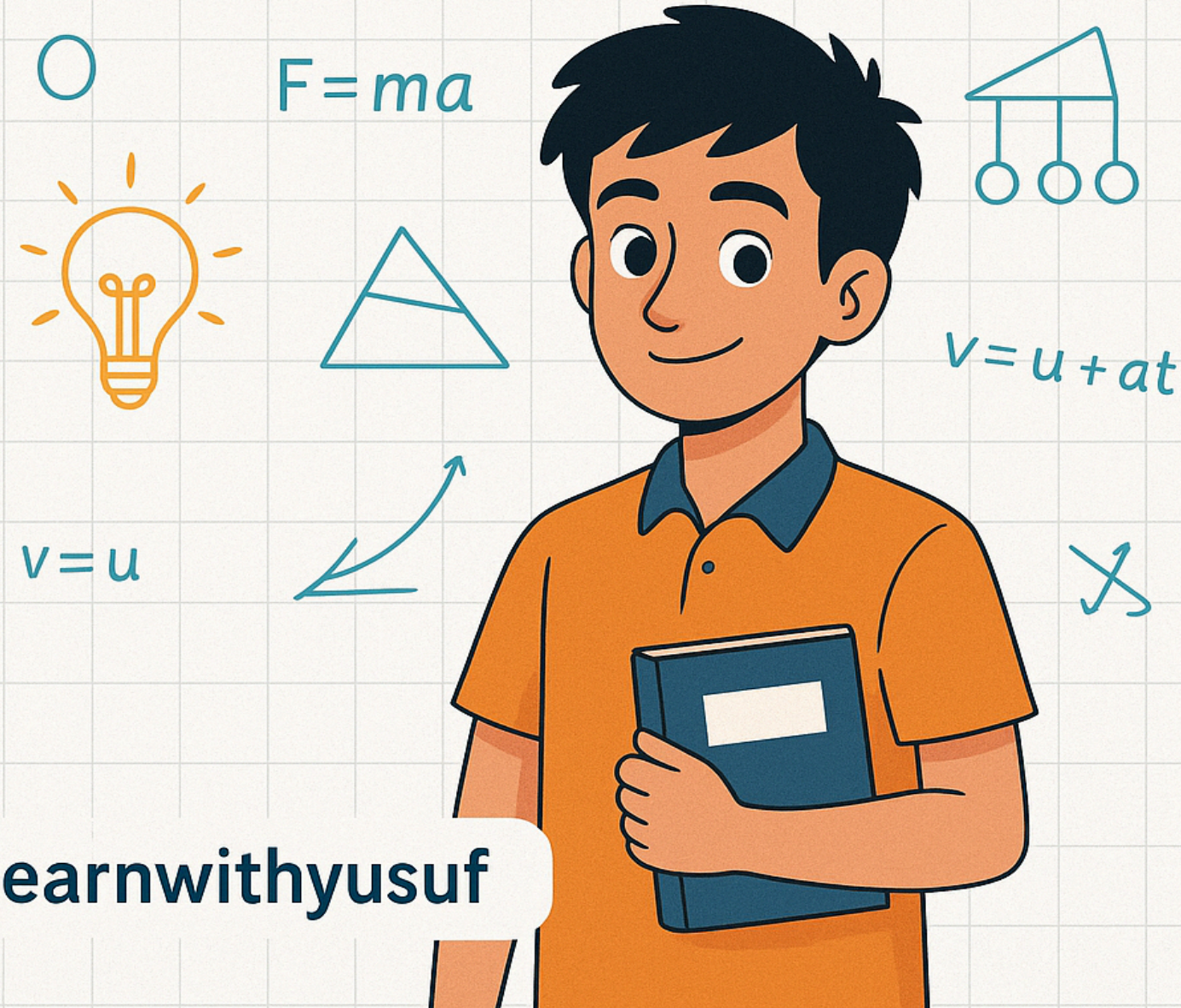
COMPETENCY-BASED MCQs

100+ Physics Questions – Class 10 ICSE

Master Concepts. Crack Every Question.



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1. To open a door, you apply a force of 10 N. At which of the following points would this force produce the greatest turning effect?
    a. At the hinge
    b. 20 cm from the hinge
    c. At the exact center of the door's width
    d. At the handle, which is farthest from the hinge
2. Two children are sitting on a seesaw. A child weighing 20 kgf sits 2 m to the left of the fulcrum. To balance the seesaw, where must a child weighing 40 kgf sit?
    a. 1 m to the right of the fulcrum
    b. 2 m to the right of the fulcrum
    c. 1 m to the left of the fulcrum
    d. 4 m to the right of the fulcrum
3. A body is in a state of rotational equilibrium. This implies that:
    a. No forces are acting on the body
    b. The sum of all forces acting on the body is zero.
    c. The sum of clockwise moments about a point equals the sum of anticlockwise moments about the same point.
    d. The body is moving with a constant velocity.
4. A student suggests that a single force can cause a pivoted body to relate. What is the error in this statement?
    a. A single force can only cause linear motion.
    b. Rotation is always produced by a pair of forces (a couple), consisting of the applied force and the reaction force at the pivot.
    c. Rotation can only be caused by two externally applied forces.
    d. A single force can cause the body to be in the equilibrium.
5. When you turn a water tap with your fingers, you are applying:
    a. A single force
    b. A couple
    c. Only torque
    d. Centripetal force

6. A uniform metre rule is pivoted at the 50 cm mark. If a weight of 25 gf is suspended at the 20 cm mark, what weight must be suspended to balance the rule?
    a. 25 gf at the 80 cm mark
    b. 50 gf at the 65 cm mark
    c. 30 gf at the 75 cm mark
    d. 10 gf at the 100 cm mark
7. Which of the following units is NOT a valid unit for moment of force?
    a. N m
    b. Dyne cm
    c. Kgf m
    d. Joule
8. 8. A student tries to balance a uniform wooden metre rule on his finger. At which mark on the rule is he most likely to succeed?
    a. The 0 cm mark
    b. The 25 cm mark
    c. The 50 cm mark
    d. The 100 cm mark
9. The centre of gravity of a hollow cone lies at a height of h/3 from the base, while for a solid cone it is at h/4. Why is a solid cone more stable than a hollow cone of the same size?
    a. The solid cone is heavier.
    b. The solid cone has a wider base.
    c. The solid cone has a lower centre of gravity.
    d. The hollow cone has air inside it.
10. A Student claims, " The centre of gravity of any object, like a doughnut, must be located within the material of the object." Why is this statement incorrect?
    a. The centre of gravity is always at the geometric center, which for a doughnut is in the hole.
    b. The centre of gravity depends on weight, not material.
    c. The centre of gravity can only be outside the material for spherical objects.
    d. The statement is correct; the student made no error.

11. For an object to be in stable equilibrium, its centre of gravity should be:
    a. As high as possible
    b. As low as possible
    c. Exactly in the middle of its height
    d. Outside the body
12. Why does a person carrying a heavy bucket in their right hand tend to lean towards the left?
    a. To decrease the weight of the bucket.
    b. To shift the combined centre of gravity of the person bucket system back over the base of support (their feet).
    c. To apply a greater force with their left hand.
    d. To walk faster.
13. A car is moving at a constant speed of 40 km/h on a circular track. Which of the following statements is true?
    a. The car's velocity is constant.
    b. The car is not accelerating
    c. The car's velocity is continuously changing because its direction is changing.
    d. The car is in static equilibrium.
14. An athlete whirls a hammer tied to string in a horizontal circle. The string suddenly breaks. The hammer will:
    a. Fly directly towards the center of the circle.
    b. Fly directly away from the center of the circle.
    c. Fly off along a tangent to the circular path at that instant.
    d. Drop straight down.
15. In the context of uniform circular motion, which statement correctly distinguishes between centripetal and centrifugal force?
    a. Centripetal force is real and acts towards the center; centrifugal force is a fictitious force that appears to act outwards for an observer in the rotating frame.
    b. Both are real forced, acting in opposite directions.
    c. Centrifugal force is real and causes objects to fly outwards; centripetal force is the reaction force.
    d. Centripetal force is directed along the tangent.

16. What provides the necessary centripetal force for the Earth to revolve around the Sun?
    a. The Earth's rotation on its axis.
    b. The gravitational force of attraction between the Earth and the Sun.
    c. The tension in the fabric of space-time.
    d. The centrifugal force acting on the Sun.
17. During the spin cycle of a washing machine, water is squeezed out of the clothes. This is an application of:
    a. The clothes apply a centripetal force on the water.
    b. The inertia of the water droplets, which tend to continue in a straight line while the drum turns.
    c. The drum applies strong gravitational forces.
    d. The water being lighter than the clothes.
18. A car takes a sharp turn on a level road. The centripetal force required to make the turn is provided by:
    a. The engine of the car.
    b. The gravitational force.
    c. The force of friction between the tires and the road.
    d. The weight of the car.
19. A student argues, "In uniform circular motion, since the speed is constant, the acceleration must be zero." Why is this wrong?
    a. Speed is not constant in uniform circular motion.
    b. Acceleration is the rate of change of velocity, and since the direction of velocity is constantly changing, there must be an acceleration.
    c. Acceleration is only zero if the object is at rest.
    d. The acceleration is not zero, but it is constant in magnitude and direction.
20. A uniform meter rod is pivoted at the 40 cm mark. A boy applies a force of 20 N vertically downward at the 80 cm mark, and a girl applies a force of 10 N vertically upward at the 20 cm mark. What is the net moment of force about the pivot?
    a. 600 N·cm (clockwise)
    b. 200 N·cm (anticlockwise)
    c. 400 N·cm (clockwise)
    d. 0 (balanced)

