3106

CANDIDATE – PLEASE NOTE!

PRINT your name on the line below and return this booklet with your answer sheet. Failure to do so may result in disqualification.

TEST CODE **01238010**

FORM TP 2023106

MAY/JUNE 2023

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION

PHYSICS

Paper 01 – General Proficiency

1 hour 15 minutes

07 JUNE 2023 (p.m.)

299

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This test consists of 60 items. You will have 1 hour and 15 minutes to answer them.

2. In addition to this test booklet, you should have an answer sheet.

3. Each item in this test has four suggested answers lettered (A), (B), (C), (D). Read each item you are about to answer and decide which choice is best.

4. On your answer sheet, find the number which corresponds to your item and shade the space having the same letter as the answer you have chosen. Look at the sample item below.

   Sample Item

   The SI unit of length is the

   (A) metre
   (B) second
   (C) newton
   (D) kilogram

   Sample Answer

   ● Ⓑ Ⓒ Ⓓ

   The best answer to this item is "metre", so (A) has been shaded.

A010

5. If you want to change your answer, erase it completely before you fill in your new choice.

6. When you are told to begin, turn the page and work as quickly and as carefully as you can. If you cannot answer an item, go on to the next one. You may return to that item later.

7. Figures are not necessarily drawn to scale.

8. You may do any rough work in this booklet.

9. You may use a silent, non-programmable calculator to answer items.

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

1. 3.1415926 expressed as TWO significant figures is

(A) 3.1
(B) 3.14
(C) 3.2
(D) 31

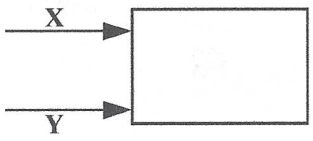
2. An example of a vector quantity is

(A) resistance (electrical)
(B) heat capacity
(C) displacement
(D) density

3. Which of the following instruments is suitable for measuring the diameter of a human hair?

(A) Metre rule
(B) Tape measure
(C) Vernier caliper
(D) Micrometer screw gauge

Item 4 refers to the following diagram which shows two forces, X and Y, applied onto an object.



4. What should be the magnitude and direction of a third force which will cause the object to remain stationary?

(A) $X - Y$ to the left
(B) $X + Y$ to the left
(C) $X - Y$ to the right
(D) $X + Y$ to the right

5. Which of the following is a derived unit?

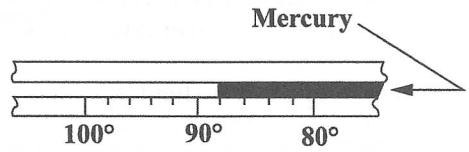
(A) K
(B) s
(C) m^3
(D) kg

6. A block is allowed to fall freely towards the ground. As it falls, its gravitational potential energy

(A) increases
(B) remains constant
(C) is converted to internal energy
(D) is converted to kinetic energy

Item 7 refers to the following diagram which shows a section of a thermometer.

7. What is the reading shown on the thermometer?



(A) 88°
(B) 89°
(C) 91°
(D) 92°

8. Which of the following is the unit of momentum?

(A) kg m s^{-2}
(B) kg m s^{-1}
(C) m s^{-1}
(D) N s

9. The kinetic energy of a body of mass, m, and velocity, v, is given by

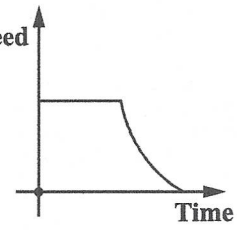
(A) mv

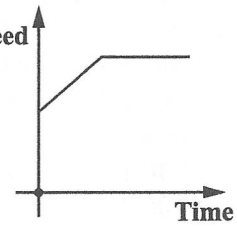
(B) mv^2

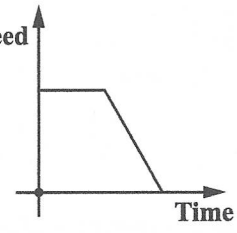
(C) $\frac{m}{v}$

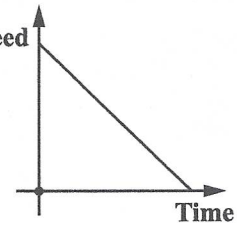
(D) $\frac{mv^2}{2}$

10. A body initially moving at a constant speed is brought to rest at a uniform rate. Which of the following speed/time graphs indicates the motion of the body?

