SECOND ROUND PHYSICS MODEL EXAM FOR GRADE 12 STUDENTS, 2017/2025

TIME ALLOWED: $2\frac{1}{2}$ HRS

GENERAL DIRECTIONS

THIS BOOKLET CONTAINS **PHYSICS SECOND ROUND MODEL EXAM** FOR **GRADE 12**
IN THIS BOOKLET, THERE ARE TOTAL OF **60** MULTIPLE CHOICE QUESTIONS.

THERE IS ONLY ONE BEST ANSWER FOR EACH QUESTION. CHOOSE THE BEST ANSWER FROM THE GIVEN ALTERNATIVES AND WRITE THE LETTER OF YOUR CHOICE ON THE ANSWER SHEET PROVIDED.

YOU ARE ALLOWED TO WORK ON THE EXAM QUESTIONS FOR **150 MINUTES ONLY.** WHEN TIME IS CALLED, YOU MUST IMMEDIATELY STOP WORKING ON THE QUESTIONS AND PUT DOWN YOUR PEN/PENCIL AND WAIT FOR WHAT YOU MIGHT BE TOLD TO DO.
ANY FORM OF CHEATING OR AN ATTEMPT TO CHEAT IN THE EXAM WILL RESULT IN AN AUTOMATIC DISMISSAL FROM THE EXAM HALL AND CANCELLATION OF YOUR SCORE.

PLEASE MAKE SURE THAT YOU HAVE WRITTEN ALL THE REQUIRED INFORMATION ON THE ANSWER SHEET BEFORE YOU START TO WORK ON THE EXAM

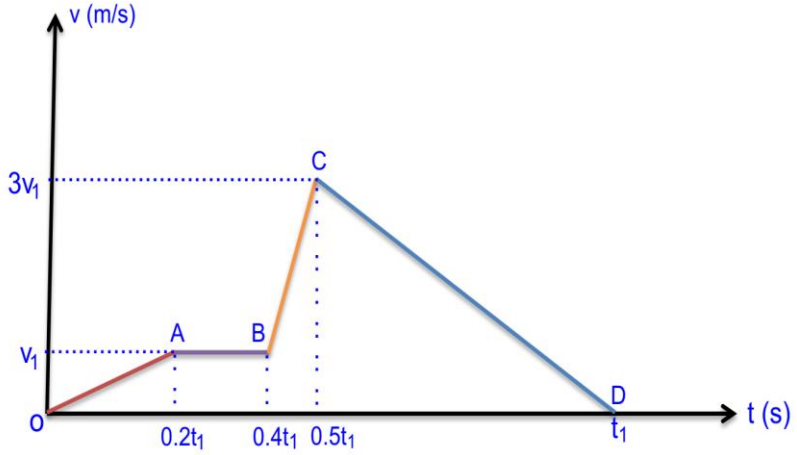
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USE THE INFORMATION IN THE TABLE BELOW WHENEVER NECESSARY.

Constant	Symbol	Value
Acceleration due to gravity	g	10 m/s^2
Coulomb's constant	k	9×10^9 Nm^2/C^2
Gravitational constant	G	6.7×10^{-11} Nm^2/kg^2
Density of water	ρ	1000 kg/m^3
Magnetic Permeability of free space	μ_0	$4\pi \times 10^{-7}\ T.m/A$
$Sin37^0 = cos53^0 = 0.6$		
$Sin53^0 = Cos37^0 = 0.8$		
$Sin60^0 = cos30^0 = \frac{\sqrt{3}}{2} = 0.87$		
$Sin30^0 = cos60^0 = \frac{1}{2} = 0.5$		
$Sin\ 0^0 = cos90^0 = 0$		
$Sin90^0 = cos0^0 = 1$		