1. A boy pushes a large wall with a force of 200 N for 10 seconds, but the wall does not move. How much mechanical work has he done on the wall?
    a. 2000 J
    b. 200 J
    c. 20 J
    d. 0 J
2. A coolie lifts a suitcase of 15 kg from the ground and puts it on his his head, 1.5 m above the ground. The work done by the coolie on the suitcase is:
(Take g = 10 N/kg)
    a. 150 J
    b. 225 J
    c. 10 J
    d. 22.5 J
3. A car is moving at a constant velocity. The work done by the force of friction on the car is:
    a. Positive
    b. Negative
    c. Zero
    d. Infinite
4. A student is holding a heavy school bag at constant position for 5 minutes. A friend claims he is doing a lot of work. Why is this incorrect in the context of physics?
    a. The bag is not heavy enough.
    b. 5 minutes is too short a time.
    c. There is no displacement of the bag, so work done is zero.
    d. The force applied is not in the direction of gravity.
5. Two motors, A and B, lift the same load to the same height. Motor A takes 10 seconds while Motor B takes 20 seconds. Which statement is correct?
    a. Motor A does more work than B
    b. Motor B does more work than A
    c. Motor A has more power than B
    d. Motor B has more power than A

6. An engine exerts a constant force of 500 N on a car, moving it at a constant velocity of 10 m/s. What is the power developed by the engine?
    a. 50 W
    b. 500 W
    c. 5000 W
    d. 50,000 W
7. The commercial unit of electrical energy is kilowatt-hour (kWh). 1kWh is equal to:
    a. 3.6 J
    b. 3600 J
    c. 3.6×10^3 J
    d. 3.6×10^6 J
8. If the speed of a moving object is doubled, its kinetic energy becomes:
    a. Half
    b. Double
    c. Four times
    d. Unchanged
9. A body is lifted vertically upwards. Its potential energy will:
    a. Increase
    b. Decrease
    c. Remain the same
    d. First increase, then decrease
10. A light car and a heavy truck are both moving with the same kinetic energy. Which one has greater momentum?
    a. The light car
    b. The heavy truck
    c. Both have the same momentum
    d. Cannot be determined
11. A stretched bow and arrow system possesses which form of energy?
    a. Kinetic energy
    b. Gravitational potential energy
    c. Elastic potential energy
    d. Chemical energy

12. A body of mass ‘m’ has a momentum ‘p’. Its kinetic energy is given by:
    a. p^2/m
    b. $p^2/2m$
    c. $2p^2/m$
    d. $p/2m$
13. A 2 kg object is lifted from a height of 1 m to a height of 3 m. The increase in its potential energy is: (Take $g = 10\ m/s^2$)
    a. 20 J
    b. 30 J
    c. 40 J
    d. 60 J
14. For a simple pendulum swinging in a vacuum, what quantity remains constant throughout its motion?
    a. Only kinetic energy
    b. Only potential energy
    c. The total mechanical energy (KE + PE)
    d. The acceleration
15. A ball is dropped from a height of 10 m. At which point in its fall will its kinetic energy be equal to its potential energy? (Assume PE at the ground is zero).
    a. At the top (10 m)
    b. At a height of 5 m
    c. Just before hitting the ground
    d. It is never equal
16. A skier starts from rest at the top of a hill. If there is no friction, the skier’s speed at the bottom of the hill depends on:
    a. The mass of the skier
    b. The shape of the slope
    c. The vertical height of the hill
    d. The length of the slope

17. A hydroelectric power plant generates electricity using water from a dam. What is the primary energy conversion?
    a. Kinetic energy of water to potential energy
    b. Gravitational potential energy of water to electrical energy.
    c. Electrical energy to kinetic energy of turbines
    d. Chemical energy of water to electrical energy
18. A bouncing ball hits the floor and does not return to its original height. This is because:
    a. Energy is destroyed during the collision.
    b. Some of the mechanical energy is converted into heat and sound.
    c. The ball's mass decreases.
    d. The force of gravity is weaker after the bounce.
19. A roller coater cart starts from rest at point A and rolls down the track. Assuming no friction, at which point will it have the highest speed?
    a. A (highest point)
    b. B (mid - point)
    c. C (lowest point)
    d. Speed is constant everywhere
20. A student claims that when a car brakes to a stop, its kinetic energy is completely destroyed, violating the law of conservation of energy. Why is this incorrect?
    a. Energy can be destroyed in some cases.
    b. The kinetic energy is not destroyed; it is converted into thermal energy (heat) in the brakes and tires.
    c. The kinetic energy is converted into potential energy.
    d. The driver's effort creates new energy to balance the loss.

1. A pair of scissors used to cut paper has blades that are longer than its handles. This is an example of a:
    a. Force multiplier, Class I lever
    b. Speed multiplier, Class I lever
    c. Force multiplier, Class II lever
    d. Speed multiplier, Class III lever
2. A person uses a 1.5 m long crowbar to lift a heavy stone. He places the fulcrum 0.25 m from the stone. What is the Velocity Ratio (VR) of the crowbar?
    a. 6
    b. 5
    c. 0.2
    d. 1.25
3. In the human body, the action of lifting a book with the forearm (using the bicep muscle) is a Class III lever. This means the effort applied by the bicep is:
    a. Less than the weight of the book
    b. Equal to the weight of the book
    c. Always much greater than the weight of the book.
    d. Zero, as bones do the work.
4. A student observes a wheelbarrow and a pair of sugar tongs. He concludes that both are force multipliers. Why is his conclusion incorrect?
    a. Both are actually speed multipliers.
    b. The wheelbarrow (Class II) is a force multiplier, but the thongs (Class III) are a speed multiplier.
    c. The tongs (Class I) are a force multiplier, but the wheelbarrow (Class III) is a speed multiplier.
    d. Both levers have a Mechanical Advantage equal to 1.
5. An ideal machine is a hypothetical machine with an efficiency of 100%. For such a machine:
    a. Mechanical Advantage > Velocity Ratio
    b. Mechanical Advantage < Velocity Ratio
    c. Mechanical Advantage = Velocity Ratio
    d. Work output is greater than work input.

6. Which of the following is an example of a Class II lever, where the load is between the fulcrum and the effort?
    a. A seesaw
    b. A fishing rod
    c. A nutcracker'
    d. A pair of tweezers
7. A lever has a Velocity Ratio of 4. If its efficiency is 75%, what is its actual Mechanical Advantage (MA)?
    a. 4
    b. 3
    c. 5.33
    d. 0.75
8. In which class of lever is the effort arm always shorter than the laid arm?
    a. Class I
    b. Class II
    c. Class III
    d. Both Class II and III
9. Why can the efficiency of a practical machine never be 100%?
    a. The VR is always less than the MA.
    b. Some energy is always lost in overcoming friction and the weight of moving parts.
    c. The work input is always less than the work output.
    d. The law of conservation of energy does not apply to machines.
10. A machine acts as a force multiplier. This directly implies that its:
    a. Mechanical Advantage is less than 1.
    b. Mechanical Advantage is greater than 1.
    c. Velocity Ratio is less than 1
    d. Efficiency is 100%
11. A worker uses a single fixed pulley to lift a bucket of paint from the ground. The main advantages of this setup is that it:
    a. Multiplies the force applied
    b. Multiplies the speed of lifting
    c. Changes the direction of effort to a more convenient one.
    d. Has an efficiency greater than 100%

12. An ideal single movable pulley is used to lift a load of 200 N. The effort required to lift this load would be:
    a. 200 N
    b. 400 N
    c. 100 N
    d. 50 N
13. A block and tackle pulley system has a Velocity Ratio of 5. If it lifts a load of 400 N with an effort of 100 N, what is the efficiency of the system?
    a. 100%
    b. 125%
    c. 80%
    d. 50%
14. A student sets up a block and tackle system with 3 pulleys in the upper fixed block. What is the Velocity Ratio (VR) of this system?
    a. 3
    b. 2
    c. 6
    d. 5
15. In a pulley system, the load is lifted by 1 meter. If the Velocity Ratio is 4, how far does the effort have to be pulled?
    a. 1 m
    b. 0.25 m
    c. 4 m
    d. 2 m
16. A student argues, “For a single movable pulley, the MA is always 2.” Why is this statement incorrect for a practical, real-world scenario?
    a. The MA is always 1.
    b. In a real system, the effort must also overcome friction and the weight of the movable pulley, making the MA less than 2.
    c. The MA of a movable pulley depends on the size of the load.
    d. The statement is always correct.

17. Which of the following pulley arrangements gives the highest ideal Mechanical Advantage?
    a. A single fixed pulley.
    b. A single movable pulley
    c. A block and tackle with 2 fixed and 2 movable pulleys.
    d. A block and tackle with 3 fixed and 2 movable pulleys.
18. In a block and tackle system, the number of rope strands supporting the movable block is 3. What its VR?
    a. 1
    b. 2
    c. 3
    d. 6
19. A pulley system with VR = 5 has an efficiency of 80%. What effort is required to lift a load of 1000 N?
    a. 200 N
    b. 250 N
    c. 160 N
    d. 800 N
20. A combination of one fixed and one movable pulley is used to lift a load. What is its ideal MA?
    a. 1
    b. 2
    c. 3
    d. 4

1. A ray of light travels from air into a glass block. Which of the following properties of the light ray remains unchanged?
    a. Speed
    b. Wavelength
    c. Direction
    d. Frequency
2. A student observes that when a light ray passes from medium A to medium B, it bends towards the normal. What can be concluded from this observation?
    a. Medium B is optically rarer than medium A.
    b. Light travels faster in medium B than in medium A.
    c. The refractive index of medium B is greater than that of medium A.
    d. Both mediums have the same refractive index.
3. The refractive index of diamond is 2.42. What does this statement imply?
    a. Light travels 2.42 times faster in diamond than in air.
    b. Light travels 2.42 times slower in diamond than in air.
    c. The critical angle of refraction is always 24.2 degrees.
    d. The angle of refraction is always 2.42 times the angle of incidence.
4. A light ray is incident at an angle of 45° degree on a rectangular glass slab. The emergent ray is parallel to the incident ray. The distance between them is called lateral displacement. On which of the following factors does this displacement NOT depend?
    a. The thickness of the slab.
    b. The angle of incidence
    c. The refractive index of the glass
    d. The area of the glass slab's surface.
5. A student passes a ray of light through a glass slab and measures the angle of incidence (i) as 60° and the angle of refraction (r) as 35°. According to Snell's law, the refractive index (μ) of the glass is:
    a. $\mu = \sin(35°) / \sin(60°)$
    b. $\mu = \sin(60°) / \sin(35°)$
    c. $\mu = 60 / 35$
    d. $\mu = \sin(60° - 35°)$
    e.