(A)


(B)


(C)


(D)


11. A 4 kg mass is travelling with a constant speed of 5 m s^{-1}. It is brought to rest in 2 seconds. The average force acting on the mass to bring it to rest is

(A) 1.6 N
(B) 2.5 N
(C) 10.0 N
(D) 40.0 N

12. An ice cube sinks in Liquid A but floats in Liquid B. Which of the following statements is true of Liquid A and Liquid B?

(A) The upthrust is less in Liquid A than in Liquid B.
(B) The upthrust is greater in Liquid A than in Liquid B.
(C) The weight of the ice cube is less in Liquid A than in Liquid B.
(D) The weight of the ice cube is greater in Liquid A than in Liquid B.

13. A bus with luggage loaded on top is more likely to tip over when rounding a corner than the same bus without the luggage. The reason for this is that the luggage

(A) increases the weight of the bus
(B) raises the centre of gravity of the bus
(C) lowers the centre of gravity of the bus
(D) increases the momentum of the bus

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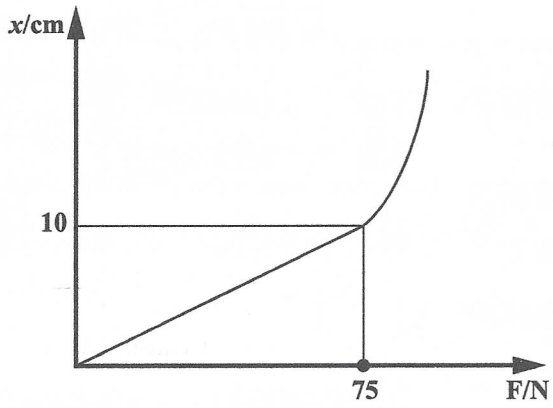
Item 14 refers to the following graph of a light spring which shows a simple extension, x, versus force, F.



14. Which of the following statements are true about the spring above?

I. The elastic limit of the spring was exceeded.
II. The spring obeyed Hooke's law over its entire extension.
III. The force per unit extension in the elastic region was 7.5 N cm^{-1}.

(A) I and II only
(B) I and III only
(C) II and III only
(D) I, II and III

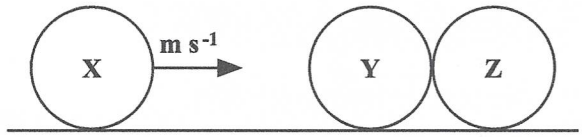
15. Power is a measure of the

(A) work done
(B) total change of energy
(C) rate of change of energy
(D) rate of change of momentum

16. Two forces of 8 N and 10 N CANNOT give a resultant of

(A) 1 N
(B) 2 N
(C) 9 N
(D) 18 N

Item 17 refers to the following diagram.



17. X, Y and Z are three billiard balls of equal mass whose centres lie in a straight line. Y and Z are touching one another. X, travelling with a velocity of 20 m s^{-1}, impinges on Y. Assuming that the spheres are perfectly elastic, the resultant motion after impact will be that

(A) X, Y and Z remain stationary
(B) X and Y remain stationary while Z moves on with a velocity of 20 m s^{-1}
(C) X, Y and Z all move on together, each with a velocity of 10 m s^{-1}
(D) X remains stationary while Y and Z move on together each with a velocity of 10 m s^{-1}

18. What is the gain in the gravitational potential energy of a body of weight 200 N, as it rises from a height of 30 m to a height of 35 m above the earth's surface?

(A) 40 J
(B) 100 J
(C) 1000 J
(D) 2000 J

19. Which of the following quantities remains unchanged with an increase in temperature?

(A) Mass
(B) Density
(C) Volume
(D) Relative density

20. The specific heat capacity of a substance is defined as the amount of thermal energy required to

(A) raise the temperature of the substance by 1 K
(B) convert unit mass of the substance from liquid to vapour
(C) convert unit mass of the substance from solid to liquid
(D) raise the temperature of unit mass of the substance by 1K

21. The specific latent heat of vaporization of water is 2.26×10^6 J kg^{-1}. When 0.01 kg of water is converted into steam, it

(A) absorbs 2.26×10^4 J
(B) gives out 2.26×10^4 J
(C) absorbs 2.26×10^8 J
(D) gives out 2.26×10^8 J

22. A gas occupies 2 m^3 at 27 °C at a pressure of 1 atmosphere. At a pressure of 2 atmospheres it occupies a volume of 1 m^3. What is its temperature at this new volume and pressure?

