AGA KHAN UNIVERSITY EXAMINATION BOARD

HIGHER SECONDARY SCHOOL CERTIFICATE

CLASS XII

ANNUAL EXAMINATIONS (THEORY) 2023

Physics Paper I

Time: 1 hour 30 minutes Marks: 50

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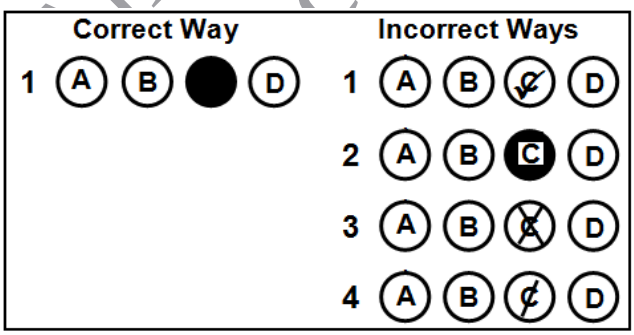
INSTRUCTIONS

1. Read each question carefully.
2. Answer the questions on the separate answer sheet provided. DO NOT write your answers on the question paper.
3. There are 100 answer numbers on the answer sheet. Use answer numbers 1 to 50 only.
4. In each question, there are four choices A, B, C, D. Choose ONE. On the answer grid, black out the circle for your choice with a pencil as shown below.



Candidate's Signature

5. If you want to change your answer, ERASE the first answer completely with a rubber, before blacking out a new circle.
6. DO NOT write anything in the answer grid. The computer only records what is in the circles.
7. You may use a scientific calculator if you wish.

1. A closed surface contains two equal and opposite charges. The net electric flux from the surface will be

   A. zero.
   B. positive.
   C. negative.
   D. undetermined.

2. A parallel plate capacitor is completely charged and battery is detached from it. Then a dielectric slab is inserted between its parallel plates.

   Which of the following options is CORRECT with respect to potential difference and energy?

	Potential Difference	**Energy**
A	Remain constant	Increase
B	Remain constant	Decrease
C	Decrease	Remain constant
D	Increase	Remain constant

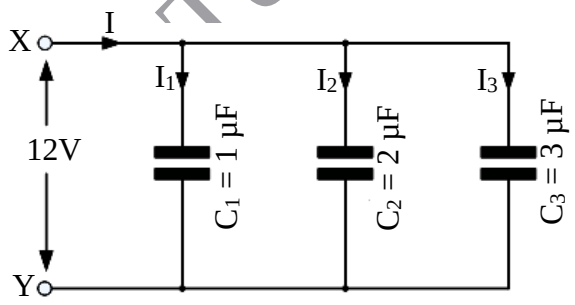
3. If two capacitors of 10 µF each are connected in series combination, then their equivalent capacitance will be

   A. 0 µF.
   B. 1 µF.
   C. 5 µF.
   D. 20 µF.

4. Due to the electric polarisation of dielectric, the capacitance of a parallel plate capacitor

   A. increases.
   B. decreases.
   C. becomes zero.
   D. remains the same.

5. In the given diagram, three capacitors are connected in an electric circuit, their equivalent capacitance will be



   A. 0.83 µF.
   B. 1.83 µF.
   C. 3 µF.
   D. 6 µF.

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6. If a test charge is moved from a lower potential area to a higher potential area, then the electric potential energy

   A. increases.
   B. decreases.
   C. becomes zero.
   D. remains the same.

7. If a light bulb operates at 220 V and resistance of the bulb is 484 Ω, then the value of power dissipated will be

   A. 0.4 W.
   B. 2.2 W.
   C. 100.0 W.
   D. 1064.8 W.

8. If an electrical instrument is dissipating 100 W of energy when a current of 10 A is passing through it, then the resistance of the instrument will be

   A. 1 Ω.
   B. 10 Ω.
   C. 100 Ω.
   D. 1000 Ω.

9. The resistance of a wire is directly proportional to the

   A. length of the wire.
   B. conductivity of the wire.
   C. colour and texture of the wire.
   D. area of cross section of the wire.

10. A filament lamp behaves like an Ohmic conductor when its temperature

    A. increases.
    B. decreases.
    C. becomes $0^{o}C$.
    D. remains constant.

11. If a 5 W LED light bulb operates at 220 V power supply for 1 minute, then the electric current passing through the bulb will be

    A. 18.333 A.
    B. 0.44 A.
    C. 0.022 A.
    D. 0.000484 A.

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12. A uniform magnetic field (B) exists in the + *x*-axis direction. A proton shoots through the field in the + *y*-axis direction with velocity (v).

