



TM

JEE | NEET | Foundation

NSEJS 2022

Detailed Solutions & Final Answer Key

PAPER CODE 51

TIME

120 minutes

QUESTIONS

60

MAX. MARKS

216

PAPER CODE 51

Questions 45-48 and 54-57 are marked DROPPED in the final key.

FINAL ANSWER KEY

DROP means that the question is not to be evaluated.

QUESTION N	ANSWER	QUESTION N	ANSWER
1	D	31	A
2	B	32	D
3	C	33	B
4	A	34	C
5	A	35	A
6	A	36	A
7	B	37	B
8	B	38	C
9	C	39	C
10	C	40	B
11	C	41	C
12	D	42	C
13	A	43	C
14	C	44	D
15	C	45	DROP
16	A	46	DROP
17	D	47	DROP
18	B	48	DROP
19	B	49	B, D
20	C	50	A, B, C
21	A	51	A, B, D
22	C	52	B, D
23	B	53	B, C, D
24	D	54	DROP
25	C	55	DROP
26	C	56	DROP
27	A	57	DROP
28	C	58	A, C
29	C	59	A, B, C
30	B	60	B, C

Dropped questions: 45, 46, 47, 48, 54, 55, 56 and 57. Each corresponding solution entry records that the question is dropped and must not be scored.

BIOLOGY

Detailed explanations, calculations and option-wise reasoning.

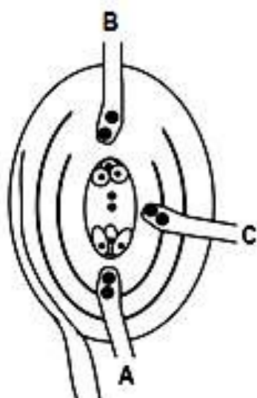
Question 1 Answer: D

Plant Growth and Development

Bakanae disease causes abnormal elongation of rice seedlings. The fungus produces growth-promoting substances that led scientists to identify gibberellins. Hence the correct answer is (d) Gibberellin.

Question 2 Answer: B

Sexual Reproduction in Flowering Plants



Entry through the micropyle is porogamy; entry through the chalazal end is chalazogamy; and entry through the side or integuments is mesogamy. In the figure, A is at the micropyle, B is at the chalaza and C enters from the side. Therefore A-Porogamy, B-Chalazogamy and C-Mesogamy: (b).

Question 3 Answer: C

Anatomy of Flowering Plants

Cucurbits characteristically possess bicollateral vascular bundles, in which phloem occurs on both the outer and inner sides of xylem. This provides a well-developed conducting arrangement for movement of photosynthates to rapidly growing fruits. Correct answer: (c).

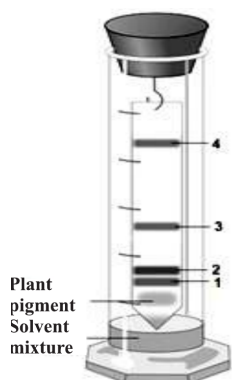
Question 4 Answer: A

Principles of Inheritance

This is the classic incomplete-dominance pattern of Andalusian fowl. Let BB = black, bb = white and Bb = blue. Selfing Bb x Bb gives BB : Bb : bb = 1 : 2 : 1, that is 1 black : 2 blue : 1 white. Correct answer: (a).

Question 5 Answer: A

Photosynthesis in Higher Plants



In paper chromatography, pigments move according to their solubility in the solvent and attraction to the paper. From the least mobile band upward, the usual order is chlorophyll b, chlorophyll a, xanthophylls/carotenols, and carotenes. Thus the correct choice is (a).

Question 6 Answer: A

Cell: Structure and Function

Glyoxysomes are specialised microbodies containing enzymes of the glyoxylate cycle. In germinating oil seeds, they help convert stored fats into carbohydrates that the seedling can use. Correct answer: (a).

Question 7 Answer: B

Microbes and Water Quality

E. coli normally inhabits the intestine of humans and other warm-blooded animals. Its presence in water therefore indicates contamination by faecal matter and possible presence of disease-causing organisms. Correct answer: (b).

Question 8 Answer: B

Environmental Science

Most freshwater organisms survive best in water that is close to neutral. The range 6.5-7.5 provides a comparatively stable environment for enzymes, respiration and ion balance. Strongly acidic or alkaline water harms many species. Correct answer: (b).