1. Given the vectors $\vec{A}$ = (6,-4) and $\vec{B}$ = (-3, 8), in xy-plane both taken from the origin as the reference point. What is the direction of the resultant vector R relative to the positive x-axis?
   A. 45° B. 53° C. 135° D. 315°
2. Which method involves placing two vectors tail-to-tail and drawing a diagonal to find the resultant?
   A. Parallelogram law C. Polygon law
   B. Triangle law D. Scalar addition
3. When comparing the geometric and analytic methods of finding the resultant of two vectors, which of the following is **TRUE**?
   A. Both methods always give different magnitudes but the same direction.
   B. The geometric method gives exact values, while the analytic method gives only estimations.
   C. Both methods yield the same resultant vector in magnitude and direction when applied correctly.
   D. The analytical method is only valid when vectors are perpendicular.
4. A vector A = $2\hat{\imath} + 3\hat{\jmath} + 4\hat{k}$ and a vector B = $4\hat{\imath} + 6\hat{\jmath} + 8\hat{k}$ are given. Which of the following statements is **TRUE** about the vectors?
   A. A and B are perpendicular C. The magnitude of A is equal to the magnitude of B
   B. A and B are parallel D. The dot product of A and B is zero
5. A motorcycle moves with an initial velocity of 15 m/s and accelerates uniformly at a rate of 3 m/s². Which of the following is the best description of the velocity after 6 seconds?
   A. 33 m/s B. 42 m/s C. 18 m/s D. 45 m/s
6. A particle moves along a straight path with a velocity described by the equation $v(t) = 4t + 3$ m/s, where t is the time in seconds. What is the instantaneous acceleration at $t = 5$ seconds?
   A. 23 $\frac{m}{s^2}$ C. 15 $\frac{m}{s^2}$
   B. 20 $\frac{m}{s^2}$ D. 4 $\frac{m}{s^2}$

7. An object starts from rest and travels 100 meters in 5 seconds while accelerating uniformly. If the initial velocity were 10 m/s instead of 0 m/s, how would the final velocity change, and why?
   A. It would increases by 10 m/s because the object starts with nonzero velocity.
   B. It would decreases by 10 m/s because the object covers the same distance in the same time.
   C. It would remain the same because acceleration is constant.
   D. It would double because both the initial velocity and acceleration contribute equally.
8. A train moves from one station to another in t_1 hours' time. Its velocity-time graph during this motion is shown in the figure below. Which curve represents maximum acceleration during the journey?



   A. Curve OA B. Curve AB C. Curve BC D. Curve CD
9. Suppose you are designing a projectile motion system that takes into account both vertical and horizontal displacements. If you wish to minimize the time of flight for the projectile while maintaining a constant range, what variable would you change?
   A. Decrease the launch angle and adjust the initial velocity to maintain the range.
   B. Increase the launch angle to achieve greater vertical displacement.
   C. Change the horizontal velocity to shorten time of flight.
   D. Increase the initial velocity to reduce the time of flight.
10. Two seconds after projection, a projectile is moving at 30^0 above the horizontal; after one more second it is moving horizontally. The initial speed of the projectile is
   A. $10\sqrt{3}$ m/s C. 10 m/s
   B. 20 m/s D. $20\sqrt{3}$ m/s
11. A flywheel rotates with a uniform angular acceleration. Its angular velocity increases from 20π rad/s to 40π rad/s in 10 seconds. How many rotations did it undergo in this period?
   A. 5 C. 150
   B. 100 D. 2
12. The equation $\theta = \omega_0 t + \frac{1}{2}\alpha t^2$ represents the angular displacement (θ) of an object with initial angular velocity (ω_0), undergoing uniform angular acceleration(α) in time (t). Which of the following conditions must be met for this equation to be valid?
   A. The object must have a constant angular velocity throughout the motion.
   B. The angular acceleration must remain constant during the motion.
   C. The initial angular velocity must be zero at the start of the motion.
   D. The motion must be linear rather than rotational.