6. When a ray of light passes through a glass prism, it splits into its constituent colours (VIBGYOR). Which colour experiences the maximum deviation?
    a. Red, because it has the longest wavelength.
    b. Violet, because it travels slowest in the glass.
    c. Yellow, because it is in the middle of the spectrum.
    d. All colours deviate by the same angle.
7. A ray of monochromatic light passes through an equilateral prism. The angle of deviation is minimum when:
    a. The angle of incidence is 90°.
    b. The ray passes parallel to the base of the prism.
    c. The angle of emergence is 0°.
    d. The angle of incidence is equal to the angle of the prism.
8. A student has two identical prisms, one made of crown glass (lower μ) and the other of flint glass (higher μ). If the same ray of light is passed through both at the same angle of incidence, which statement is true?
    a. The crown glass prism will produce more deviation.
    b. The flint glass prism will produce more deviation.
    c. Both will produce equal deviation
    d. Neither will produce deviation.
9. The phenomenon of splitting of white light into its component colours by a prism is known as:
    a. Reflection
    b. Refraction
    c. Dispersion
    d. Total Internal Reflection
10. A swimmer inside a swimming pool looks up at a friend standing at the edge. Due to refraction, the friend will appear to be:
    a. Taller than his actual height.
    b. Shorter than his actual height.
    c. At his actual height
    d. Blurry and inverted.

11. A coin is placed at the bottom of a beaker filled with water ($\mu = 4/3$). If the coin appears to be at a depth of 9 cm, what is the actual depth of the water?
    a. 12 cm
    b. 6.75 cm
    c. 9 cm
    d. 16 cm
12. A student places a glass slab over a postage stamp. He observes that the image of the stamp appears raised. This "shift" is greatest for:
    a. Red light
    b. Yellow light
    c. Green light
    d. Violet light
13. A straight pencil is partly immersed in water at an angle. To an observer in the air, the pencil appears:
    a. Shorter and bent away from the normal at the water surface.
    b. Longer and bent towards the normal at the water surface.
    c. Shorter and bent towards the normal at the water surface.
    d. Thicker and bent at the water surface.
14. For total internal reflection to occur, two essential conditions must be met. Which of the following is one of those conditions?
    a. Light must travel from a rarer medium to a denser medium.
    b. The angle of incidence must be less than the critical angle.
    c. Light must travel from a denser medium to a rarer medium.
    d. The angle of incidence must be 90°.
15. The critical angle for diamond is approximately 24°.
    This low value is the primary reason for its:
    a. Hardness
    b. Colour
    c. Brilliance and sparkle
    d. High density

16. A ray of light travels from glass (μ = 1.5) to air. What is the critical angle for the glass-air interface? (sin 42° ≈ 1/1.5)
    a. 90°
    b. 60°
    c. 45°
    d. 42°
17. A right-angled isosceles prism (45° - 90° - 45°) is used in a periscope to deviate a ray of light by 90°. This is achieved through:
    a. Refraction at two surfaces.
    b. Dispersion
    c. A single total internal reflection.
    d. Two total internal reflections.
18. A student argues, "A totally reflecting prism is better than a plane mirror because it reflects more light". Why is this statement correct?
    a. Mirrors absorb a significant amount of light, while TIR reflects nearly 100% of the incident light.
    b. Mirrors produce a virtual image, while prisms produce a real image.
    c. Prisms are made of a more reflective material than silver.
    d. Mirror work by refraction, which is less efficient.
19. A fish in a pond looks upwards at the surface of the water. Its view of the outside world is restricted to a circular patch. This phenomenon is known as Snell's Window and is a direct consequence of:
    a. Dispersion
    b. Diffraction
    c. Total internal reflection
    d. Scattering
20. Optical fibers, used in modern telecommunications, transmit light signals over long distances with minimal loss. The guiding principle behind this technology is:
    a. Refraction
    b. Scattering
    c. Total Internal Reflection
    d. Polarization

1. A student observes that a beam of parallel light rays bends outwards and spreads apart after passing through a lens. The lens is thicker at its edges and thin in the middle. This lens is a:
    a. Convex or Converging lens
    b. Concave or diverging lens
    c. Plano-convex lens
    d. A glass prism
2. A ray of light is directed towards the optical centre of a thin convex lens. After refraction through the lens, the ray will:
    a. Pass through the principal focus
    b. Emerge parallel to the principal axis
    c. Pass through undeviated.
    d. Reflect back along the same path
3. An optician has two convex lenses. Lens A is very thick, while Lens B is quite thin. Which statement correctly describes their power?
    a. Lens A has a longer focal length and higher power.
    b. Lens B has a shorter focal length and higher power.
    c. Lens A has a shorter focal length and higher power.
    d. Both lenses have the same power but different focal lengths.
4. A convex lens is made of glass with a refractive index of 1.5. If it is placed in a transparent liquid with a refractive index of 1.6., it will behave like a:
    a. Converging lens with a shorter focal length.
    b. Diverging (concave) lens.
    c. Plane glass slab.
    d. Converging lens with a longer focal length.
5. In order to be used as a magnifying glass, a convex lens must form a virtual, erect, and magnified image. This is only possible when the object is placed:
    a. Between the optical centre and the principal focus (F_1).
    b. Exactly at the principal focus (F_1).
    c. At twice the focal length ($2F_1$).
    d. Beyond twice the focal length (beyond $2F_1$).

6. A photographer is taking a picture of a distant mountain. The camera lens (a convex lens) forms an image on the sensor that is:
    a. Virtual, erect, and highly diminished.
    b. Real, inverted, and highly diminished.
    c. Real, erect, and the same size.
    d. Virtual, inverted, and magnified.
7. A student sets up an experiment with a convex lens and places an object at $2F_1$. The image formed on the other side will be located:
    a. At F^2
    b. Between F^2 and $2F^2$
    c. At $2F^2$
    d. Beyond $2F^2$
8. A person suffering from myopia (short - sightedness) cannot see distant objects clearly because the image is formed in front of the retina. To correct this defeat, their spectacles should use a:
    a. Convex lens to converge the rays more.
    b. Concave lens to diverge the rays before they enter the eye.
    c. Bifocal lens.
    d. Plano-convex lens.
9. An image formed by a lens is always virtual, erect, and smaller than the object, regardless of the object's position. The lens must be:
    a. Concave
    b. Convex
    c. Plano-concave
    d. Any of the above
10. In a slide projector, a bright, magnified image is formed on a screen. Which of the following correctly describes the lens used and the image produced?
    a. Concave lens forming a virtual image.
    b. Convex lens forming a real, inverted, and magnified image.
    c. Convex lens forming a virtual, erect, and magnified image.
    d. Concave lens forming a real, inverted, and magnified image.

11. A student covers the bottom half of a convex lens with black paper and tries to form an image of a candle on a screen.The result will be:
    a. Only the top of the candle's image will be formed.
    b. No image will be formed.
    c. A complete image will be formed, but its brightness will be reduced.
    d. A blurry, complete image will be formed.

12. A ray of light emerges from a concave lens parallel to the principal axis. The incident ray must have been:
    a. Parallel to the principal axis.
    b. Passing through the optical centre.
    c. Directed towards the first principal focus (F_1).
    d. Directed towards the second principal focus (F_2).
13. According to the Cartesian sign convention, which of the following quantities is always considered positive?
    a. The object distance (u).
    b. The focal length of a concave lens.
    c. The focal length of a convex lens.
    d. The image distance of a virtual image.
14. A lens produces a linear magnification of -1. This implies that the image is;
    a. Real, inverted, and the same size as the object.
    b. Virtual, erect, and the same size as the object.
    c. Real, inverted, and magnified.
    d. Virtual, erect, and diminished.
15. An optical prescribes glasses with a power of - 2.5 D. The prescribed lens is a:
    a. Convex lens of focal length 40 cm.
    b. Concave lens of focal length 40 cm.
    c. Convex lens of focal length 2.5 m.
    d. Concave lens of focal length 2.5 m.

16. A student solves a lens problem and finds that the magnification is +3. What can she conclude about the image?
    a. It is real, inverted, and three times the size of the object.
    b. It is virtual, erect, and three times the size of the object.
    c. It is real, erect, and one-third the size of the object.
    d. It is virtual, inverted, and one-third the size of the object.
17. A student claims that it's impossible for a convex lens to have a negative image distance (v). Why is this claim incorrect?
    a. A convex lens always forms a real image, so v is always positive.
    b. The claim is correct; v is never negative for a convex lens.
    c. A convex lens forms a virtual image (with a negative v) when the object is placed within its focal length.
    d. Image distance is a scalar quantity and has no sign.
18. To form a real image of the same size as the object using a convex lens of focal length 20 cm, the object must be placed:
    a. At 20 cm from the lens.
    b. At 30 cm from the lens.
    c. At 40 cm from the lens.
    d. At 50 cm from the lens.
19. The power of a lens is a measure of its:
    a. Ability to magnify an image.
    b. Degree of convergence or divergence of light rays.
    c. Diameter.
    d. Brightness of the image it forms.
20. A ray of light travelling from a distance source is parallel to the principal axis of a concave lens. After refraction, the ray appears to diverge from:
    a. The optical centre (O)
    b. The first principal focus (F_1)
    c. The second principal focus (F_2)
    d. The centre of curvature ($2F_2$)

1. A student is experimenting with a prism and a laser beam. She notices that as she slowly increases the angle of incidence (i), the angle of deviation (δ) initially:
    a. Increases continuously.
    b. Remains constant.
    c. First decreases, reaches a minimum, and then increases.
    d. First increases, reaches a maximum, and then decreases.
2. For a given prism, the angle of minimum deviation (δ_{min}) is found to be 40°. At this specific deviation, the angle of incidence (i) is equal to:
    a. 40 degree
    b. The angle of refraction (r)
    c. The angle of the prism (A)
    d. The angle of emergence (e)
3. Which of the following factors does the angle of deviation produced by a prism NOT depend on?
    a. The angle of the prism (A)
    b. The material of the prism (μ)
    c. The angle of incidence (i)
    d. The size and weight of the prism

4. A ray of light is incident on an equilateral prism (A = 60°) at the angle of minimum deviation. If the angle of incidence?
    a. 30°
    b. 45°
    c. 60°
    d. 90°
5. A prism made of flint glass (μ ≈ 1.65) and a prism of the same shape made of crown glass (μ ≈ 1.52) are used to deviate a ray of yellow light. Which statement is correct?
    a. The flint glass prism will cause a greater deviation.
    b. The crown glass glass prism will cause a greater deviation.
    c. The deviation depends on the prism's temperature, not its material.
    d. Both prisms will cause the same deviation.