(A) 54.0 °C
(B) 27.0 °C
(C) 6.75 °C
(D) −198 °C

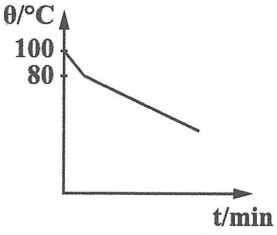
23. Which of the following methods is the MOST suitable means of heating a brass bob in order to determine its specific heat capacity by the method of mixtures?

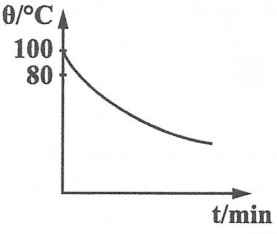
(A) Subjecting it to an open flame for ten minutes
(B) Subjecting it to an infrared beam for ten minutes
(C) Placing it in a boiling water-bath for ten minutes
(D) Placing it in contact with an electrical heater for ten minutes

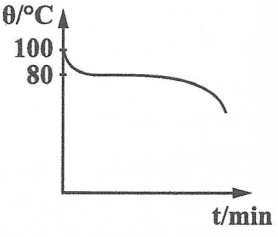
24. According to the kinetic theory, when a gas in a closed container is heated the pressure rises because

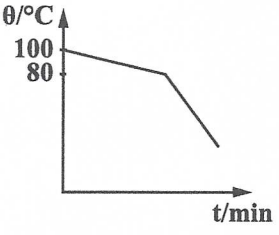
(A) there are more molecules hitting the walls of the container
(B) the molecules move faster and hit each other harder and more often
(C) the molecules expand and push harder on the walls of the container
(D) the molecules move faster and hit the walls of the container harder and more often

25. Molten naphthalene at 100 °C is allowed to cool down to room temperature. If naphthalene has a melting point of 80 °C, which of the following graphs BEST represents the cooling curve?

(A)


(B)


(C)


(D)


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26. In which of the following is conduction the MAIN method of energy transfer?

(A) Food heated in a microwave oven
(B) Energy transferred from the sun to earth
(C) Food being cooked on a barbecue
(D) Food being cooked in a pot on an electric stove

27. Which of the following are reasons why a hot liquid, placed in a double-walled vacuum flask, retains its heat for a long time?

I. Silver inner walls reduce the loss of heat by radiation.
II. The silvered outer wall helps to absorb heat from the surroundings.
III. Evacuated space between the double walls reduces the loss of heat by conduction.

(A) I and II only
(B) I and III only
(C) II and III only
(D) I, II and III

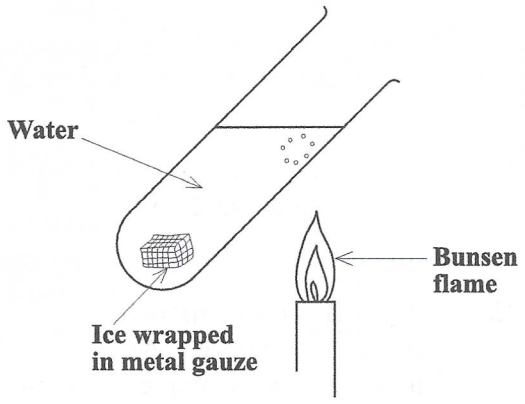
28. A person coming out of the sea would feel cool because

(A) the sea is cold
(B) heat is lost by radiation
(C) seawater evaporates from the skin
(D) convection of thermal energy occurs into the air

29. The kinetic theory of matter suggests that the molecules of a gas are

(A) closely packed and vibrating
(B) closely packed and moving over each other
(C) far apart and vibrating about a fixed point
(D) far apart and moving at random

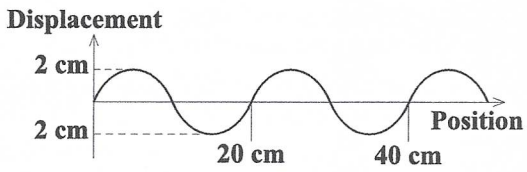
Item **30** refers to the following diagram which shows water boiling at the top of a glass test tube while a piece of ice remains unmelted at the bottom.



30. Which of the following statements provides the reason for this occurrence?

(A) Water is a poor conductor of heat.
(B) Water is a good conductor of heat.
(C) Gauze is a poor conductor of heat.
(D) Glass is a good conductor of heat.

Item 31 refers to the following diagram which shows the instantaneous profile of a wave travelling across a water surface.