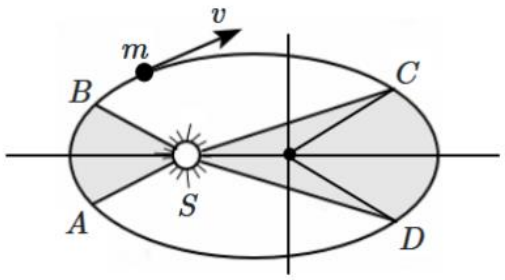
13. A wheel having moment of inertia 2 kg m^2 about its vertical axis rotates at the rate of 60 rpm about the axis. The magnitude of torque which can stop the wheel's rotation in one minute would be:–

A. $\frac{\pi}{12}$ N m
C. $\frac{\pi}{4}$ N m
B. $\frac{\pi}{60}$ N m
D. $\frac{\pi}{15}$ N m

14. Two spherical objects, each with mass 5.0×10^5 kg, are placed at a separation of 100 m from each other. What is the gravitational force between them?

A. 6.7×10^{-7} N B. 3.0×10^{-4} N C. 1.7×10^{-3} N D. 2.0×10^{-1} N

15. The figure below shows the elliptical orbit of a planet m about the sun S. The shaded area SCD is twice the shaded area SAB. If t_1 is the time for the planet to move from C to D and t_2 is the time to move from A to B, then:



A. $t_1 = t_2$ B. $t_1 = 2t_2$ C. $t_1 = 4t_2$ D. $t_2 > t_1$

16. What does Newton's second law state when it is expressed in terms of momentum?

A. Force is the time rate of change of momentum.
B. Force is proportional to velocity.
C. Force is equal to the change in acceleration.
D. Force equals mass times velocity.

17. A block of mass 50 kg slides over a horizontal distance of 4 m. If the coefficient of friction between their surface is 0.2, then work done against friction is:

A. 100 J
C. 200 J
B. 400 J
D. 150 J

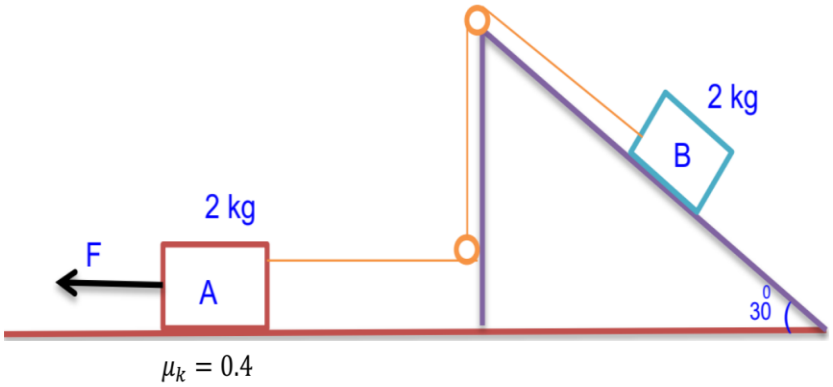
18. Two objects, one with a mass of 4 kg and the other with a mass of 8 kg, are moving with the same speed in uniform circular motion on the same horizontal plane, but the radius of the path for the 8-kg object is twice that of the 4-kg object. What will be the ratio of the centripetal force exerted on the 8-kg object to that exerted on the 4-kg object?

A. 1:2
C. 1:4
B. 2:1
D. 1:1

19. Consider two objects: Object A, with a mass of 5 kg, and Object B, with a mass of 10 kg. If both objects are subjected to the same applied force, which of the following statements best evaluates the relationship between their accelerations?

A. Object A will have half the acceleration of Object B
B. Object A and Object B will have the same acceleration.
C. Object A will have double the acceleration of Object B.
D. The accelerations of both objects cannot be compared with the given information.

