moon?

A. Mass
B. Weight
C. Temperature
D. Gravity

34. A 2 kg mass has a momentum of magnitude 10 kg m/s. How much joule of energy does this mass have?

A. 75 J
B. 50 J
C. 25 J
D. 20 J

35. The diagram below is a swinging pendulum bob. At which point does the bob have its **maximum** speed?



A. **P**
B. **Q**
C. **R**
D. **S**

36. Which of the following is **not** true about a freely falling body?

A. Its initial speed is zero.
B. Its acceleration is 9.8 m/s^2 as it falls
C. Its speed will increase as time progresses.
D. Its initial acceleration is zero.

37. What is the efficiency of a machine if it puts out 100 watts for every 1000 watts put into it?

A. 10%
B. 50%
C. 90%
D. 100%

38. Shadows are formed by an object that is

A. transparent.
B. translucent.
C. opaque.
D. apparent.

Turn over

39. A ray of light passes from air into water at 30°. What is the angle of refraction if the refractive index of air is 1.33?

A. 22.0°
B. 30.7°
C. 39.9°
D. 41.6°

40. A cell of e.m.f. 1.1 V is connected in series with a resistor of 100 ohms. A high resistance voltmeter put across the cell registers only 0.9 V. Calculate the internal resistance of the cell.

A. 220.00 Ω
B. 22.20 Ω
C. 2.20 Ω
D. 0.22 Ω

41. A trolley on a straight track travels **ten** blocks to the end of the track, then back **six** blocks, and then **three** more blocks forward. What is the magnitude of the trolley's displacement?

A. 7 blocks
B. 9 blocks
C. 19 blocks
D. 30 blocks

42. A sound wave of frequency 1200 Hz is reflected from a barrier 75 m away and is received 0.5 s after transmission. Calculate the wavelength of the sound waves.

A. 0.625 m
B. 0.550 m
C. 0.250 m
D. 0.125 m

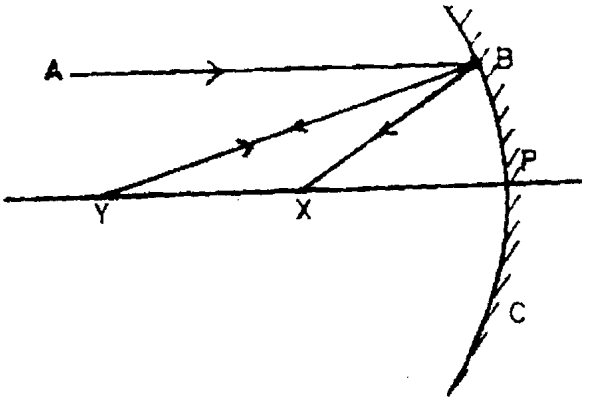
43 A boy kicks a tree stump. If this force is the *action* force, on what does the *reaction* force act?

A. The tree
B. The ground
C. The boy
D. The stump

44. An echo is due to

A. interference of sound waves.
B. superposition of sound waves.
C. refraction of sound waves.
D. reflection of sound waves.

45. In the diagram below, *BC* is a concave mirror of small curvature. *P*, *X* and *Y* are points on the principal axis. Ray *AB* is parallel to and near the principal axis. Ray *BX* represents the reflection of *AB* from the mirror and ray *BY* represents the reflection of *YB*. Which of the following statements is **correct**?



I. $BY = PY$
II. $PX = YX$
III. $PB = PX$

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

46. An object placed 5 cm in front of a converging lens produces a virtual image at a distance of 10 cm from the lens. Calculate the power of the lens.

A. 0.1 cm^{-1}
B. 0.2 cm^{-1}
C. 0.3 cm^{-1}
D. 0.4 cm^{-1}

47. Which of the following instruments are optical instruments?

I. Projector
II. Camera
III. Telescope
IV. Telephone

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

48. Which of the following are characteristics of sound?

I. Pitch
II. Loudness
III. Noise
IV. Quality

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

49. A wave has a wavelength of 8.0 m and a speed of 4 m/s. What is the period of this wave?

A. 0.5 seconds
B. 2 seconds
C. 3.5 seconds
D. 6 seconds

50. An instrument used to test for electric charge is

A. electroscope.
B. ammeter.
C. voltmeter.
D. chargemeter.

END OF OBJECTIVE TEST

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

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

PAPER 2

1½ hours

ESSAY
[40 marks]

Paper 2 *consists of* **two** *sections,* A and B. *Section* A *has* **three** *compulsory questions and Section* B *has* **three** *questions of which you are required to answer* any **two**.

Write your answers in **ink only** *(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 material.

SECTION A
(COMPULSORY)
[18 marks]

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

1. (*a*) Differentiate between *kinetic energy* and *potential energy* with **two** examples of each.

(*b*) State and explain the **three** types of *equilibrium* with an example of each.

2. (*a*) Is it possible for a series of measurements to be *precise* **but** *inaccurate*? Justify your answer with **two** examples.

(*b*) A beam of light traveling from air to glass is refracted at an angle of 50°. Calculate the angle of incidence if the refractive index is 1.5

3. (*a*) Differentiate between a *torque* and a *couple*.

(*b*) A boy claps his hands and hears the echo 3 seconds later. If the speed of sound in air is 330 m/s and the temperature of the air at the time is 60° C, determine the distance of the boy from the sound reflector.

SECTION B
[22 marks]

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

4. (*a*) What is the difference between fusion and fission?

(*b*) A uniform meter bar of mass 80 kg is supported on two knife edges placed 20 cm from its center. With the aid of a suitable diagram, calculate the reactions at these supports when a 120 kg mass is suspended 10 cm from the center of gravity of the bar towards the left end.

5. (*a*) A stone thrown from the top of a vertical wall with a velocity of 15 m/s hits the ground at a point 45m from the base of the wall. Calculate the
(*i*) time the stone spends in the air.
(*ii*) height of the wall.

(*b*) Three capacitors of magnitudes 6 μF , 6 μF and 8 μF are connected in series to a charge of 40 μC. Calculate the
(*i*) equivalent capacitance of the three capacitors.
(*ii*) potential difference.

6. (*a*) A wire of length 70 cm and diameter 1 mm is stretched by 3 mm. If the Young' modulus of the matrial of the wire is 2.0×10^{10} N/m^2, calculate the tension in the string. [Use $\pi = 3.14$]

(*b*) An object with a height of 12 cm is placed 4 cm in front of a concave mirror whose radius of curvature is 16 cm.
(*i*) Draw a ray diagram to show how an image is formed.
(*ii*) Determine the position of the image formed by this mirror.
(*iii*) Determine the height of the image.

END OF PAPER