31. From the information above, the frequency is

(A) $\frac{1}{20}$ Hz

(B) 10 Hz
(C) 20 Hz
(D) unknown

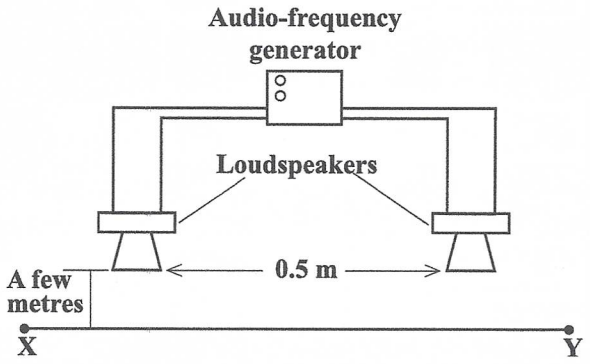
32. The sharp edges of shadows suggest that light

(A) travels in straight lines
(B) travels very quickly
(C) is a form of energy
(D) has a wave nature

33. An echo is quieter than the original sound that produced it. This shows that, compared to the original sound, the echo has a

(A) shorter wavelength
(B) smaller amplitude
(C) lower frequency
(D) slower speed

Item 34 refers to the following diagram which shows two similar loudspeakers connected to the same audio-frequency generator. The speakers are set up a few metres away from a path, XY.



34. At some points along XY no sound is heard because

(A) the sound waves are diffracted
(B) interference of the sound waves takes place
(C) the sound waves are refracted away from those points
(D) the sound waves are reflected back to the same source

35. A ray of light leaving air enters glass of refractive index 1.6. The angle of refraction is 27°. What is the sine of the angle of incidence?

(A) $1.6 + \sin 27°$

(B) $\frac{1.6}{\sin 27°}$

(C) $\frac{\sin 27°}{1.6}$

(D) $1.6 \sin 27°$

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36. Which of the following waves travel only longitudinally?

I. Sound waves
II. Radio waves
III. Water waves

(A) I only
(B) II only
(C) II and III only
(D) I, II and III

37. Which of the following can produce a diminished virtual image of a real object?

(A) A converging lens
(B) A diverging lens
(C) A plane mirror
(D) A glass block

38. Total internal reflection in glass occurs when

(A) all the light is transmitted
(B) the angle of incidence is 90
(C) the critical angle is exceeded
(D) the incident ray is perpendicular to the glass boundary

39. A ray of light in air strikes a glass block at an angle of incidence of 0°. On entering the glass block, the light will be

(A) undeviated
(B) totally reflected
(C) refracted at 90° to the normal
(D) refracted at an unknown angle

40. The position of an image formed by a plane mirror depends on the

(A) distance of the observer from the mirror
(B) distance of the object from the mirror
(C) angle at which the image is viewed
(D) angle at which the object is viewed

41. Which of the following expressions would represent the formula(e) for linear magnification?

I. $\frac{\text{Height of image}}{\text{Height of object}}$

II. $\frac{\text{Height of object}}{\text{Height of image}}$

III. $\frac{\text{Object distance}}{\text{Image distance}}$

(A) I only
(B) II only
(C) I and III only
(D) II and III only

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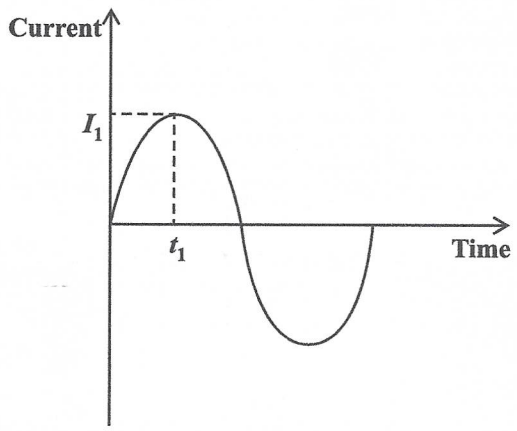
Item 42 refers to the following graph showing the variations of alternating current with time.



