AP Physics C: Electricity and Magnetism Common Mistakes · 常见错误

Most lost points here are a symmetry argument that was never stated, or a sign that was dropped between a field and a potential. Everything below is a rule the readers apply. 失分多因没写对称性论证，或在场与电势之间丢了负号。

How the readers score a physics free response

✗ Choosing an option and then explaining the other one.

✓ **Make the selection first, and make every sentence support it.**

The guidelines state that reasoning cannot earn credit if the incorrect selection is made – the choice gates the explanation.

选错了，理由也不给分 SG 3 years

✗ Writing an explanation and leaving the choice blank.

✓ **Answer the question explicitly, then justify.**

The guidelines award no credit for an answer without an explanation, and none for an explanation without the answer.

选项和理由都要写 SG 2 years

✗ Ranking quantities without giving the ranking.

✓ **Write the ranking out, then explain it.**

The guidelines state a ranking must be given for any of the explanation points to be earned.

排序题先写出排序 SG2023

✗ Deriving an expression in part (b) using symbols the diagram never defined.

✓ **Define every variable in the diagram or the procedure of part (a).**

The guidelines require all terms to be indicated in part (a) for full credit in part (b).

变量要在图或步骤中定义 SG 2 years

✗ Writing kx where the question defined the compression as d.

✓ **Use the question's own symbols.**

The guidelines state that an answer of kx does not earn the point where the quantity was named d.

用题目给定的符号 SG2023

✗ Checking a derived expression only by re-reading the algebra.

✓ **Test a limiting case: does it reduce to g when the mass is zero, or to zero when the angle is?**

The guidelines award credit for a limiting-case argument, and it catches sign and factor errors nothing else will.

用极限情形检验结果 MS

✗ Drawing a graph as a horizontal line along the time axis.

✓ **Read what the physics requires before drawing – a flat line at zero is almost never the answer.**

The guidelines state that no credit is earned for a horizontal line along the t-axis.

不要画成横轴上的直线 SG2023

✗ Drawing a free-body diagram with forces starting from anywhere.

✓ **Draw each force from the point where it acts, in the right direction – the normal force from the contact point, perpendicular to the surface.**

Mark schemes specify the origin and direction of each arrow, so a correctly named force in the wrong place earns nothing.

受力箭头的起点和方向都要对 MS

■ Answer in the order asked. Where a part says JUSTIFY, the justification sentence IS the point; where it says CALCULATE, the substituted equation is.

“ 说明理由 ” 与 “ 计算 ” 要求不同 SG 3 years

8 · Electric Charges, Fields, and Gauss's Law 电荷、电场与高斯定律

✗ Applying Gauss's law to a charge distribution with no symmetry.

✓ **It gives the field only where a surface of constant field magnitude exists – spherical, cylindrical or planar.**

The law always holds; it is only USEFUL under symmetry, and saying which symmetry is a scored step.

高斯定律需要对称性 CED 8.5

✗ Choosing a Gaussian surface and not saying why.

✓ **State the surface and the symmetry argument before integrating.**

The readers score the justification separately from the algebra.

要说明高斯面的选择理由 CED 8.5

✗ Adding electric fields as though they were scalars.

✓ **Add the components: fields superpose as vectors.**

The magnitudes alone give a plausible number that is wrong wherever the directions differ.

场强是矢量叠加 CED 8.3

9 · Electric Potential 电势

✗ Confusing potential with potential energy.

✓ **Potential is per unit charge; multiply by q to get the energy.**

The two differ by a factor of the charge, and the units say which is wanted.

电势是单位电荷的势能 CED 9.2

✗ Losing the minus sign relating field and potential.

✓ **$E_x = -\dfrac{\mathrm{d}V}{\mathrm{d}x}$, and $V = -\int \mathbf{E}\cdot\mathrm{d}\mathbf{l}$.**

The sign decides the direction of the field, which the next part usually depends on.

电场是电势的负梯度 CED 9.4

10 · Conductors and Capacitors 导体与电容器

✗ Treating a dielectric as simply increasing the capacitance.

✓ **Say which quantity is held constant – charge or voltage – because the energy changes differently in each case.**

The question always fixes one of them, and that fixes everything else.