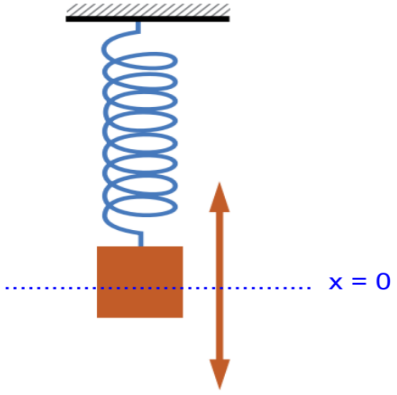
20. In the figure shown below two blocks A and B are connected with the string through two frictionless and massless movable pulleys, the coefficient of friction between block A and ground is 0.4 and that between wedge and block B is zero.



If the wedge is fixed and F is 28 N, what is the tension in the string and acceleration of block A respectively?

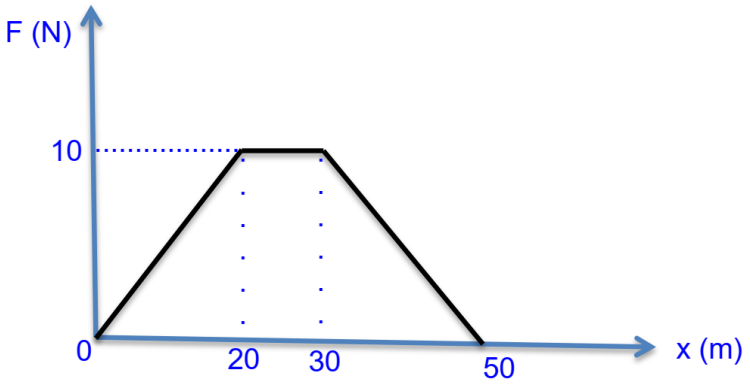
A. 20 N and 10 m/s^2
B. 15 N and 7.5 m/s^2
C. 15 N and 2.5 m/s^2
D. 18 N and 3 m/s^2

21. Which statement accurately distinguishes conservative forces from non-conservative forces?
    A. Conservative forces always lead to an increase in mechanical energy.
    B. Non-conservative forces are path-dependent and can change mechanical energy.
    C. Conservative forces are always attractive, while non-conservative forces are always repulsive.
    D. Non-conservative forces never perform work on an object.
22. Which combination correctly describes the energy values at the topmost point of vertical oscillation in a spring-mass system shown below?



    A. Kinetic energy is zero, gravitational potential energy is maximum, and elastic potential energy is minimum.
    B. Kinetic energy is maximum, gravitational potential energy is zero, and elastic potential energy is maximum.
    C. Kinetic energy is zero, gravitational potential energy is maximum, and elastic potential energy is maximum.
    D. Kinetic energy is maximum, gravitational potential energy is maximum, and elastic potential energy is zero.

23. An object of mass 1.5 kg is acted upon by the force as shown in the figure that varies with the position of the object as shown below. If the object start from rest at a point $x = 0$, then what is the speed at $x = 50$ m?



A. 20 m/s B. 25 m/s C. 15 m/s D. 17 m/s

24. A system uses fixed pulley and movable pulley. If the load is 200 N and the effort force is 100 N, and the efficiency of the system is 80%, what is the velocity ratio (VR) of the system?

A. 2 B. 4 C. 3.5 D. 2.5

25. How would you evaluate the effect on the apparent weight of an object when it is immersed in a fluid, compared to its true weight in a vacuum?

A. The apparent weight will be greater than the true weight due to the buoyant force exerted by the fluid.
B. The apparent weight will be the same as the true weight because the fluid has no impact on the force of gravity.
C. The apparent weight will be less than the true weight due to the upward buoyant force exerted by the fluid.
D. The apparent weight will fluctuate depending on the depth of the fluid.

26. Two objects with different temperature are placed in contact and, after some time, no more heat flows between them, what does this mean?