6. When white light passes through a prism, violet light deviates the most and red light deviates the least. This happens because:
    a. The refractive index of the prism material is highest for violet light.
    b. The angle of incidence is greater for violet light.
    c. Red light travels faster in vacuum than violet light.
    d. The prism absorbs red light more than violet light.
7. A student claims that for a thin prism, the angle of deviation is independent of the angle of incidence. This is a valid approximate because the formula for deviation simplifies to:
    a. $\delta = i - r$
    b. $\delta = A(\mu - 1)$
    c. $\delta = i + e$
    d. $\delta = 2i - A$
8. In the position of minimum deviation for an equilateral prism, the refracted ray inside the prism:
    a. Bends at a 90° angle.
    b. Travels parallel to the base of the prism.
    c. Reverses its path
    d. Emerges without any deviation.
9. A ray of light passes through an equilateral glass prism (A = 60°). If the angle of incidence is 48° and the angle of emergence is 38°, what is the angle of deviation?
    a. 10°
    b. 26°
    c. 86°
    d. 22°
10. If the angle of incidence for a ray of light on a prism is increased from 30 degree to 40 degree, and this is still less than the angle for minimum deviation, the angle of deviation will:
    a. Increase
    b. Decrease
    c. Remain the same
    d. Become zero

11. Which of the following radiations has the shortest wavelength and is the most energetic?
    a. Infrared
    b. Ultraviolet
    c. X-rays
    d. Gamma rays
12. A TV remote control uses a beam of invisible radiation to change channels. This radiation is:
    a. Ultraviolet (UV) rays
    b. Infrared (IR) rays
    c. Microwaves
    d. Radio waves
13. Doctors use a certain type of electromagnetic radiation to check for bone fractures because it can pass through flesh but is stopped by bones. This radiation is:
    a. Gamma rays
    b. X-rays
    c. Ultraviolet rays
    d. Microwaves
14. A student is trying to detect infrared radiation coming from a hot iron. Which of the following instruments would be most effective?
    a. A photographic plate.
    b. A fluorescent screen.
    c. A thermometer with a blackened bulb.
    d. A quartz prism.
15. When an electromagnetic wave passes from air into water, which of its properties remains constant?
    a. Wavelength
    b. Speed
    c. Frequency
    d. Amplitude

16. A student argues, "Glass is transparent, so it must allow all types of invisible radiation to pass through it". Why is this statement incorrect?
    a. Glass is opaque to radio waves
    b. Glass absorbs ultraviolet (UV) and infrared (IR) radiation.
    c. Glass only allows visible light to pass through.
    d. The student is correct.
17. Which of the following is NOT a property common to all electromagnetic waves?
    a. They are transverse waves.
    b. They travel at the speed of light in a vacuum.
    c. They can be deflected by electric and magnetic fields.
    d. They do not require a material medium for propagation.
18. The ozone layer in the Earth's atmosphere is crucial for life because it absorbs a large portion of harmful:
    a. Infrared radiation from the sun.
    b. Gamma rays from space.
    c. Ultraviolet radiation from the sun.
    d. Radio waves from satellites.
19. Which radiation is used in radar systems for aircraft navigation and weather forecasting?
    a. Infrared rays
    b. Gamma rays
    c. Microwaves
    d. X- rays
20. Arrange the following electromagnetic radiations in order of increasing wavelength: Gamma rays, Infrared, Ultraviolet, Microwaves.
    a. Infrared < Ultraviolet < Gamma < Microwaves
    b. Microwaves < Infrared < Ultraviolet < Gamma
    c. Gamma < Ultraviolet < Infrared < Microwaves
    d. Ultraviolet < Gamma < Microwaves < Infrared

1. A student claps his hands loudly while standing 10 meters away from a tall, flat wall. Why will he not hear a distinct echo? (Speed of sound in air 340 m/s)
    a. The wall is not smooth enough to reflect sound.
    b. The sound is not loud enough to travel 20 meters.
    c. The reflected sound will return in less than 0.1 seconds, overlapping with the original sound.
    d. Sound cannot be reflected by walls, only by mountains
2. A ship uses a SONAR device to determine the depth of the sea. It sends out an ultrasonic pulse and receives the echo 3 seconds later. If the speed of sound in seawater is 1500 m/s, what is the depth of the sea?
    a. 4500 m
    b. 2250 m
    c. 500 m
    d. 3000 m
3. Bats navigate in the dark by emitting high-frequency sounds and listening for the echoes. The waves they use are:
    a. Infrasonic
    b. Audible sound
    c. Ultrasonic
    d. Electromagnetic
4. A person shouts in a large empty hall and notices that the sound seems prolonged. This phenomenon, caused by multiple reflections of sounf from the walls, is know as:
    a. An echo
    b. Resonance
    c. Reverberation
    d. Damping
5. Which of the following conditions is necessary to hear a distinct echo?
    a. The listener must be moving towards the reflector.
    b. The sound must have a very high pitch.
    c. The reflecting surface must be at a sufficient distance from the source.
    d. The temperature of the air must be exactly 20 degree C.

6. When the stem of a variation tuning fork is pressed against a tabletop, the table starts vibrating. The vibrations produced in the tabletop are an example of:
    a. Natural vibrations
    b. Damped vibrations
    c. Forced vibrations
    d. Resonant vibrations
7. A simple pendulum is set to oscillate in the air. Its amplitude gradually decreases over time. This is an example of:
    a. Free (Natural) vibrations
    b. Damped Vibrations
    c. Resonant vibrations
    d. Forced vibrations
8. Soldiers are asked to break their step while crossing a suspension bridge. This is to avoid a situation where:
    a. The frequency of their marching matches the natural frequency of the bridge, causing resonance and potentially large, dangerous oscillations.
    b. The weight of the soldiers becomes too much for the bridge.
    c. The sound of their marching creates a loud echo.
    d. The bridge forces the soldiers to march at a different frequency.
9. Two identical tuning forks, A and B, are mounted on separate sound boxes. If fork A is struck and then silenced, fork B is heard vibrating. This phenomenon is:
    a. Damped vibrations
    b. Reflection
    c. Forced vibrations
    d. Resonance
10. A student has four pendulums (A, B, C, D) hanging from a common string. Pendulums A and C have the same length, while B is shorter and D is longer. If pendulum A is set into oscillation, which other pendulum will start to swing with the largest amplitude?
    a. Pendulum B
    b. Pendulum C
    c. Pendulum D
    d. All will swing with the same amplitude.

11. A guitar's hollow body (soundbox) plays a crucial role in making the sound louder. It works on the principle of:
    a. Damped vibrations
    b. Natural vibrations
    c. Forced vibrations
    d. Echoes.
12. A key condition for resonance to occur is that the frequency of the external periodic force must be:
    a. Much greater than the natural frequency of the body.
    b. Much less than the natural frequency of the body.
    c. Exactly equal to the natural frequency of the body.
    d. Continuously changing.
13. A guitarist plays a note. To make the sound louder without the note, she should:
    a. Pluck the string with greater force.
    b. Tighten the string
    c. Shorter the string
    d. Use a thinner string.
14. The pitcher of a sound is primarily determined by which physical property of the sound wave?
    a. Amplitude
    b. Speed
    c. Wavelength
    d. Frequency
15. A violin and a piano both play the same note (same pitch) at the same loudness. A listener can still distinguish between the two instruments. This is possible due to the difference in their:
    a. Amplitude
    b. Frequency
    c. Quality (or Timbre)
    d. Speed of sound

16. A student notices that the voice of his female teacher is generally higher and shriller than that of his male teacher. This is because the female voice typically has a:
    a. Higher amplitude
    b. Higher frequency
    c. Higher speed
    d. More complex waveform
17. To increase the pitch of a note produced by a guitar string, one can:
    a. Decrease the tension in the string.
    b. Increase the length of the string
    c. Increase the tension in the string
    d. Use a thicker string
18. A student draws two sound waves, A and B. Wave A has a larger amplitude but the same wavelength as wave B. This means:
    a. Sound A is louder and has a pitch than B.
    b. Sound A is louder but has the same pitch as B.
    c. Sound A has a higher pitch but the same loudness as B.
    d. Sound A is softer and has a lower pitch than B.
19. The "quality" or "timbre" of a musical sound depends on:
    a. Only the fundamental frequency.
    b. The presence and relative intensity of overtones (harmonics).
    c. The overall loudness of the sound.
    d. The medium through which the sound travels.
20. A student makes the claim: "Loudness and intensity of a sound wave are the same thing." Why is this statement not entirely correct?
    a. Intensity is objective (energy/area/time), while loudness is a subjective sensation that also depends on the listener's ear sensitivity.
    b. Intensity is measured in decibels, while loudness has no units.
    c. Loudness depends on frequency, while intensity does not.
    d. The statement is correct.