Question 9 Answer: C

Chemical Coordination and Integration

Estradiol is the principal and most biologically active estrogen during the reproductive years. Estrone and estriol are generally less potent, while estrane is a parent hydrocarbon name rather than the required ovarian hormone. Correct answer: (c).

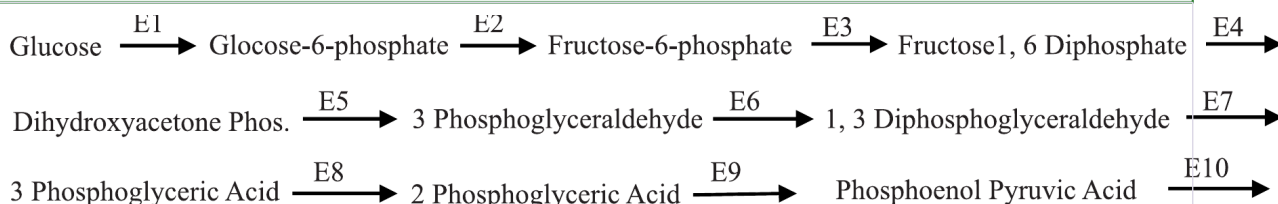
Question 10 Answer: C

Locomotion and Movement

The five sacral vertebrae fuse to form the sacrum, which articulates with the hip bones and forms the posterior part of the pelvis. Correct answer: (c) Sacral.

Question 11 Answer: C

**Respiration in Plants /
Cellular Respiration**



ATP is formed directly at two glycolytic steps: 1,3-bisphosphoglycerate to 3-phosphoglycerate, catalysed by phosphoglycerate kinase, and phosphoenolpyruvate to pyruvate, catalysed by pyruvate kinase. These correspond to E7 and E10. Correct answer: (c).

Question 12 Answer: D

**Neural Control and
Coordination**

The corpus callosum is a broad band of myelinated nerve fibres connecting the left and right cerebral hemispheres. It allows information to pass between them. Correct answer: (d).

Question 13 Answer: A

Biological Classification

Giardia has a characteristically bilaterally symmetrical, pear-shaped body with paired structures. The other choices do not represent the intended example of bilateral symmetry. Correct answer: (a).

Question 14 Answer: C

Neural Tissue

Nissl bodies are groups of rough endoplasmic reticulum and ribosomes found in the cell body and dendrites of neurons. They are involved in protein synthesis. Correct answer: (c).

Question 15 Answer: C

Viruses and Viroids

Viruses are obligate intracellular parasites. A virion has no independent metabolic or protein-synthesising machinery and therefore cannot replicate autonomously outside a host cell. Correct answer: (c).

Question 16 Answer: A

**Taxonomy and
Systematics**

Linnaeus classified plants mainly by the number and arrangement of stamens and carpels. Because only a few selected characters were used, it is an artificial system. Correct answer: (a).

Question 49 Answer: B, D

Evolution

Homo habilis and Homo heidelbergensis are placed among prehistoric humans in the classification intended by the paper. Ramapithecus is treated as an earlier hominid stock, while Homo sapiens fossilis is grouped with early modern humans. Correct options: (b) and (d).

Question 50 Answer: A, B, C

Human Nutrition

Beri-beri is linked to B_1 deficiency and pellagra to B_3 . Wernicke-Korsakoff syndrome is mainly due to B_1 deficiency, and several B-vitamin deficiencies cause dermatitis. Cheilosis is associated especially with B_2 , while pernicious anaemia results from B_{12} deficiency/absorption failure. Marasmus and kwashiorkor are protein-energy malnutrition. Correct options: (a), (b) and (c).