A. The cold object took all the heat
B. The objects have reached thermal equilibrium
C. The object has different abilities to conduct heat
D. Heat is no longer necessary

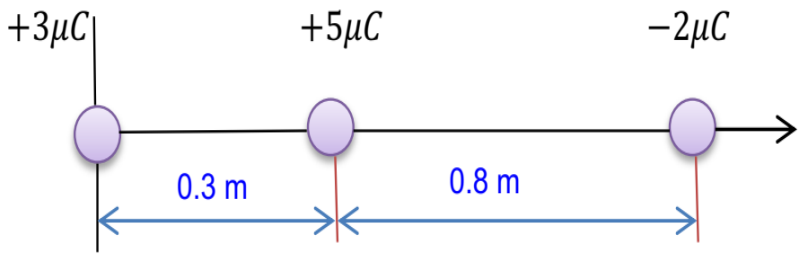
27. A student compares three substances (P, Q, and R) that undergo heating from solid to gas. Their heating curves show the following trends:

- P has the steepest slope in the solid phase.
- Q has the longest melting horizontal line.
- R has the shortest boiling horizontal line.

Which of the following conclusions can be drawn?

A. P has the lowest specific heat capacity in the solid phase.
B. Q has the lowest latent heat of fusion.
C. R has the highest latent heat of vaporization.
D. P has the highest specific heat capacity in the solid phase.

28. A student uses 418 J of heat energy to increase the temperature of a 200 g sample of water. If the specific heat capacity of water is 4.18 J/g°C, by how many degrees Celsius will the temperature increase?
    A. 2.0 °C
    B. 0.38 °C
    C. 1.5 °C
    D. 0.5 °C
29. A group of students want to calculate how much energy is required to melt 100 grams of ice at 0^0C without changing its temperature. Which concept must they use in their design?
    A. Specific heat capacity of ice
    B. Thermal conductivity of water
    C. Latent heat of fusion of ice
    D. Latent heat of vaporization of water
30. Which of the following is a key difference between mechanical and electromagnetic waves?
    A. Mechanical waves can travel in a vacuum, but electromagnetic waves cannot.
    B. Electromagnetic waves require a medium to travel, whereas mechanical waves do not.
    C. Mechanical waves require a medium to travel, while electromagnetic waves do not.
    D. Electromagnetic waves are always longitudinal, while mechanical waves are transverse.
31. An object is placed 4 cm in front of a concave mirror. The center of curvature of the mirror is located 40 cm from the pole. What is the distance between the object and the image formed?
    A. 9 cm
    B. 1 cm
    C. 24 cm
    D. 8 cm
32. A light passes from lead glass (refractive index $n_1 = 1.65$) into air (refractive index $n_2 = 1.00$). What is the critical angle for the light ray at the glass-air interface?
    A. 53^0
    B. 30^0
    C. 37^0
    D. 45^0
33. Which phenomenon occurs when two waves meet and combine to form a wave with larger amplitude?
    A. Diffraction
    B. Interference
    C. Refraction
    D. Reflection
34. Three charges are located along a straight line, as in figure below. What is the magnitude of net electrostatic force on the $+5\mu C$ charge?

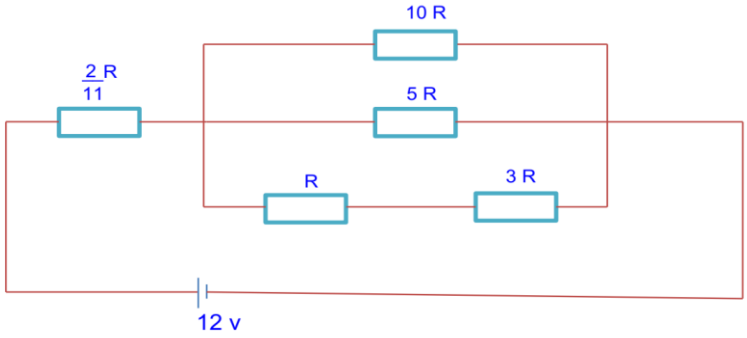


    A. 0.14 N
    B. 1.50 N
    C. 1.64 N
    D. 1.36 N
35. A designer wants to maximize the total capacitance using three 10 μF capacitors. Which combination should they choose, and why?
    A. All in parallel, because it gives the maximum total capacitance.
    B. All in series, because it gives the highest voltage rating
    C. One in series with two in parallel, because it balances both voltage and capacitance.
    D. It doesn't matter; all combinations give the same result.