1. A copper wire is used to connect a battery to a bulb. The particles responsible for the flow of current in the copper wire are:
    a. Protons
    b. Positive ions
    c. Free electrons
    d. Neutrons
2. A student plots a V-1 graph for a metallic conductor at a constant temperature. The graph is a straight line passing through the origin. This verifies:
    a. The principle of calorimetry
    b. The law of conservation of energy
    c. Snell's Law
    d. Ohm's Law
3. The resistance of a conductor is defined as the ratio of:
    a. Current of potential difference (I/V)
    b. Potential difference to current (V/I)
    c. Charge to time (Q/t)
    d. Work done to charge (W/Q)
4. A student argues. "A thick copper wire has more resistance than a thin copper wire of the same length because it contains more material." Why is this reasoning incorrect?
    a. A thick wire has a larger cross-sectional area, providing more paths for electrons and thus lower resistance.
    b. The resistance depends on the length, not the thickness.
    c. Both wires have the same resistance as they are both made of copper.
    d. The student's reasoning is correct.
5. The specific resistance (resistivity) of a material depends on:
    a. Its length and cross-sectional area.
    b. Its shape and volume.
    c. The nature of the material and its temperature.
    d. The current flowing through it

6. Two resistors of 4Ω and 6Ω are connected in series. The equivalent of the combination is:
    a. 2.4 Ω
    b. 10 Ω
    c. 2 Ω
    d. 24 Ω
7. Two resistors of 4 Ω and 6 Ω are connected in parallel. The equivalent resistance of the combination is:
    a. 2.4 Ω
    b. 10 Ω
    c. 5 Ω
    d. Less than 4 Ω
8. When resistors are connected in parallel, which of the following physical quantities remains the same across all of them?
    a. Current
    b. Resistance
    c. Potential difference (Voltage)
    d. Power dissipated
9. You are given three resistors, each of 2 Ω. How would you connect them to get an equivalent resistance of 3 Ω?
    a. All three in series
    b. All three in parallel
    c. Two in parallel, connected in series with the third.
    d. Two in series, connected in parallel with the third.
10. In a household circuit, appliances like bulbs, fans, and TVs are connected in parallel. The primary advantage of this is:
    a. It saves on the cost of wiring.
    b. The total resistance of the circuit is increased.
    c. Each appliance receives the full mains voltage and can be operated independently.
    d. The current drawn from the mains is reduced.

11. A student measures the voltage across a new battery with a voltmeter and finds it to be 1.5 V. When she connects the battery to a bulb, the voltmeter reading drops to 1.2 V. The 1.5 V reading represents the:
    a. Terminal voltage
    b. Voltage drop
    c. Electromotive force (e.m.f.)
    d. Power of the battery
12. The terminal voltage of a cell is always less than its e.m.f. When current is being drawn from it. This is because:
    a. The voltmeter is not accurate.
    b. The external resistance is too high
    c. Work has to be done to move the charge through the cell's own internal resistance.
    d. The e.m.f. Decreases as the cell is used.
13. A cell of e.m.f. 2 V and internal resistance 1 Ω is connected to an external resistor of 9 Ω. The current flowing in the circuit is:
    a. 0.2 A
    b. 2 A
    c. 0.22 A
    d. 5 A
14. The internal resistance of a cell increases with:
    a. An increase in the surface area of the electrodes.
    b. A decrease in the distance between the electrodes.
    c. An increase in temperature.
    d. Use over a long period of time (as the cell gets old).
15. An electric bulb is rated '100 W - 220 V'. The '100 W' signifies:
    a. The energy consumed by the bulb in one second when connected to a 220 V supply.
    b. The total energy the bulb will ever consume.
    c. The current drawn by the bulb.
    d. The resistance of the bulb's filament.

16. Two bulbs are rated '100 W - 220 V' and '60 W - 220 V'. Which bulb has a filament with higher resistance?
    a. The 100 W bulb
    b. The 60 W bulb
    c. Both have the same resistance.
    d. It cannot be determined from the rating.
17. A family uses an air conditioner of power 2 kW for 5 hours each day. If the cost of electricity is ₹5per unit (kWh), what is the daily cost of running the air conditioner?
    a. ₹10
    b. ₹20
    c. ₹50
    d. ₹100
18. According to Joule's law of heating, the heat produced in a resistor is directly proportional to the:
    a. Current (I)
    b. Square of the current (I^2)
    c. Square root of the current (I)
    d. Reciprocal of the current (1/I)
19. An electric kettle and an electric bulb are connected to the same 220 V mains. The fuse wire used for the kettle is thicker than the one used for the bulb. This is because:
    a. The kettle is a more important appliance.
    b. The kettle draws a much higher current and requires a fuse with a higher current rating.
    c. The kettle operates at a lower voltage.
    d. A thicker fuse has higher resistance.
20. A student has two bulbs: A (100 W, 220 V) and B (10 W, 220 V). He connects them in series to a 220 V supply. Which bulb will glow brighter?
    a. Bulb A (100 W) will glow brighter
    b. Bulb B (10 W) will glow brighter
    c. Both will glow with equal brightness.
    d. Neither bulb will glow.

1. Electricity from a power generating station is transmitted over long distances at very high voltages. What is the primary reason for this?
    a. To increase the speed of electricity.
    b. To reduce the loss of energy as heat in the transmission wires.
    c. High voltage is required to operate heavy machinery.
    d. It is easier to generate high voltages.
2. In the main distribution board of a house, all domestic appliances like bulbs, fans, and sockets are connected in:
    a. Series, to ensure they all receive the same current.
    b. Parallel, so that each appliance gets the full mains voltage and can operate independently.
    c. A combination of series and parallel.
    d. A star-shaped circuit.
3. According to the new international convention, the color code for the live, neutral, and earth wires is, respectively:
    a. Red, Black, Green
    b. Brown, Light Blue, Green-and-Yellow
    c. Red, Green, Black
    d. Brown, Green, Light Blue
4. The main switch in a household electrical circuit is a ‘double pole’ switch. Its primary advantage is that it:
    a. Is cheaper than a single pole switch
    b. Disconnects only the live wire from the main supply.
    c. Disconnects only the neutral wire from the main supply.
    d. Disconnects both the live and neutral wires simultaneously, ensuring complete safety.
5. A student is examining a three-pin plug. The longest and thickest pin is the:
    a. Live pin
    b. Neutral pin
    c. Earth pin
    d. Fuse pin

6. Why is the earth pin made longer than the other two pins in a three-pin plug?
    a. To make it look different.
    b. It ensures that the earth connection is made first before the live connection, providing safety.
    c. It is thicker, so it needs to be longer for stability.
    d. It carries the most current.
7. The "ring system" of wiring is preferred in modern homes. One of its key advantages is that:
    a. It uses a single wire for all appliances, saving cost.
    b. It allows current to reach an appliance through two separate paths, enabling the use of thinner, cheaper wire for the main ring.
    c. All appliances are connected in series.
    d. It eliminates the need for a fuse.
8. In a staircase wiring system, a single lamp is controlled by two switches, one at the top and one at the bottom of the stairs. This allows the lamp to be:
    a. Switched on only from the bottom.
    b. Switched off only from the top.
    c. Operated (switched on or off) independently from either switch.
    d. Glow with half brightness.
9. An electric fuse is a safety device that works on the principle of the:
    a. Magnetic effect of current.
    b. Heating effect of current
    c. Chemical effect or current.
    d. Motor principle
10. A fuse wire should be made of a material that has:
    a. High melting point and high resistance.
    b. High melting point and low resistance.
    c. Low melting point and high resistance.
    d. Low melting point and low resistance.

11. A student argues, "It is okay to connect a switch in the neutral wire because it still breaks the circuit and stops the appliance." Why is this a dangerous practice?
    a. The switch will get damaged by the high voltage.
    b. The appliance will not stop working.
    c. Even when the switch is off, the appliance remains connected to the high potential live wire, making it unsafe to handle.
    d. Connecting a switch in the neutral wire is the correct and safe method.
12. The primary purpose of earthing an electrical appliance with a metallic body (like an electric iron or refrigerator) is to:
    a. Increase the power of the appliance.
    b. Provide an extra path for the current to flow, making it work better.
    c. Ensure the appliance has a stable voltage.
    d. Protect the user from an electric shock if the live wire accidentally touches the metallic body.
13. A short circuit occurs when:
    a. The switch is in 'off' position.
    b. The live wire and the neutral wire come into direct contact.
    c. Too many appliances are connected to a single socket.
    d. The fuse melts
14. An electric heater rated at 2200 W is operated on a 220 V line. What should be the minimum current rating of the fuse used for this appliance.
    a. 2 A
    b. 5 A
    c. 10 A
    d. 15 A
15. What is the modern safety device that is now widely used in place of fuses in household wiring because it is more convenient and offers a quicker response?
    a. A switch
    b. A regulator
    c. A Miniature Circuit Breaker (MCB)
    d. A voltmeter

16. Two fuse wires, one rated 5 A and the other 15 A, are made of the same material. The 15 A fuse wire will be:
    a. Thicker than the 5 A wire.
    b. Thinner than the 5 A wire.
    c. Longer than the 5 A wire.
    d. The same thickness as the 5 A wire
17. Overloading of a circuit happens when:
    a. A high-power appliance is used.
    b. A faulty appliance is connected.
    c. The current drawn from the mains exceeds the safe limits of the wiring, often by connecting too many appliances to one socket.
    d. The voltage from the mains suddenly drops.
18. A fuse should always be connected in the:
    a. Neutral wire, after the switch.
    b. Earth wire.
    c. Live wire, before the switch and the appliance.
    d. Neutral wire, before the switch
19. Which wire in a household circuit is maintained at zero potential by being earthed at the local substation?
    a. The live wire
    b. The neutral wire
    c. The fuse wire
    d. All wires are at zero potential
20. A person touches a faulty electric toaster with a metal casing that is not earthed. The live wire inside is touching the casting. Why do they receive a severe electric shock?
    a. The toaster draws too much power.
    b. The person's body provides a path for the current to flow from the high-potential casing to the earth.
    c. The neutral wire is faulty
    d. The MCB did not trip.

1. A student wraps an insulated copper wire around a soft iron nail and connects the ends of the wire to a battery. The nail becomes a magnet. This is an example of the:
    a. Heating effect of current
    b. Chemical effect of current
    c. Magnetic effect of current
    d. Motor principle.
2. To increase the strength of an electromagnet, which of the following actions would be LEAST effective?
    a. Increasing the number of turns in the coil
    b. Increasing the current flowing through the coil.
    c. Replacing the soft iron core with a steel core.
    d. Using a thicker copper wire for the coil (assuming the same power source)
3. A straight wire carrying current is held vertically. If the current flows downwards, the magnetic field lines, as viewed from above, will be:
    a. Clockwise concentric circles.
    b. Anti-clockwise concentric circles.
    c. Radial lines pointing outwards
    d. Parallel lines pointing downwards
4. A DC motor is a device that converts:
    a. Mechanical energy into electrical energy.
    b. Electrical energy into mechanical energy
    c. Electrical energy into heat energy
    d. Magnetic energy into electrical energy
5. In a simple DC motor, what is the primary function of the split-ring commutator?
    a. To increase the speed of rotation.
    b. To reverse the direction of current in the coil every half rotation, ensuring continuous rotation.
    c. To act as a switch to turn the motor on and off.
    d. To reverse the direction of the magnetic field.