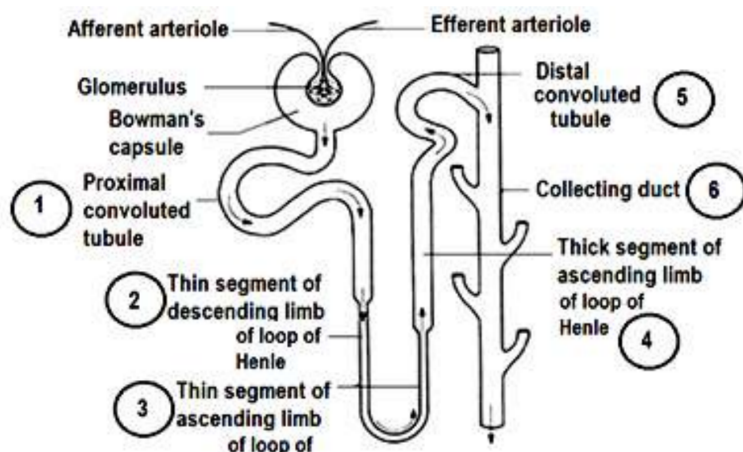
Question 51 Answer: A, B, D

Plant Kingdom

The organisms in (a), (b) and (d) include freshwater algae and floating or aquatic plants commonly found in ponds. The group in (c) is dominated by terrestrial bryophytes, a pteridophyte and a gymnosperm, so it is not a pond assemblage. Correct options: (a), (b) and (d).

Question 52 Answer: B, D

Excretory Products and Their Elimination



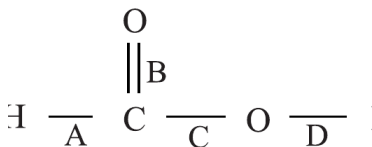
Part 1 is the proximal convoluted tubule. Its cuboidal/columnar epithelial cells possess a dense brush border for extensive reabsorption, so (b) is correct. The thin descending and ascending limbs and the collecting duct (2, 3 and 6) are the segments highlighted in the question for their contrasting or regulated water permeability, so (d) is also selected. Correct options: (b) and (d).

CHEMISTRY

Detailed explanations, calculations and option-wise reasoning.

Question 17 Answer: D

Acids, Bases and
Chemical Bonding



Methanoic acid donates the hydrogen attached to oxygen. Thus the O-H bond labelled D breaks heterolytically, producing H^+ (more correctly H_3O^+ in water) and the formate ion. Correct answer: (d).

Question 18 Answer: B

Chemical Diversity and
Valency

The final official key uses the intended broad order $\text{H} > \text{C} > \text{Co} > \text{Cl}$, written as $\text{N}_1 > \text{N}_2 > \text{N}_4 > \text{N}_3$. Hydrogen and carbon occur in an exceptionally large variety of compounds, while cobalt also shows extensive oxidation-state and coordination chemistry in the comparison intended by the question. Correct answer: (b).

Question 19 Answer: B

Structure of Atom /
Nuclear Chemistry

Lead has stable nuclides, including very heavy ^{208}Pb . Bismuth-209 is now known to be radioactive, although its half-life is extremely long; technetium and neptunium have no stable isotopes. Correct answer: (b) Lead.

Question 20 Answer: C

Solutions and Mole
Concept

Take 1 mol of the original solution: 0.2 mol urea has mass 12 g and 0.8 mol water has mass 14.4 g, so 26.4 g solution contains 0.2 mol urea. In 1000 g, urea = 7.576 mol. After dilution to 5000 g, water mass = 4545.5 g = 252.5 mol. Therefore $x_{\text{urea}} = 7.576 / (7.576 + 252.5) = 0.029$. Correct answer: (c).

Question 21 Answer: A

States of Matter

By Graham's law, $r(\text{CH}_4)/r[\text{Ni}(\text{CO})_x] = \sqrt{(M_{\text{compound}}/16)} = 3.24$. Hence $M_{\text{compound}} = 16(3.24)^2 \approx 168$. Now $58.7 + 28x \approx 168$, giving $x \approx 3.90$. The known compound is $\text{Ni}(\text{CO})_4$. Correct answer: (a).

Question 22 Answer: C

Chemical Bonding

For complete charge separation, $\mu_{\text{ionic}} = er = (1.602 \times 10^{-19})(1.596 \times 10^{-10}) = 2.557 \times 10^{-29}$ C m. Percentage ionic character = $(1.964/2.557) \times 100 = 76.8\%$. Correct answer: (c).

Question 23 Answer: B

Stoichiometry and Neutralisation

Each carbonate consumes one mole of H_2SO_4 . Let x g be MgCO_3 . Then $x/84 + (2-x)/100 = 2/98$. Solving gives $x \approx 0.214$ g. Thus percentage $\text{MgCO}_3 = (0.214/2) \times 100 \approx 10.7\%$, or about 11%. Correct answer: (b).