36. Two wires A and B are made of the same material. Wire A has twice the length and half the diameter of wire B. What is the ratio R_A/R_B of their resistances?

A. 1 B. 8 C. 4 D. 16

37. In the circuit shown below, what is the value of the unknown resistor R and current through 5 R respectively, so that the total resistance of the circuit is equal to 6 Ω?



A. 6 Ω and 8 A

B. 6 Ω and 2 A

C. 3 Ω and $\frac{8}{11}$ A

D. 3 Ω and $\frac{5}{11}$

38. A student says "If the current flows upward in a vertical wire, the magnetic field lines will form clockwise circles around the wire" what is wrong with this statement?
   A. Magnetic field lines do not form circles
   B. The direction of the field is counterclockwise, not clockwise
   C. Magnetic fields do not exist around straight wires
   D. The current direction should be downward for counterclockwise fields

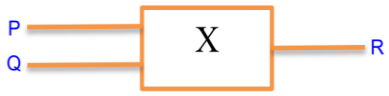
39. You are conducting an experiment in the laboratory to demonstrate the force on a current-carrying conductor placed in a magnet field. You have a straight wire, a magnetic field, and a power supply. Which of the following new setups will most effectively demonstrate the force exerted on the conductor?
   A. Use stronger magnetic field and lower the current in the wire
   B. Use a weaker magnetic field and increase the length of the conductor
   C. Use stronger magnetic field, increase the current, and keep the wire perpendicular to the magnetic field
   D. Keep the current constant and place the wire at an angle of 45^0 to the magnetic field

40. A square of side L meters lies in the xy-plane in a region where the magnetic field is given by $\vec{B} = B_0(2\hat{i} + 3\hat{j} + 4\hat{k})$ T Where B_0 is constant. The magnitude of flux passing through the square will be:
   A. $2B_0L^2$ Wb B. $3B_0L^2$ Wb C. $4B_0L^2$ Wb D. $4B_0L$ Wb

41. What happens if a permanent magnet cut into two pieces?
   A. The two piecies lose their magnetic properties
   B. One piece becomes north pole, and the other becomes a south pole.
   C. Each pieces becomes a new magnet with a north and a south pole.
   D. The magnet retains only its north pole.