6. A student is designing a DC motor. To increase the turning force (torque) on the coil, she should:
    a. Decrease the current in the coil
    b. Use a magnet with a weaker magnetic field.
    c. Decrease the number of turns in the coil.
    d. Increase the area of the coil
7. The direction of the force experienced by a current-carrying conductor placed in a magnetic field is given by:
    a. Ohm's Law
    b. Fleming's Right-Hand Rule
    c. Fleming's Left-Hand Rule
    d. Right-Hand Thumb Rule
8. An AC generator works on the principle of:
    a. The magnetic effect of current.
    b. The force on a current-carrying conductor
    c. The heating effect of current.
    d. Electromagnetic induction
9. A student rapidly pushes the north pole of a bar magnet into a coil of wire connected to a galvanometer. She will observe:
    a. No deflection in the galvanometer.
    b. A momentary deflection in one direction
    c. A steady, constant deflection
    d. A momentary deflection that immediately reverses.
10. According to Lenz's Law, the direction of the induced current is such that it:
    a. Assists the change in magnetic flux that produces it.
    b. Opposes the change in magnetic flux that produces it.
    c. Is always in the clockwise direction.
    d. Is always perpendicular to the magnetic field.
11. To increase the magnitude of the e.m.f. Induced in an AC generator, one should:
    a. Decrease the speed of rotation of the coil.
    b. Use a magnet with a weaker magnetic field.
    c. Decrease the number of turns in the coil.
    d. Increase the area of the coil

12. The main difference in construction between a simple AC generator and a DC generator is the use of:
    a. Slip rings in an AC generator and a split-ring commutator in a DC generator.
    b. A split-ring commutator in an AC generator and slip rings in a DC generator.
    c. A soft iron core in an AC generator and a steel core in a DC generator.
    d. More turns in the coil for a DC generator than for an AC generator.
13. The frequency of the AC supply in India households is 50 Hz. This means the direction of the current reverses:
    a. 50 times in one second.
    b. 100 times in one second
    c. 25 times in one second
    d. Once every 50 seconds.
14. A transformer is a device used to change the magnitude of:
    a. A high DC voltage
    b. A low DC voltage
    c. An alternating voltage.
    d. The frequency of an AC supply
15. A student connects a 12 V DC battery to the primary coil of a set-up transformer, hoping to get a 240 V output. He measures no voltage at the secondary coil. Why?
    a. The battery is not powerful enough.
    b. A transformer requires a changing magnetic flux to induce an e.m.f., and a DC source provides a constant flux.
    c. The turns ratio is incorrect for this conversion
    d. The soft iron core is not laminated.
16. In a step-up transformer, which of the following is true?
    a. The number of turns in the primary coil is greater than in the secondary coil.
    b. The voltage in the secondary coil is less than in the primary coil.
    c. The current in the secondary coil is less than in the primary coil (for an ideal transformer)
    d. It converts AC to DC.

17. An ideal transformer has 200 turns in its primary coil and 1000 turns in its secondary coil. If the primary is connected to a 240 V AC supply, the output voltage will be:
    a. 48 V
    b. 240 V
    c. 1200 V
    d. 2400 V
18. The core of a transformer is made of thin, insulated soft iron sheets (laminated). This is done to:
    a. Make the transformer lighter
    b. Increase the strength of the magnetic field
    c. Reduce energy loss due to eddy currents.
    d. Reduce energy loss due to hysteresis.
19. Which of the following energy conversion is the basis for the working of an electrical transformer?
    a. Electrical to mechanical energy
    b. Mechanical to electrical energy
    c. Electrical to magnetic to electrical energy
    d. Electrical to heat energy
20. A step-down transformer is used for a doorbell. It typically converts the 220 V AC mains supply to a lower voltage like 12 V. In this transformer:
    a. The secondary coil has more turns than the primary coil.
    b. The primary coil has more turns than the secondary coil.
    c. Both coils have an equal number of turns.
    d. The wire used for the secondary coil is thinner than the primary coil.

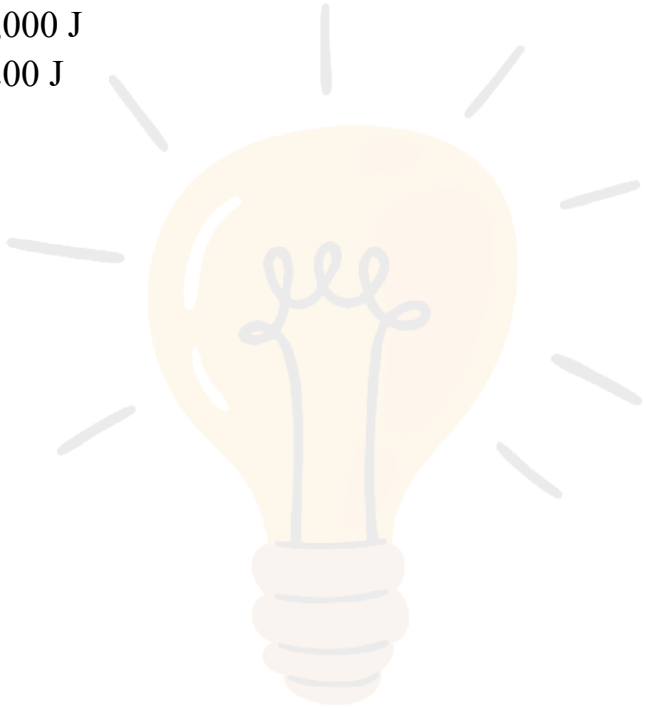
1. A student has a 1 kg block of copper and 1 kg block of lead. Both are heated with the same amount of energy. The temperature of the lead block rises more than the copper block. This is because:
    a. Lead is denser than copper.
    b. Lead has a lower specific heat capacity than copper.
    c. Lead is a better conductor of heat.
    d. Lead has a higher specific heat capacity than copper.
2. The specific heat capacity of water is exceptionally high (4200 J kg^{-1} K^{-1}). This property is responsible for which natural phenomenon?
    a. The rapid heating of land during the day.
    b. The ability of water to act as an effective coolant in car radiators and for moderating coastal climates.
    c. The formation of ice at 0° C.
    d. The boiling of water at 100° C.
3. The heat capacity of a body is 50 J K^{-1}. What does this statement mean?
    a. The body contains 50 J of heat energy.
    b. The body requires 50 J of heat energy to raise its temperature by 1K.
    c. The body gives out 50 J of heat energy when it cools by 50 K.
    d. The specific heat capacity of the body is 50 J kg^{-1} K^{-1}.
4. Two spheres, A and B, are made of the same material and are at the same temperature. Sphere A has twice the mass of sphere B. If both are supplied with the same amount of heat, which statement is correct?
    a. The temperature rise of sphere A will be twice that of B.
    b. The temperature rise of sphere B will be twice that of A.
    c. Both spheres will have the same temperature rise.
    d. The heat capacity of sphere B is greater than A.
5. The S.I. unit of specific heat capacity is:
    a. J K^{-1}
    b. J kg^{-1}
    c. J kg K^{-1}
    d. J kg^{-1} K^{-1}

6. A student claims, “Heat capacity and specific heat capacity are the same thing.” Why is this incorrect?
    a. Heat capacity is for a specific body (depends on mass), while specific heat capacity is for a substance (property of the material).
    b. Heat capacity is measured in Joules, while specific heat capacity is in calories.
    c. Both are the same, the student is correct.
    d. Heat capacity depends on temperature, while specific heat capacity does not.
7. How much heat energy is required to raise the temperature of 2 kg of water from 10° C to 50° C? (Specific heat capacity of water = 4200 J kg^{-1} K^{-1})
    a. 84,000 J
    b. 336,000 J
    c. 420,000 J
    d. 8,400 J
8. The principle of calorimetry, or the method od mixtures, is based on which fundamental law of physics?
    a. Newton’s Law of Cooling
    b. The Law of Conservation of Energy
    c. Ohm’s Law
    d. The Law of Conservation of Momentum
9. A hot solid object is placed in an insulated container of cold water. Heat will flow from the object to the water until:
    a. The object has lost all its heat.
    b. The water has gained as much heat as it can hold.
    c. Both the object and the water reach the same final temperature.
    d. The temperature of the water is twice the temperature of the object.
10. A calorimeter is typically made of a thin sheet of copper because copper has:
    a. High specific heat capacity and is a poor conductor.
    b. High specific heat capacity and is a good conductor.
    c. Low specific heat capacity and is a poor conductor.
    d. Low specific heat capacity and is a good conductor.

11. 100 g of water at 80° C is mixed with 100 g of water at 20° C. Assuming no heat loss, the final temperature of the mixture will be:
    a. 40° C
    b. 50° C
    c. 60° C
    d. 100° C
12. A piece of iron (specific heat capacity ≈ 450 J kg^{-1} K^{-1}) and a piece of aluminium (specific heat capacity ≈ 900 J kg^{-1} K^{-1}) have the same mass. Both are heated to 100 C and then placed on a large block of wax. Which piece will melt more max?
    a. The iron piece, because it is denser.
    b. The aluminum piece, because it contains more heat energy at the same amount of wax.
    c. Both will melt the same amount of wax.
    d. The iron piece, because it has a lower specific heat capacity.
13. During the melting of ice at 0° C, the heat energy supplied is used to:
    a. Increase the average kinetic energy of the water molecules, thus increasing the temperature.
    b. Decrease the potential energy of the molecules.
    c. Increase the potential energy of the molecules to overcome the forces of attraction, while kinetic energy remains constant.
    d. Increase both the kinetic and potential energy of the molecules
14. A burn from steam at 100° C is generally more severe than a burn from boiling water at 100° C. This is because:
    a. Steam is a gas and can penetrate the skin more easily
    b. Steam gives out a large amount of additional energy (latent heat of vaporization) when it condenses on the skin.
    c. Steam has a higher specific heat capacity than water.
    d. The temperature of steam is actually higher than 100°C.