Question 24 Answer: D

Redox Reactions

Toluene is neutral. Hydrogen bonded to carbon is assigned +1. If S is the sum of oxidation states of all seven carbon atoms, then $S + 8(+1) = 0$, so $S = -8$. Correct answer: (d).

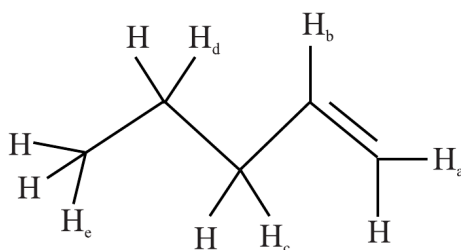
Question 25 Answer: C

Redox and Special Compounds

The compound is best written as $[\text{O}_2]^+[\text{PtF}_6]^-$. The dioxygen unit carries a total charge +1, so the average oxidation state of each oxygen atom is +1/2. Correct answer: (c).

Question 26 Answer: C

Hydrocarbons and Free-Radical Reactions



Bromination is highly selective and favours removal of the hydrogen that gives the most stable radical. Abstraction of H_c forms a tertiary allylic radical, stabilised both by substitution and resonance with the adjacent double bond. Therefore H_c is removed most readily. Correct answer: (c).

Question 27 Answer: A

Hydrocarbons

The degree of unsaturation is $(2C + 2 - H)/2 = (22 - 16)/2 = 3$. One triple bond uses 2 degrees and one ring uses 1, so that combination is possible. Three double bonds also use 3. Two triple bonds require 4 degrees and are impossible. Correct answer: (a).

Question 28 Answer: C

Surface Chemistry

Palladium can absorb/adsorb a very large volume of hydrogen, which occupies interstitial sites in its metal lattice. This property is used in hydrogen purification and catalysis. Correct answer: (c).

Question 29 Answer: C

Coordination Chemistry

In VO_4^{3-} , vanadium is +4 with configuration d^1 . The unpaired electron makes it paramagnetic, and d-level transitions give colour. Cr(VI) and Ti(IV) are d^0 , while Cu(I) is d^{10} ; these are diamagnetic. Correct answer: (c).

Question 30 Answer: B

Organic Reactions and Gas Analysis

On dehydration, HCOOH gives CO , while oxalic acid gives $\text{CO} + \text{CO}_2$. Let their moles be x and y . Total gas = $x + 2y$; KOH absorbs only y mole of CO_2 . Thus $y/(x + 2y) = 1/6$, giving $x = 4y$. The ratio is 4:1. Correct answer: (b).

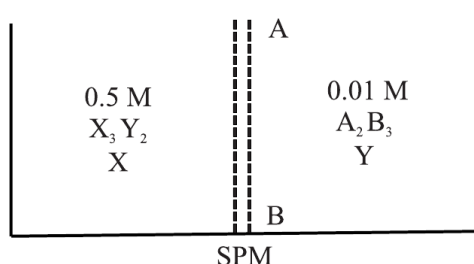
Question 31 Answer: A

Structure of Atom

For a one-electron hydrogen atom, energy depends only on the principal quantum number n : $E_n = -13.6/n^2$ eV. Therefore 3s, 3p and 3d are degenerate and all lie above 2s. Correct answer: (a).

Question 32 Answer: D

Solutions and Osmosis



A semipermeable membrane permits solvent molecules to cross but not the solute ions. Water moves toward the side of higher osmotic pressure, but X_3Y_2 and A_2B_3 never come into contact. Therefore the colour-forming reaction does not occur on either side. Correct answer: (d).

Question 53 Answer: B, C, D

Ionic Equilibrium

NH_4Cl dissociates completely, so chloride remains approximately 0.01 M; option (a) is false. NH_4^+ hydrolyses slightly, making its equilibrium concentration a little below 0.01 M. The solution is acidic, so $\text{pH} < 7$, $\text{pOH} > 7$ and $[\text{H}^+] > 10^{-7}$ M. Correct options: (b), (c) and (d).

Question 54 Answer: DROPPED

Metallurgy of Aluminium

Official status: DROPPED. The IAPT final answer key for Paper Code 51 does not assign a correct option to this question. It must not be scored. The official document does not state a reason, so no reason is inferred here.