    Based on the given statement, the direction of force on the proton is in the

    A. – *y*-axis direction.
    B. – *z*-axis direction.
    C. + *y*-axis direction.
    D. + *z*-axis direction.

13. The magnetic force experienced by a charged particle moving in a magnetic field will be minimum when it moves

    A. at an angle of 30^{o}.
    B. at an angle of 45^{o}.
    C. parallel to the field.
    D. perpendicular to the field.

14. If a 1 m metallic wire is placed perpendicularly in a uniform magnetic field of 0.10 T and carrying current of 10 A, then the force acting on the wire will be

    A. 0.01 N.
    B. 1 N.
    C. 10 N.
    D. 100 N.

15. The sensitivity of a galvanometre increases in relation to all of the following EXCEPT for the

    A. area of the coil.
    B. amount of current.
    C. strength of magnetic field.
    D. number of turns in the coil.

16. If a charged particle moving at a constant speed enters a uniform magnetic field whose direction is perpendicular to the velocity of this particle, then the particle will

    A. increase its speed.
    B. experience no force.
    C. follow a circular path.
    D. follow a parabolic path.

17. If constant current passes through the primary coil of a transformer, then the induced electromotive force (e.m.f.) across the secondary coil of the transformer will

    A. be zero.
    B. increase.
    C. decrease.
    D. be undetermined.

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18. The self-inductance of a straight wire carrying current is equal to

A. 0.
B. 1.
C. less than 0.
D. more than 1.

19. The direction of the induced current always opposes the change which causes the induced current.

Which of the following laws states the given statement?

A. Lenz's law
B. Faraday's law
C. Ampere's law
D. Biot-Savart's law

20. The electromotive force (e.m.f) produced by a generator operating at constant speed depends on the

A. strength of the magnetic field.
B. thickness of the wire on the armature.
C. thickness of the wire on the field magnet.
D. duration of time when the generator operates.

21. In a three phase alternating current (AC) generator, the voltage generated across the third pair of coils with reference to slip rings has a phase of

A. 0°
B. 90°
C. 120°
D. 240°

22. Which of the following electrical devices is NOT used for controlling current and voltage in an alternating current (AC) circuit?

A. Resistor
B. Inductor
C. Capacitor
D. Transistor

23. At a high frequency, the alternating current through a capacitor in an alternating current circuit will be

A. zero.
B. large.
C. small.
D. undetermined.

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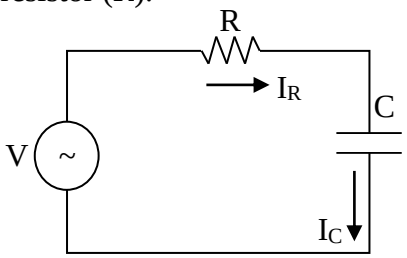
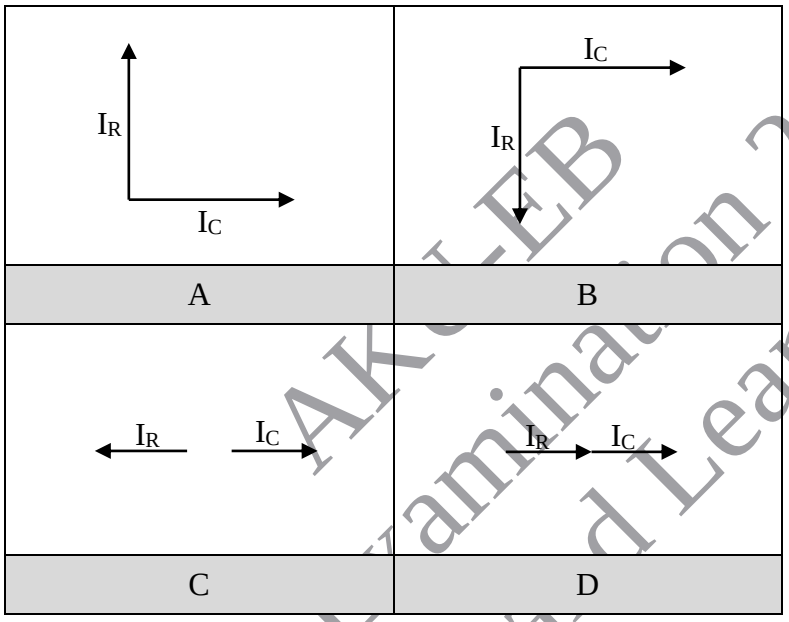
24. The given circuit diagram consists of a source of alternating voltage (V), a capacitor (C) and a resistor (R).



Which of the following vector diagrams CORRECTLY describes the phase relationship between (I_C) and (I_R)?



25. Conductivity of a semiconductor material increases by

I. increasing temperature.
II. increasing the surface area.
III. decreasing the density of charge carriers.
IV. doping with small amounts of impurities.

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

26. Which of the following materials has the maximum energy gap?

A. Insulator
B. Conductor
C. Semiconductor
D. Super conductor

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27. A solid containing irregular arrangement of molecules produces irregular fragments upon breaking. This solid is called

I. amorphous
II. crystalline
III. polymeric

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

28. The ratio between applied stress to the volumetric strain is called

A. bulk modulus.
B. shear modulus.
C. Young's modulus.
D. modulus of plasticity.

29. Which types of impurity is added to a semiconductor material so that it can provide holes?

A. Trivalent
B. Tetravalent
C. Pentavalent
D. Monovalent

30. In a *p*-*n* junction diode, the depletion region carries

A. zero charge.
B. infinite charge.
C. positive charge.
D. negative charge.

31. A *n*-type semiconductor is formed in an extrinsic semiconductor when

A. only a trivalent impurity is added to it.
B. only a pentavalent impurity is added to it.
C. both trivalent and pentavalent impurities are added to it.
D. both trivalent and pentavalent impurities are removed from it.