15. What is the meaning of the statement, "The specific latent heat of fusion of ice is 336,000 J/kg"?
    a. 1 kg of ice requires 336,000 J of heat to raise its temperature by 1°C.
    b. 1 kg of ice at 0°C requires 336,000 J of heat to convert into water at 0°C.
    c. 1 kg of water at 0°C releases 336,000 J of heat when its temperature rises.
    d. 1 kg of water at 100°C requires 336,000 J of heat to turn into steam.
16. On a mountain top, water boils at a temperature lower than 100°C. This is because at high altitudes:
    a. The atmospheric pressure is lower.
    b. The atmospheric pressure is higher.
    c. The specific latent heat of vaporization is lower.
    d. The surrounding temperature is colder.
17. A student observes the heating curve for a piece of ice initially at -10°C as it is heated to become steam at 110°C. The graph will show two flat, horizontal plateaus. These plateaus correspond to:
    a. The ice warming up and the steam superheating.
    b. The melting of ice and the boiling of water.
    c. The water warming up and cooling down.
    d. The initial and final temperatures.
18. To cool a drink quickly, it is more effective to add 10 g of ice at 0°C rather than 10 g of water at 0°C. The reason is:
    a. The ice is solid and therefore colder.
    b. The ice has a lower specific heat capacity.
    c. The ice will absorb extra heat from the drink (latent heat of fusion) in order to melt.
    d. The water at 0°C will add heat to the drink.

19. Which of the following processes involves the absorption of latent heat?
    a. Freezing of water
    b. Condensation of steam
    c. Melting of wax
    d. Deposition of frost
20. How much heat is released when 50 g of steam at 100°C condenses to form water at 100°C? (Specific latent heat of vaporization of water = 2260 J/g)
    a. 11,300 J
    b. 22,600 J
    c. 113,000 J
    d. 45,200 J



1. A neutral atom of a radioactive element is represented by $^{238}_{92}U$. The number of protons, neutrons, and electrons in this atom is:
    a. Protons=92, Neutrons = 238 , Electrons=92
    b. Protons = 92 , Neutrons = 146 , Electrons=238
    c. Protons = 92 , Neutrons = 146 , Electrons=92
    d. Protons = 146 , Neutrons=92, Electrons=92
2. Two atoms are represented as $^{35}_{17}Cl$ and $^{37}_{17}Cl$. They have the same number of protons but a different number of neutrons. These two atoms are known as:
    a. Isobars
    b. Isotones
    c. Isotopes
    d. Isomers
3. The nuclei $^{40}_{18}Ar$.and $^{40}_{20}Ca$. have the same mass number but different atomic numbers. They are examples of:
    a. Isotopes
    b. Isobars
    c. Isotones
    d. Allotropes
4. A student claims, "Radioactivity is a chemical process because it involves the change of one element into another." Why is this statement fundamentally incorrect?
    a. Radioactivity does not change one element into another.
    b. Chemical processes involve changes in the electron shells, whereas radioactivity is a nuclear phenomenon involving changes within the nucleus.
    c. Radioactivity is a physical process, not a chemical one.
    d. The student is correct; it is a special type of chemical reaction.
5. A scientist places a radioactive source in a lead block and allows the emissions to pass through an electric field. The radiation that passes through undeflected is:
    a. Alpha radiation
    b. Beta radiation
    c. Gamma radiation
    d. Both Alpha and Beta radiation

6. Which of the following radioactive emissions has the highest ionizing power, causing the most intense biological damage over a very short distance?
    a. Alpha particles
    b. Beta particles
    c. Gamma rays
    d. X-rays
7. A radioactive source is placed in a container. To effectively block all three types of radiation (α, β, and y), the container must be made of a thick sheet of:
    a. Paper
    b. Aluminum
    c. Lead
    d. Glass
8. An alpha particle is identical to the:
    a. Nucleus of a hydrogen atom.
    b. Nucleus of a helium atom.
    c. A high-energy electron.
    d. A neutral helium atom.
9. When an alpha particle is emitted from a nucleus, the mass number of the nucleus:
    a. Decreases by 2
    b. Decreases by 4
    c. Increases by 2
    d. Remains unchanged
10. When a beta particle is emitted from a nucleus, a neutron inside the nucleus is converted into:
    a. Two protons
    b. A proton and an electron
    c. Two electrons
    d. An alpha particle

11. A radioactive nucleus X emits an alpha particle to become a new nucleus Y. The correct nuclear equation is:
    a. ${}^{A}_{Z}X \rightarrow {}^{A}_{Z^{-2}}Y + {}^{4}_{2}He$
    b. ${}^{A}_{Z}X \rightarrow {}^{A-4}_{Z^{-2}}Y + {}^{4}_{2}He$
    c. ${}^{A}_{Z}X \rightarrow {}^{A-2}_{Z^{-4}}Y + {}^{4}_{2}He$
    d. ${}^{A}_{Z}X \rightarrow {}^{A}_{Z}Y + {}^{0}_{-1}e$
12. The nucleus of Radium-226 (${}^{226}_{88}$ Ra) decays by alpha emission. The resulting daughter nucleus is:
    a. ${}^{222}_{86}Rn$ (Radon)
    b. ${}^{226}_{89}Ac$ (Actinium)
    c. ${}^{226}_{88}Ra$ (Radium)
    d. ${}^{222}_{88}Ra$ (Radium)
13. The nucleus of Carbon-14 (${}^{14}_{6}C$) undergoes beta decay. The daughter nucleus formed is:
    a. ${}^{14}_{5}B$ (Boron)
    b. ${}^{14}_{7}N$ (Nitrogen)
    c. ${}^{13}_{6}C$ (Carbon)
    d. ${}^{12}_{4}Be$ (Beryllium)
14. A nucleus has 90 protons and 144 neutrons. It undergoes one alpha decay followed by one beta decay. The final nucleus will have:
    a. 89 protons and 141 neutrons
    b. 89 protons and 142 neutrons
    c. 88 protons and 142 neutrons
    d. 88 protons and 140 neutrons
15. Following a radioactive decay, the nucleus is left in an excited state. It returns to its ground state by emitting:
    a. An alpha particle
    b. A beta particle
    c. A gamma ray
    d. A proton

16. A doctor uses a radioisotope to treat a cancerous tumor deep inside a patient's body. Which type of radiation would be most suitable for this purpose? a)
    a. Alpha particles, due to their high ionizing power. b)
    b. Beta particles, as they have a medium range. c)
    c. Gamma rays, due to their high penetrating power. d)
    d. The choice of radiation does not matter.
17. Archaeologists use the radioactive isotope Carbon-14 to determine the age of ancient organic remains. This process is known as: a)
    a. Isotopic dating b)
    b. Nuclear imaging c)
    c. Radiotherapy d)
    d. Radiocarbon dating
18. A student argues that since alpha particles are stopped by a sheet of paper, they are completely harmless. The danger of alpha radiation is greatest when: a)
    a. The source is far away from the body. b)
    b. The source is inhaled or ingested, causing intense internal damage to cells. c)
    c. The source is shielded by lead. d)
    d. The student's argument is correct; alpha particles are harmless.
19. The process where a heavy nucleus like Uranium-235 splits into lighter nuclei upon being struck by a neutron, releasing a tremendous amount of energy, is called: a)
    a. Nuclear fusion b)
    b. Nuclear fission c)
    c. Beta decay d)
    d. Alpha decay
20. The immense energy of the Sun and other stars is generated by a process in which light nuclei (like hydrogen) combine to form heavier nuclei (like helium). This process is known as: a)
    a. Nuclear fission b)
    b. Nuclear fusion c)
    c. Spontaneous decay d)
    d. A chain reaction

1. Force

1. b) 30 N m
2. d) At the handle, which is farthest from the hinge.
3. a) 1 m to the right of the fulcrum
4. c) The sum of clockwise moments about a point equals the sum of anticlockwise moments about the same point.
5. b) Rotation is always produced by a pair of forces (a couple), consisting of the applied force and the reaction force at the pivot.
6. b) A couple
7. a) 25 gf at the 80 cm mark
8. d) Joule
9. c) the 50 cm mark
10. c) The solid cone has a lower centre of gravity.
11. a) The centre of gravity is always at the geometric center, which for a doughnut is in the hole.
12. b) As low as possible
13. b) To shift the combined centre of gravity of the person-bucket system back over the base of support (their feet).
14. c) The car's velocity is continuously changing because its direction is changing.
15. c) Fly off along a tangent to the circular path at that instant.
16. a) Centripetal force is real and acts towards the center; centrifugal force is a fictitious force that appears to act outwards for an observer in the rotating frame.
17. b) The gravitational force of attraction between the Earth and the sun.
18. b) The inertia of the water droplets, which tend to continue in a straight line while the drum turns.
19. c) The force of friction between the tires and the road.
20. b) Acceleration is the rate of change of velocity, and since the direction of velocity is constantly changing, there must be an acceleration.

2. Work, Energy and Power

1. d) 0 J
2. b) 225 J
3. b) Negative
4. c) There is no displacement of the bag, so work done is zero.
5. c) Motor A has more power than B.
6. c) 5000 W
7. d) 3.6×10^6 J
8. c) Four times
9. a) Increase
10. b) The heavy truck
11. c) Elastic potential energy
12. b) $p^2/2m$
13. c) 40 J
14. c) The total mechanical energy (KE + PE)
15. b) At a height of 5 m
16. c) The vertical height of the hill
17. b) Gravitational potential energy of water to electrical energy
18. b) Some of the mechanical energy is converted into heat and sound.
19. c) C (lowest point)
20. b) The kinetic energy is not destroyed; it is converted into thermal energy (heat) in the brakes and tires.