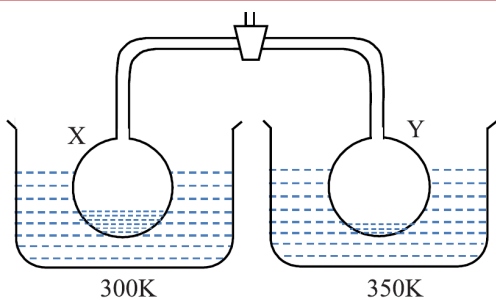
Question 55 Answer: DROPPED

Periodicity

Official status: DROPPED. The IAPT final answer key for Paper Code 51 does not assign a correct option to this question. It must not be scored. The official document does not state a reason, so no reason is inferred here.

Question 56 Answer: DROPPED

**States of Matter -
Vapour Pressure**



Official status: DROPPED. The IAPT final answer key for Paper Code 51 does not assign a correct option to this question. It must not be scored. The official document does not state a reason, so no reason is inferred here.

PHYSICS

Detailed explanations, calculations and option-wise reasoning.

Question 33 Answer: B

Work, Energy and Power

Power is the rate of increase of kinetic energy: $P = dK/dt$. Starting from rest, $K = Pt = 1.5t$. Setting $K = 15$ J gives $t = 15/1.5 = 10$ s. Correct answer: (b).

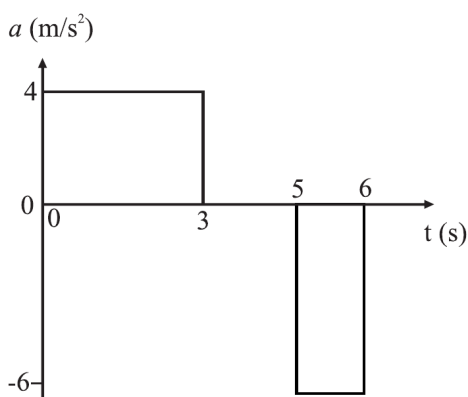
Question 34 Answer: C

Linear Momentum and Variable Mass

The initial speed is $36 \text{ km/h} = 10 \text{ m/s}$. The leaking sand has the same horizontal velocity as the trolley at the instant it leaves; there is no horizontal external force or backward jet effect. Hence the trolley's horizontal speed remains 10 m/s . Correct answer: (c).

Question 35 Answer: A

Kinematics



From 0-3 s, $a = 4 \text{ m/s}^2$, so $v = 12 \text{ m/s}$ and displacement $= \frac{1}{2} \times 4 \times 3^2 = 18 \text{ m}$. From 3-5 s, displacement $= 12 \times 2 = 24 \text{ m}$. From 5-6 s, $a = -6$, so final $v = 6 \text{ m/s}$ and displacement $= (12 + 6)/2 \times 1 = 9 \text{ m}$. Total displacement $= 18 + 24 + 9 = 51 \text{ m}$. Correct answer: (a).

Question 36 Answer: A

Gravitation

Initial energy is $-GM^2/d$. At separation $d/2$, potential energy is $-2GM^2/d$. The increase in total kinetic energy is GM^2/d . Since both stars have speed v , total kinetic energy is $2(\frac{1}{2} Mv^2) = Mv^2$. Thus $v = \sqrt{GM/d}$. Correct answer: (a).

Question 37 Answer: B

Sound and Relative Motion

The train speed is 20 m/s . During the complete echo time t , sound covers the initial 700 m to the cliff plus the decreasing return distance $700 - 20t$. Hence $330t = 700 + (700 - 20t)$, so $350t = 1400$ and $t = 4.00 \text{ s}$. Correct answer: (b).

Question 38 Answer: C

Mechanical Properties of Fluids

At equilibrium, weight equals the sum of buoyant forces: $\rho_s Vg = \rho_1 (V/2)g + \rho_2 (V/2)g$. Therefore $\rho_s = (0.8 + 13.6)/2 = 7.2 \text{ g/cm}^3$. Correct answer: (c).

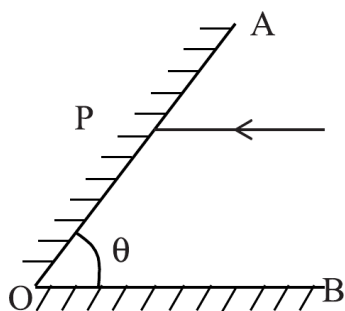
Question 39 Answer: C

Motion under Gravity and Buoyancy

It takes $\sqrt{2h/g} = \sqrt{(39.2/9.8)} = 2$ s to reach the water with speed 19.6 m/s. In water, buoyancy is twice the weight, so the net acceleration is g upward. It takes 2 s to stop while descending and 2 s to return to the surface, then 2 s to rise to the original height. Total = $2 + 2 + 2 = 8$ s. Correct answer: (c).

