

JEE Advanced Practice Mock Test 01 — Offline Worksheet

Questions 3–6, 9–12, 15–18 (48 marks) — Southwide original practice questions, not a copy of an official paper. These questions require multi-select or exact numerical-entry scoring that the website's mock-test engine does not currently support, so they are provided here as a downloadable worksheet alongside the 6-question online mini mock. Answer key and solutions are included on the last page — work the questions first, then check your answers.

Marking scheme (for self-scoring)

Section B — One or more correct (MSQ): +4 for selecting all correct options and no incorrect option; +2 for selecting at least one — but not all — correct options and no incorrect option; –2 if any incorrect option is selected; 0 if unanswered.

Section C — Numerical answer (NAT): +4 for the correct answer entered in the format stated with each question (integer, or to the stated number of decimal places); 0 otherwise — no partial credit for values outside the required precision.

Use $g = 10 \text{ m/s}^2$ where required.

Physics

Q3. Simple harmonic motion

A particle performs SHM according to $x = A \cos(\omega t)$. At an instant when $x = A/2$, which statements are correct?

- A. Its speed magnitude is $\sqrt{3} A\omega/2$.
- B. Its acceleration magnitude is $A\omega^2$.
- C. Its kinetic energy is $3/4$ of the total energy.
- D. Its potential energy is $1/4$ of the total energy.

Q4. Photoelectric effect

For a metal surface obeying Einstein's photoelectric equation, which statements are correct?

- A. At fixed frequency above threshold, increasing intensity increases the saturation current.
- B. At fixed frequency above threshold, increasing intensity increases the maximum kinetic energy.
- C. The threshold frequency is a property of the emitting material.
- D. The stopping potential is independent of light intensity for fixed frequency.

Q5. Atwood machine

Masses 3 kg and 2 kg are connected by a light inextensible string passing over a smooth massless pulley. Enter the tension in the string, in newtons. (Enter as an integer.)

Q6. Capacitor and dielectric

A charged parallel-plate capacitor is disconnected from the battery. Its stored energy is 12 mJ. A dielectric of relative permittivity 3 completely fills the gap. Enter the new stored energy, in mJ. (Enter as an integer.)

Chemistry

Q9. Ideal solutions

Which statements are correct for an ideal binary liquid solution?

- A. $\Delta H_{\text{mix}} = 0$
- B. $\Delta V_{\text{mix}} = 0$
- C. It obeys Raoult's law over the full composition range.
- D. The unlike-molecule interactions are approximately comparable to the like-molecule interactions.

Q10. Coordination chemistry

For the complex ion $[\text{Co}(\text{en})_2\text{Cl}_2]^+$, where en is neutral ethane-1,2-diamine, which statements are correct?

- A. The oxidation state of cobalt is +3.
- B. The coordination number of cobalt is 6.
- C. It can show cis–trans isomerism.
- D. Its cis form can show optical isomerism.

Q11. Ionic equilibrium

Assuming complete dissociation, enter the pH of $0.010 \text{ mol L}^{-1} \text{ Ba}(\text{OH})_2$ at 25°C . Use $\log_{10} 2 = 0.301$. Give the answer to two decimal places.

Q12. First-order kinetics

A first-order reaction has a half-life of 10 minutes. Enter the time, in minutes, required for 87.5% completion. (Enter as an integer.)

Mathematics**Q15. Cubic function**

For $f(x) = x^3 - 3x$, which statements are correct?

- A. f has a local maximum at $x = -1$.
- B. f has a local minimum at $x = 1$.
- C. f is increasing on $(-\infty, -1) \cup (1, \infty)$.
- D. Its real zeros are $-\sqrt{3}$, 0 , $\sqrt{3}$.

Q16. Idempotent matrix

Let A be an $n \times n$ real matrix satisfying $A^2 = A$. Which statements are always correct?

- A. Every eigenvalue of A is either 0 or 1.
- B. A is diagonalizable over the reals.
- C. $\text{tr}(A) = \text{rank}(A)$.
- D. $\det(A)$ is either 0 or 1.

Q17. Onto functions

Enter the number of onto functions from a four-element set to a two-element set. (Enter as an integer.)

Q18. Area between curves

The region bounded by $y = x^2$ and $y = 2x$ has area A . Enter the value of $3A$. (Enter as an integer.)

Answer key

Q	Answer	Q	Answer
3	A, C, D	12	30
4	A, C, D	15	A, B, C, D
5	24	16	A, B, C, D
6	4	17	14
9	A, B, C, D	18	4
10	A, B, C, D		
11	12.30		

Concise solutions

Physics

Q3. $v = \omega\sqrt{A^2 - x^2} = \sqrt{3} A\omega/2$. Also $K/E = 1 - x^2/A^2 = 3/4$ and $U/E = 1/4$. Acceleration magnitude is $A\omega^2/2$, not $A\omega^2$ — this is why option B is not in the answer key.

Q4. Intensity changes the emitted-electron rate and saturation current, not the maximum kinetic energy or stopping potential at fixed frequency. Threshold frequency depends on the material.

Q5. $a = (3-2)g/(3+2) = 2 \text{ m/s}^2$; $T = 2(g+a) = 24 \text{ N}$.

Q6. With the battery disconnected, charge is constant. Since $C' = 3C$, $U' = Q^2/(2C') = U/3 = 4 \text{ mJ}$.

Chemistry

Q9. These are the defining thermodynamic and intermolecular features of an ideal solution.

Q10. If cobalt has oxidation state x , then $x - 2 = +1$, so $x = +3$. Two bidentate en ligands and two chlorides give coordination number 6. Cis–trans isomerism occurs, and the cis form has optical isomers.

Q11. $[\text{OH}^-] = 0.020 \text{ M}$. Thus $\text{pOH} = 2 - \log 2 = 1.699$, and $\text{pH} = 12.301 \approx 12.30$.

Q12. 87.5% completion means 12.5% remains, or $1/8$ of the initial amount. This requires three half-lives: 30 minutes.

Mathematics

Q15. $f'(x) = 3(x^2-1)$, giving the stated monotonicity and extrema. Also $f(x) = x(x^2-3)$.

Q16. The polynomial $t(t-1)$ annihilates A and has distinct real roots, so A is diagonalizable with eigenvalues 0 and 1. Trace and rank both count the eigenvalue 1, and the determinant is the product of the eigenvalues.

Q17. Total functions: $2^4=16$. Exclude the two constant functions, giving 14 onto functions.

Q18. The curves meet at $x=0,2$. Thus $A = \int_0^2 (2x-x^2)dx = 4/3$, so $3A=4$.

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