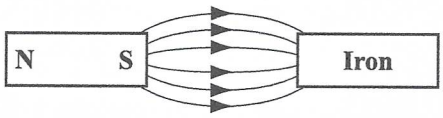
42. The value of the current, I_1, at time, t_1, is called the

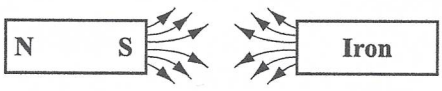
(A) root mean square value
(B) sinusoidal value
(C) average value
(D) peak value

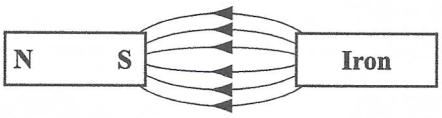
43. When a polythene rod is rubbed with a cloth, it becomes

(A) positively charged by gaining protons
(B) negatively charged by gaining electrons
(C) positively charged by gaining electrons
(D) negatively charged by losing protons

44. Which of the following diagrams shows the magnetic field formed between a bar magnet and a piece of iron?

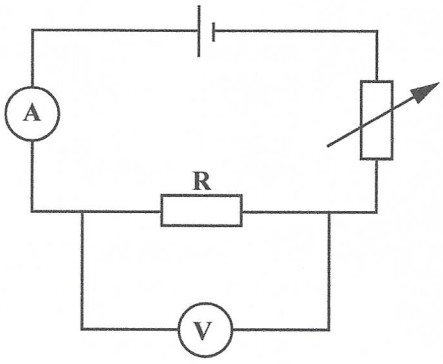
(A)


(B)


(C)


(D)


Item 45 refers to the following circuit where the ammeter reads 0.4 A and the voltmeter reads 0.6 V.



45. What is the resistance of R?

(A) 15 Ω
(B) 1.5 Ω
(C) 0.67 Ω
(D) 0.24 Ω

46. A conductor, rotating in a uniform magnetic field, induces maximum instantaneous current when the conductor cuts the magnetic field lines at

(A) 30°
(B) 45°
(C) 90°
(D) 180°

47. Which of the following relationships is correct for the combined resistance, R_T, of resistors R_1, R_2, and R_3 connected in parallel?

(A) $R_T = R_1 + R_2 + R_3$

(B) $\frac{1}{R_T} = R_1 + R_2 + R_3$

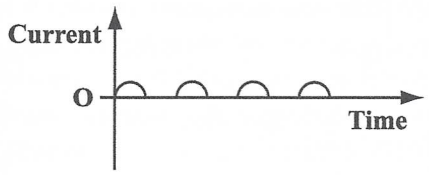
(C) $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

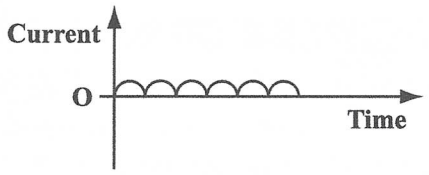
(D) $R_T = \frac{R_1 R_2 R_3}{R_1 + R_2 + R_3}$

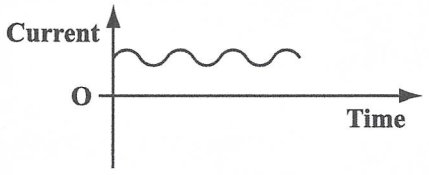
48. A voltmeter has a very high resistance so that it can be placed in

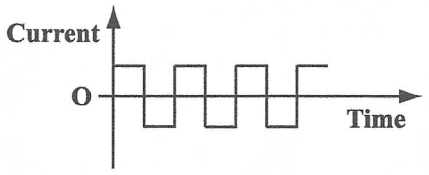
(A) parallel with a component and not affect the circuit
(B) series with a component and not affect the circuit
(C) parallel with a component and the voltmeter does not heat up
(D) series with a component and the voltmeter does not heat up

49. Which of the following graphs illustrates an **alternating** current?

(A)


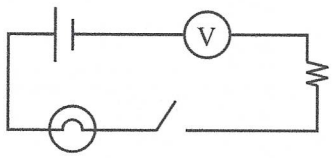
(B)


(C)


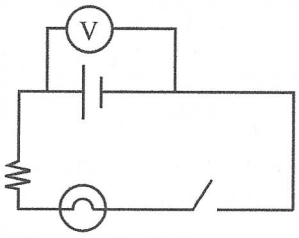
(D)


50. Which of the following circuit arrangements is BEST suited for measuring a lamp's voltage?

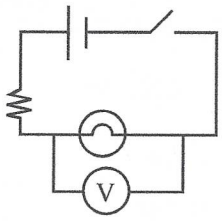
(A)