32. If a NOT gate is connected to an electrical circuit, then the electrical signals are

A. resisted.
B. inverted.
C. enhanced.
D. re-complemented.

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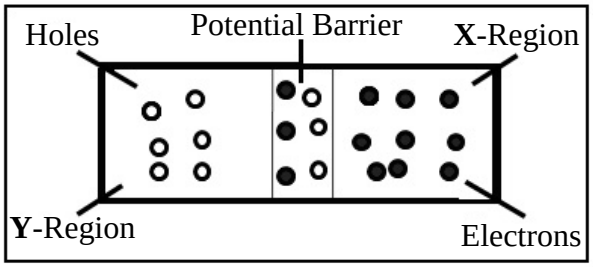
33. The colour of light emitted by a light emitting diode (LED) depends upon the

A. amount of current.
B. velocity of the light.
C. amplitude of the light.
D. material of semiconductor.

34. For every electron that diffuses across a junction and combines with a hole, a positive charge is left in the **X** region and a negative charge is created in the **Y** region forming a potential barrier.



Considering the given image, the **X** and **Y** regions are

	X-Region	**Y-Region**
A	*n*	*p*
B	*p*	*n*
C	*p*	*p*
D	*n*	*n*

35. When an incident light is targeted to a metallic surface, photoelectrons are ejected as a result.

The number of photoelectrons ejected are

A. inversely proportional to the frequency of the incident light.
B. directly proportional to the frequency of the incident light.
C. inversely proportional to the intensity of the incident light.
D. directly proportional to the intensity of the incident light.

36. All of the following are the characteristics of an ideal black body EXCEPT that

A. it is the most efficient radiator.
B. it is a perfect absorber of radiation.
C. its absorption power is equal to one.
D. it reflects incident radiation of all wavelengths.

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37. In the Davison and Germer experiment of wave nature of electrons, the velocity of electrons emitted from the electron gun can be increased between anode and heated filament by

A. increasing the applied voltage.
B. decreasing the applied voltage.
C. increasing the amount of electric current.
D. decreasing the amount of electric current.

38. When X-rays are scattered by loosely bound electrons from a graphite target, it is known as

A. pair production.
B. pair annihilation.
C. Compton's effect.
D. uncertainty principle.

39. Light of a single frequency falls on a photoelectric material, but no electrons are emitted.

On the contrary, if the electrons are to be emitted, then which of the following options will cause it?

	Intensity	**Frequency**
A	Remains same	Decreases
B	Remains same	Increases
C	Increases	Remains same
D	Decreases	Remains same

40. If the transition in hydrogen atom is from excited state ($n_i = 6$) to lower state ($n_f = 3$) and Rydberg's constant is $1.0974 \times 10^7\ m^{-1}$, then the wavelength of spectral line is

A. 1.093×10^{-6} m.
B. 2.524×10^{-6} m.
C. 3.645×10^{-7} m.
D. 4.140×10^{-7} m.

41. In a hydrogen atom, spectral lines are emitted when electrons radiate energy. This happens because of the

I. change in its orbital motion.
II. weak nuclear attractive force.
III. jumping from higher to a lower energy level.

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

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42. The characteristics of X-rays are similar in nature to

A. alpha particles.
B. beta particles.
C. cathode rays.
D. gamma rays.

43. All of the following are properties of X-rays EXCEPT that they

A. are diffracted by a crystal lattice.
B. pass through wood and flesh easily.
C. are deflected by electric and magnetic fields.
D. travel in a straight line with the velocity of light.

44. When an electron in a hydrogen atom drops from the higher orbit to the (n = 2) orbit, the spectral lines emitted through this transition is called

A. Lyman series.
B. Balmer series.
C. Bracket series.
D. Paschen series.

45. If a beta particle is emitted from $_{88}Ra^{226}$, then the mass and atomic number will be

	Mass Number	**Atomic Number**
A	224	89
B	227	87
C	222	86
D	226	89

46. The Wilson cloud chamber is based on the principle that supersaturated vapours condense more easily on

I. ions
II. molecules
III. nuclear dust particles

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

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47. If the penetration power of gamma rays is compared to the penetration power of alpha and beta particles, then which of the following options is CORRECT?

	Penetration Power of Alpha Particle	**Penetration Power of Beta Particle**
A	Less	Less
B	More	More
C	Less	More
D	More	Less

48. In the given nuclear equation, **X** represents a/ an

$${}_1H^2 + {}_1H^2 \longrightarrow {}_2He^3 + \mathbf{X}$$

A. alpha particle.
B. beta particle.
C. neutron.
D. proton.

49. The MOST appropriate isotope for the treatment of thyroid gland is

A. Cobalt-60.
B. Iodine-131.
C. Carbon-14.
D. Strontium-90.

50. Which of the following basic forces of nature is responsible for the stability of a nucleus?

A. Magnetic force
B. Gravitational force
C. Weak nuclear force
D. Strong nuclear force

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END OF PAPER

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