42. A current 3 A flows through a long straight wire. At a distance 0.2 m fro the wire, the magnetic field is 4×10^{-7} T. What is the magnetic field at a distance of 0.4 m?
    A. 2×10^{-7} T B. 4×10^{-7} T C. 8×10^{-7} T D. 1×10^{-7} T
43. A coil with 200 turns has an area of 0.3 m^2. The magnetic field strength is 0.8 T. Initially, the magnetic field makes an angle of 60^0 with respect to the normal of the coil's plane. After 5 seconds, the coil is rotated to 90^0. What is the induced electromotive force?
    A. 4.8 V B. 3.0 V C. 2.4 V D. 1.6 V
44. An ideal transformer has a primary coil with 600 turns and a secondary coil with 150 turns. If the primary voltage is 240 V and secondary current is 10 A, what is the primary current?
    A. 1.5 A B. 4.0 A C. 3.0 A D. 2.5 A
45. Which of the following phenomenon is best explained by Newtonian mechanics in Astronomy?
    A. The Moon revolves around the Earth
    B. The Sun's light bends when passing near another Star
    C. Galaxies are moving away from each other
    D. A star becomes a black hole after it dies
46. Which of the following is a branch of Earth science that focuses on the study of solid and liquid matter of the Earth?
    A. Astronomy B. Geology C. Meteorology D. Oceanography
47. A company wants to improve the efficiency of its electrical power transmission system. Which branch of physics should electrical engineers apply to reduce energy loss?
    A. Thermodynamics C. Electrostatics
    B. Nuclear physics D. Electromagnetism
48. When holding a pencil between your fingers and applying force, why does a finger on sharper side feel more pain than the other?
    A. The pencil is haiver on the flat side
    B. The pressure is greater on the sharper side
    C. The pressure on both fingers is equal
    D. The pressure is lower on the finger that feels pain
49. A diver in fresh water expriences a pressure of 600 kPa. If they move up by 10 m, what will be the new pressure? (atmospheric pressure = 100 kPa)
    A. 500 kPa B. 520 kPa C. 540 kPa D. 550 kPa
50. Two hydraulic presses (A and B), have identical fluid and input forces, but press A has larger output piston area than press B. Which of the following is true about the force they produce?
    A. Press B produces a larger output force than press A
    B. Both presses produce the same output
    C. Press A produces a larger output force than press B
    D. The output force depends only on the input force, not the piston area
51. A team of engineers is building a cargo ship. They need to ensure that the ship remains floating even when fully loaded. What is the best design change they could make?
    A. Increase the ship's height to make it more visible in water.
    B. Increase the surface area of the ship's bottom to displace more water.
    C. Use denser materials in the ship's construction to make it more stable.
    D. Reduce the ship's total volume to make it more compact.

52. A metal block weighs 50 N in air and 42 N when fully submerged in water. What is the density of the metal?
    A. 5000 kg/m^3 B. 2000 kg/m^3 C. 2500 kg/m^3 D. 6250 kg/m^3
53. An airplane wing is designed so that air moves faster over the top surface than below. If the speed of air over the top is 200 m/s and under the wing is 150 m/s, which of the following is true?
    A. Pressure above the wing is greater than below.
    B. Pressure below the wing is greater than above.
    C. Pressure is equal on both sides.
    D. Bernoulli's principle does not apply here.
54. Which one of the following is the safety measures when using a gas cylinder?
    A. Use the gas cylinder for long hours C. Keep the gas cylinder in a vertical position
    B. Store the gas cylinder in warm area D. Keep the gas knob open all the times
55. How does electrical conductivity of a P-type semiconductor differ from that of N-type semiconductor?
    A. P-type semiconductor conduct via electron flow, while N-type semiconductor conduct via hole movement.
    B. Both conduct through free electrons, but N-type semiconductors have more.
    C. P-type semiconductors do not conduct electricity under normal conditions.
    D. N-type semiconductor conduct via electron flow, while P-type semiconductor conduct via hole movement.
56. What happen to the potential barrier of P-N junction diode under forward bias?
    A. It increases B. It decreases C. It remains constant D. It becomes infinite
57. Designing a power supply for a sensitive audio amplifier requires smoothed signal in the DC output. Which rectifier configuration would most appropriate, and what additional component would you incorporate to achieve this?
    A. Half-wave rectifier with a resistor C. Full-wave rectifier with a capacitor
    B. Full-wave rectifier with an ammeter D. Half-wave rectifier with an inductor
58. A transistor with a common-emitter current gain of 100 has a collector current of 10 mA. What is the base current?
    A. 10 μA B. 0.1 μA C. 1 μA D. 100 μA
59. Which of the following is a typical advantage of integrated circuits?
    A. Capability to withstand very high voltage C. Ability to operate at high speed
    B. Large physical size for better handling D. High individual component replacement ease
60. Logic gates X and Y have the truth tables shown below





X		
P	Q	R
0	0	0
1	0	0
0	1	0
1	1	1

Y	
R	S
0	1
1	0

When the output of X is connected to the input of Y, the resulting combination is equivalent to a single:
A. NOT gate B. NOR gate C. NAND gate D. AND gate