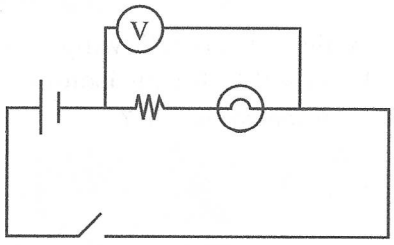
(B)



(C)

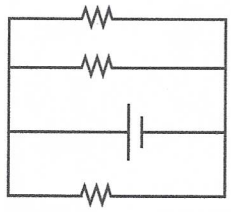


(D)



51. Which of the following circuit diagrams BEST represents a series arrangement?

(A)



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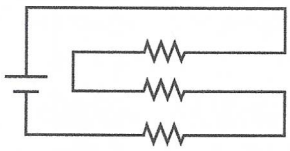
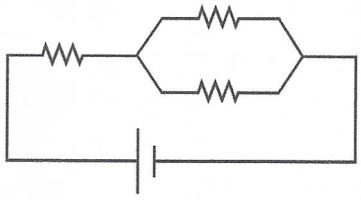
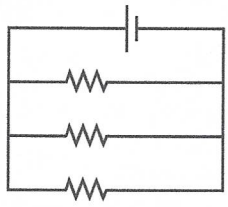


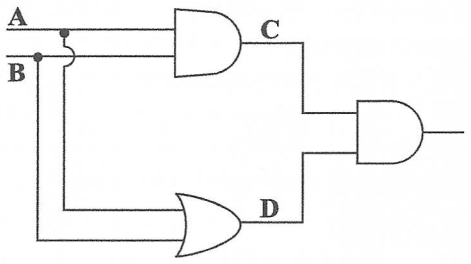
(C)



(D)



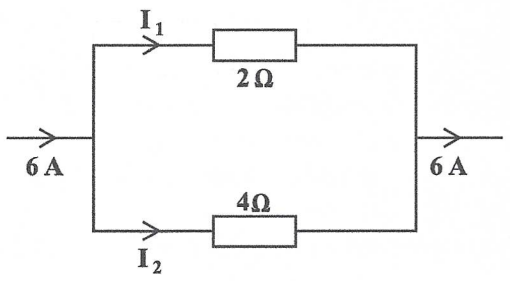
Item 52 refers to the following diagram.



52. What is the output at **C** and **D** when an input of 0 0 is made at **A** and **B**?

	C	D
(A)	0	0
(B)	1	1
(C)	0	1
(D)	1	0

Item 53 refers to the following circuit diagram.



53. Using the information given in the circuit diagram, which pair of values of I_1 and I_2 is correct?

	I_1	I_2
(A)	1	5
(B)	2	4
(C)	3	3
(D)	4	2

54. Which of the following materials is MOST suitable for the core of an electromagnet?

(A) Steel
(B) Copper
(C) Carbon
(D) Soft iron

55. According to the Rutherford–Bohr model of a neutral, stable atom, if

n = number of neutrons,
p = number of protons, and
e = number of electrons in the atom,

then for all elements

(A) $n = e$
(B) $p = e$
(C) $n + e = p$
(D) $n + p = e$

56. Which of the following symbols would be possible for an isotope of a nuclide represented by ${}^{A}_{Z}X$?

(A) ${}^{A-2}_{Z+2}X$

(B) ${}^{A}_{Z-1}X$

(C) ${}^{A-2}_{Z-2}X$

(D) ${}^{A+2}_{Z}X$

57. Which of the following CANNOT be deflected by a magnetic field?

(A) Alpha particles
(B) Beta particles
(C) Gamma rays
(D) Electrons

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58. Which of the following pairs of statements is true for BOTH iron and steel?

	Iron	Steel
(A)	Easily magnetized	Does not retain its magnetism
(B)	Easily magnetized	Retains its magnetism well
(C)	Not easily magnetized	Retains its magnetism well
(D)	Not easily magnetized	Does not retain its magnetism

59. Which of the following scientists discovered radium?

(A) Marie Curie
(B) Isaac Newton
(C) J.J. Thompson
(D) Albert Einstein

60. Which of the following equations is correct?

(A) $^{226}_{88}Ra \rightarrow {}^{222}_{86}Rn + \beta\text{-particle}$

(B) $^{14}_{6}C \rightarrow {}^{15}_{7}N + \beta\text{-particle}$

(C) $^{226}_{88}Ra \rightarrow {}^{222}_{86}Rn + \alpha\text{-particle}$

(D) $^{14}_{6}C \rightarrow {}^{15}_{7}N + \alpha\text{-particle}$

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.