3. Machines

1. b) Speed multiplier, Class I lever
2. b) 5
3. c) Always much greater than the weight of the book.
4. b) The wheelbarrow (Class II) is a force multiplier, but the thongs (Class III) are a speed multiplier.
5. c) Mechanical Advantage = Velocity Ratio
6. c) A nutcracker
7. b) 3
8. c) Class III
9. b) Some energy is always lost in overcoming friction and the weight of moving parts.
10. b) Mechanical Advantage is greater than 1
11. c) Changes the direction of effort to a more convenient one.
12. c) 100 N
13. c) 80 %
14. d) 5
15. c) 4 m
16. b) in a real system, the effort must also overcome friction and the weight of the movable pulley, making the MA less than 2.
17. d) A block and tackle with 3 fixed and 2 movable pulleys.
18. c) 3
19. b) 250 N
20. b) 2

4. Refraction of light

1. d) Frequency
2. c) the refractive index of medium B is greater than that of medium A.
3. b) Light travels 2.42 times slower in diamond than in air.
4. d) The area of the glass slab's surface.
5. b) $\mu = \sin(60°) / \sin(35°)$
6. b) violet, because it travels slowest in the glass.
7. b) The ray passes parallel to the base of the prism.
8. b) The flint glass prism will produce more deviation.
9. c) Dispersion
10. a) Taller than his actual height.
11. a) 12 cm
12. d) Violet light
13. d) Thicker and bent at the water surface.
14. c) Light must travel from a denser medium to a rarer medium.
15. c) Brilliance and sparkle
16. d) 42°
17. c) a single total internal reflection.
18. a) Mirrors absorb a significant amount of light, while TIR reflects nearly 100% of the incident light.
19. c) Total internal reflection
20. c) Total internal Reflection

5. Refraction through a Lens

1. b) Concave or diverging lens
2. c) Pass through undeviated.
3. c) Lens A has a shorter focal length and higher power.
4. d) Diverging (Concave) lens.
5. a) Between the optical centre and the principle focus (F_1).
6. b) Real, inverted, and highly diminished.
7. c) At $2F_2$
8. b) Concave lens to diverge the rays before they enter the eye.
9. a) Concave
10. b) Convex lens forming a real, inverted, and magnified image.
11. c) A complete image will be formed, but its brightness will be reduced.
12. c) Directed towards the first principal focus (F_1).
13. c) The focal length of a convex lens.
14. a) Real, Inverted, and the same size as the object.
15. b) Concave lens of focal length 40 cm.
16. b) It is virtual, erect, and three times the size of the object.
17. c) A convex lens forms a virtual image (with a negative v) when the object is placed within its focal length.
18. c) At 40 cm from the lens
19. b) Degree of convergence or divergence of light rays.
20. c) The second principal focus (F_2)

6. Spectrum

1. c) First decreases, reaches a minimum, and then increases.
2. d) The angle of emergence (e)
3. d) The size and weight of the prism
4. b) 45°
5. a) The flint glass prism will cause a greater deviation.
6. a) the refractive index of the prism material is highest for violet light.
7. b) $\delta = A (\mu - 1)$
8. b) Travels parallel to the base of the prism.
9. b) 26°
10. b) Decrease
11. d) Gamma rays
12. b) Infrared (IR) rays
13. b) X-rays
14. c) A thermometer with a blackened bulb.
15. c) Frequency
16. b) Glass absorbs ultraviolet (UV) and infrared (IR) radiation.
17. c) They can be deflected by electric and magnetic fields.
18. c) Ultraviolet radiation from the sun.
19. c) Microwaves
20. c) Gamma < Ultraviolet < Infrared < Microwaves.

7. Sound

1. c) The reflected sound will return in less than 0.1 seconds, overlapping with the original sound.
2. b) 2250 m
3. c) Ultrasonic
4. c) Reverberation
5. c) The reflecting surface must be at a sufficient distance from the source.
6. c) Forced vibrations
7. b) Damped vibration
8. a) The frequency of their meaning marching the natural frequency of the bridge, causing resonance and potentially large, dangerous oscillations.
9. d) Resonance
10. b) Pendulum C
11. c) Forced Vibrations
12. c) Exactly equal to the natural frequency of the body.
13. a) Pluck the string with greater force.
14. d) Frequency
15. c) Quality (or Timbre)
16. b) Higher frequency
17. c) Increase the tension in the string.
18. b) Sound A is louder but has the same pitch as B
19. b) The presence and relative intensity of overtones (harmonics).
20. a) Intensity is objective (energy / area / time), while loudness is a subjective sensation that also depends on the listener's ear sensitivity.

8. Current Electricity

1. c) Free electrons
2. d) Ohm's Law
3. b) Potential difference to current (V/I)
4. a) A thick wire has a larger cross- sectional area, providing more paths for electrons and thus lower resistance.
5. c) The nature of the material and its temperature.
6. b) 10Ω
7. d) Less than 4 Ω
8. c) Potential difference (Voltage)
9. c) Two in parallel, connected in series with the third.
10. c) Each appliance receives the full mains voltage and can be operated independently.
11. c) Electromotive force (e.m.f.)
12. c) Work has to be done to move the charge through the cell's own internal resistance.
13. a) 0.2 A
14. d) Use over a long period of time (as the cell gets old).
15. a) The energy consumed by the bulb in one second when connected to a 220 V supply
16. b) The 60 W bulb
17. c) ₹50
18. b) Square of the current (I^2)
19. b) The kettle draws a much higher current and requires a fuse with a higher current rating.
20. b) Bulb B (10 W) will glow brighter.

9. Household Circuits

1. b) To reduce the loss of energy as heat in the transmission wires.
2. b) Parallel, so that each appliance gets the full mains voltage and can operate independently.
3. b) Brown, Light Blue, Green-and-Yellow
4. d) Disconnects both the live and neutral wires simultaneously, ensuring complete safety.
5. c) Earth pin
6. b) It ensures that the earth connection is made first before the live connection, providing safety.
7. b) It allows current to reach an appliance through two separate paths, enabling the use of thinner cheaper wire for the main ring.
8. c) Operated (switched on or off) independently from either switch.
9. b) Heating effect of current.
10. c) Low melting point and high resistance.
11. c) Even when the switch is off, the appliance remains connected to the high potential live wire, making it unsafe to handle.
12. d) Protect the user from an electric shock if the live wire accidentally touches the metallic body.
13. b) The live wire and the neutral wire come into direct contact.
14. d) 15 A
15. c) A Miniature Circuit Breaker (MCB)
16. a) Thicker than the 5 A wire.
17. c) The current draw from the mains exceeds the safe limit of the wiring, often by connecting too many appliances to one socket.
18. c) Live wire, before the switch and the appliance.
19. b) the neutral wire
20. b) The person's body provides a path for the current to flow from the high-potential casing to the earth.

10. Electromagnetism

1. c) Magnetic effect of current
2. c) Replacing the soft iron with a steel
3. a) Clockwise concentric circles. (By Right-Hand Thumb Rule).
4. b) Electrical energy into mechanical energy.
5. b) To reverse the direction of current in the coil every half rotation, ensuring continuous rotation.
6. d) Increase the area of the coil
7. c) Fleming's Left-Hand Rule
8. c) Electromagnetic induction
9. b) A momentary deflection in one direction.
10. b) Opposes the change in magnetic flux that produces it.
11. d) Increase the area of the coil
12. a) Slip rings in an AC generator and a split-ring commutator in a DC generator.
13. b) 100 times in one second. (All full cycles have two reversals, so 50 cycles/sec means 100 reversals sec).
14. c) An alternating voltage
15. b) A transformer requires a changing magnetic flux to induce an e.m.f., and a DC source provides a constant flux.
16. c) The current in the secondary coil is less than in the primary coil (for an ideal transformer).
17. c) 1200 V
18. c) Reduce energy loss due to eddy currents.
19. c) Electrical to magnetic to electrical energy.
20. b) The primary coil has more turns than the secondary coil.

11. Calorimetry

1. b) Lead has a lower specific heat capacity than copper.
2. b) The ability of water to act as an effective coolant in car radiators for moderating coastal climates.
3. b) The body requires 50 J of heat energy to raise its temperature by 1 K.
4. b) The temperature rise of sphere B will be twice that of A.
5. d) J kg^{-1} K^{-1}
6. a) Heat capacity is for a specific body (depends on mass), while specific heat capacity is for a substance (property of the material).
7. b) 336,000 J
8. b) The Law of Conservation of Energy
9. c) Both the object and the water reach the same final temperature.
10. d) Low specific heat capacity and is good conductor.
11. b) 50°C
12. b) The aluminium piece, because it contains more heat energy at the same temperature.
13. c) Increase the potential energy of the molecules to overcome the forces of attraction, while the kinetic energy remains constant.
14. b) Steam gives out a large amount of additional energy (latent heat of vaporization) when it condenses on the skin.
15. b) 1 kg of ice at 0°C requires 336,000 of heat to convert into water at 0°C.
16. a) The atmospheric pressure is lower.
17. b) The melting of ice and the boiling of water.
18. c) The ice will absorb extra heat from the drink (latent heat of fusion) in order to melt.
19. c) Melting of wax
20. c) 113,000 J

12. Radioactivity

1. c) Protons = 92, Neutrons = 146, Electrons = 92
2. c) Isotopes
3. b) Isobars
4. b) Chemical processes involve changes in the electron shells, whereas radioactivity is a nuclear phenomenon involving changes within the nucleus.
5. c) Gamma radiation
6. a) Alpha particles
7. c) Lead
8. b) Nucleus of a helium atom.
9. b) Decreases by 4
10. b) A proton and an electron
11. b) ${}^{A}zX \rightarrow {}^{A-4}z^{-2}Y + {}^{4}_{2}He$
12. a) ${}^{222}_{86}Rn$ (Radon)
13. b) ${}^{14}_{7}N$ (Nitrogen)
14. a) 89 protons and 141 neutrons
15. c) A gamma ray
16. c) Gamma rays, due to their high penetrating power.
17. d) Radiocarbon dating
18. b) The source is inhaled or ingested, causing intense internal damage to cells.
19. b) Nuclear fission
20. b) Nuclear fusion