Question 40 Answer: B

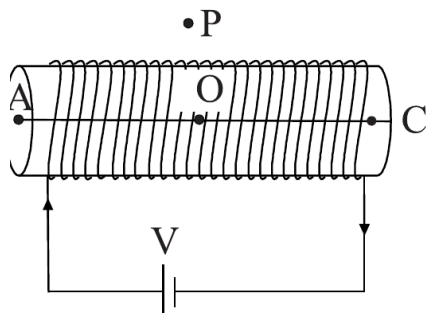
Ray Optics



Let OB be at 0 degrees and OA at θ . Reflection in a line changes a direction angle ϕ to $2\alpha - \phi$. The incident ray has direction 180 degrees. After reflection at OA and then OB, its direction becomes $180 - 2\theta$. For the final ray to be parallel to OA, $180 - 2\theta = \theta$, giving $\theta = 60$ degrees. Correct answer: (b).

Question 41 Answer: C

Magnetic Effects of Current



Inside a long solenoid, the field is strong and nearly uniform; at an open end it is approximately half the central value, and outside it is very weak. Therefore the maximum among the labelled points is at O, the centre. Correct answer: (c).

Question 42 Answer: C

Mechanical Properties of Fluids

At the door, the pressure difference is $\Delta p = (1.8 - 1.0)(1000)(9.8)(5.0) = 39200$ Pa. Door area = $10 \text{ cm}^2 = 1.0 \times 10^{-3} \text{ m}^2$. Hence $F = \Delta p A = 39200 \times 10^{-3} = 39.2$ N, approximately 39 N. Correct answer: (c).

Question 43 Answer: C

Moving Charges and Magnetism

Take east as $+x$ and north as $+y$. For an electron, $F = q(v \times B)$ is opposite to $v \times B$. To make the force $+y$, $v \times B$ must be $-y$. Since $+x \times +z = -y$, the field must be upward ($+z$). Correct answer: (c).

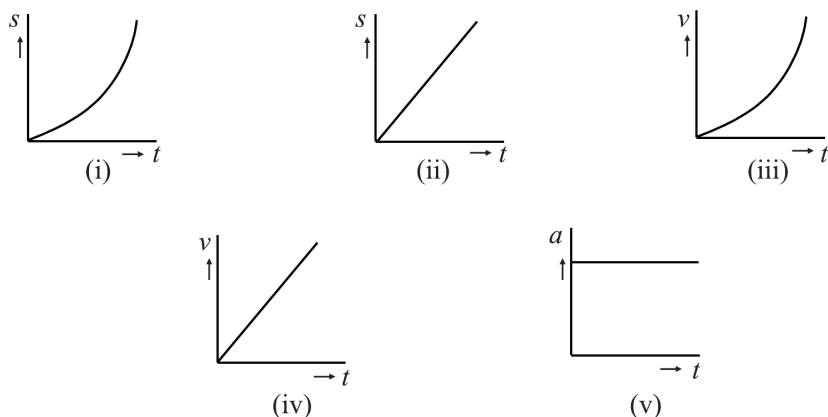
Question 44 Answer: D

Light and Matter

In the Raman effect, scattered photons have frequencies slightly different from the incident light because energy is exchanged with molecular vibrations or rotations. It is therefore inelastic scattering of light. Correct answer: (d).

Question 45 Answer: DROPPED

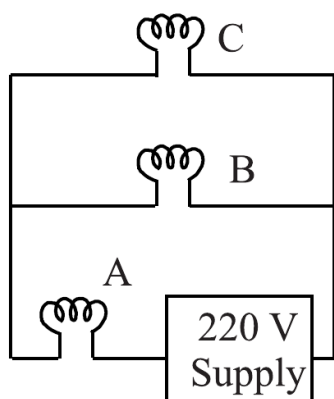
Kinematics - Motion Graphs



Official status: DROPPED. The IAPT final answer key for Paper Code 51 does not assign a correct option to this question. It must not be evaluated or included in the score. The concept remains useful for practice, but no option is presented here as the official answer.