先看是恒压还是恒电荷 CED 10.6

✗ Adding capacitors in series the way resistors add in series.

✓ **Capacitors add reciprocally in series and directly in parallel – the opposite of resistors.**

The reversal is the standard trap in this unit.

电容串并联与电阻相反 CED 10.5

11 · Electric Circuits 电路

✗ Analysing an RC circuit at an arbitrary time by algebra.

✓ **Use the limiting cases the question asks about: at $t = 0$ the capacitor behaves as a wire, and after a long time as a break.**

The two limits are what the readers score, and they need no differential equation.

用 t=0 和 t→∞ 两个极限 CED 11.5

✗ Writing a loop equation without a consistent sign convention.

✓ **Choose a direction, keep it, and take a potential drop as negative through a resistor in that direction.**

An inconsistent convention gives an equation that looks right and solves wrong.

回路方程要统一正方向 CED 11.3

12 · Magnetic Fields and Electromagnetism 磁场与电磁学

✗ Using the wrong hand, or the wrong order, in a cross product.

✓ **$\mathbf{F} = q\mathbf{v}\times\mathbf{B}$ – the order matters and reversing it reverses the force.**

The direction is usually the whole answer, and a sign error is not a partial one.

叉乘顺序不能颠倒 CED 12.2

✗ Applying Ampère's law without a symmetry argument.

✓ **Choose an Amperian loop on which the field is constant, and say why.**

As with Gauss's law, the choice and its justification are scored.

安培环路要说明对称性 CED 12.6

13 · Electromagnetic Induction 电磁感应

✗ Computing an induced e.m.f. from the flux rather than its rate of change.

✓ **$\varepsilon = -\dfrac{\mathrm{d}\Phi}{\mathrm{d}t}$ – a large steady flux induces nothing.**

The derivative is the law; the flux value alone is not.

感应电动势看磁通变化率 CED 13.2

✗ Dropping the minus sign in Faraday's law.

✓ **Keep it, and state the direction Lenz's law requires – opposing the change.**

The direction is separately scored, and the sign is where it comes from.

楞次定律给出方向 CED 13.3

■ Where a derivation is asked for in terms of given symbols, do not substitute numbers. An expression in the question's own variables is the answer.

符号推导不要代入数字 SG 2 years

9 · Electric Potential 电势

✗ Setting the zero of potential wherever is convenient and not saying so.

✓ **State the reference point – usually infinity – before writing any value.**

Potential is defined relative to a reference, and a value without one cannot be checked.

要说明电势零点 CED 9.3

✗ Adding potentials as vectors.

✓ **Potential is a SCALAR: add the values, with their signs.**

The scalar sum is why potential is often the easier route, and treating it as a vector wastes that.

电势是标量, 直接相加 CED 9.2

11 · Electric Circuits 电路

✗ Saying a capacitor in a steady-state DC circuit carries current.

✓ **After a long time no current flows through it, so the branch it sits in carries none.**

This is what makes the long-time limit solvable, and it is the point the question tests.

稳态时电容支路无电流 CED 11.5

12 · Magnetic Fields and Electromagnetism 磁场与电磁学

✗ Saying a magnetic force does work on a moving charge.

✓ **It is always perpendicular to the velocity, so it does NO work – it changes direction, not speed.**

The property follows from the cross product and is a standard discriminator.

磁场力不做功 CED 12.2

13 · Electromagnetic Induction 电磁感应

✗ Determining an induced current's direction by guessing.

✓ **Apply Lenz's law: the induced current opposes the CHANGE in flux, not the flux itself.**

Opposing the flux rather than its change reverses the answer whenever the flux is decreasing.

感应电流阻碍磁通的变化 CED 13.3

✗ Treating an inductor as a break at the instant a switch closes.

✓ **An inductor opposes a CHANGE in current: at $t = 0$ it behaves as a break, and after a long time as a wire – the opposite of a capacitor.**

The two limits are reversed relative to a capacitor, which is exactly why they are asked together.

电感与电容的极限相反 CED 13.5

✗ Reporting an induced e.m.f. without saying which way the current flows.

✓ **Give the direction – clockwise or anticlockwise as seen from a stated side.**

The direction is scored separately from the magnitude, and 'as seen from' is what makes it unambiguous.

要写明电流的方向 CED 13.3