Question 46 Answer: DROPPED

Current Electricity



Official status: DROPPED. The IAPT final answer key for Paper Code 51 does not assign a correct option to this question. It must not be evaluated or included in the score. The concept remains useful for practice, but no option is presented here as the official answer.

Question 47 Answer: DROPPED

Current Electricity

Official status: DROPPED. The IAPT final answer key for Paper Code 51 does not assign a correct option to this question. It must not be evaluated or included in the score. The concept remains useful for practice, but no option is presented here as the official answer.

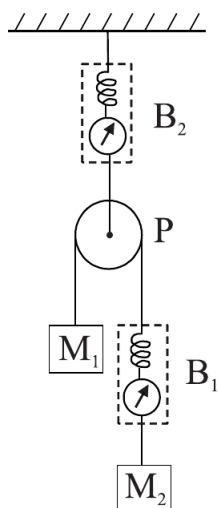
Question 48 Answer: DROPPED

Sound Waves and Measurement

Official status: DROPPED. The IAPT final answer key for Paper Code 51 does not assign a correct option to this question. It must not be evaluated or included in the score. The concept remains useful for practice, but no option is presented here as the official answer.

Question 57 Answer: DROPPED

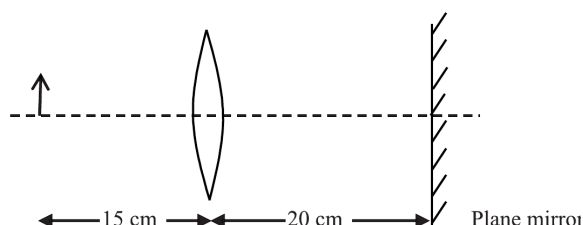
Laws of Motion and Pulley Systems



Official status: DROPPED. The IAPT final answer key for Paper Code 51 does not assign a correct option to Question 57. It must not be evaluated. The official key does not specify the reason, so the solution booklet records only its dropped status.

Question 58 Answer: A, C

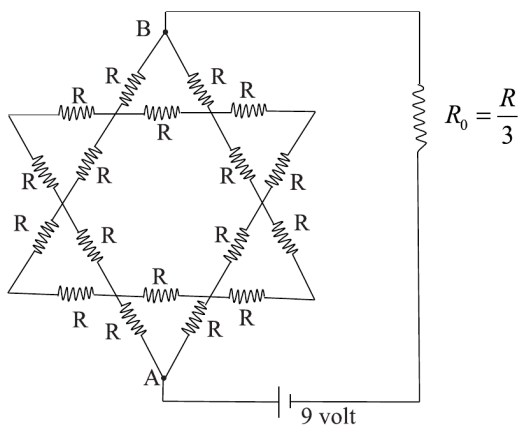
Ray Optics



For the lens, $1/f = 1/v - 1/u$ with $f = 10$ cm and $u = -15$ cm gives $v = +30$ cm. Thus the converging rays are aimed at a point 10 cm behind the mirror. A plane mirror reflects them to the symmetric point 10 cm in front of the mirror, which is 10 cm to the right of the lens. Lens magnification is $v/u = -2$ and the plane mirror contributes $+1$, so final magnification is -2 . Correct options: (a) and (c).

Question 59 Answer: A, B, C

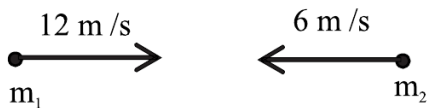
Current Electricity



By symmetry and series-parallel reduction, the eighteen-resistor network between A and B has equivalent resistance 5 ohm. Since $R_0 = 1$ ohm, total resistance is 6 ohm and current is $9/6 = 1.5$ A. Hence $V_{AB} = 1.5 \times 5 = 7.5$ V and $P_{R_0} = I^2 R_0 = 2.25$ W. Network power is $7.5 \times 1.5 = 11.25$ W, not 12.25 W. Correct options: (a), (b) and (c).

Question 60 Answer: B, C

Collisions



Take $u_1 = +12$ m/s and $u_2 = -6$ m/s. For a one-dimensional elastic collision, $v_1 = [(m_1 - m_2)u_1 + 2m_2 u_2] / (m_1 + m_2) = 0$, while $v_2 = [2m_1 u_1 + (m_2 - m_1)u_2] / (m_1 + m_2) = +18$ m/s. Correct options: (b) and (c).