

This exam scores reasoning, not answers: a selection with the wrong justification earns nothing, and a correct expression with undefined symbols earns nothing either. Everything below is a rule the readers apply. 本科评分看推理: 选项选错则理由不给分, 符号未定义则表达式不给分。

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

9 · Thermodynamics 热力学

- ✗ Saying temperature measures the heat in a gas.
- ✓ **Temperature is proportional to the AVERAGE kinetic energy of the molecules; heat is energy transferred.**
The distinction is the content of the topic, and the wrong word makes the answer wrong.
温度不是热量 CED 9.2
- ✗ Using a Celsius temperature in a gas-law calculation.
- ✓ **Every gas law takes kelvin.**
A 27 °C substituted as 27 rather than 300 K is out by a factor of eleven.
气体定律用开尔文 CED 9.3

- ✗ Saying entropy ‘is disorder’ and stopping.
- ✓ **Say what changed: more accessible microstates, so more ways to arrange the energy.**
The explanation point is for the mechanism, and the metaphor names none.
摘要用微观状态解释 CED 9.6

10 · Electric Force, Field, and Potential 电力、电场与电势

- ✗ Confusing electric field with electric potential.
- ✓ **Field is a vector and follows an inverse-square law; potential is a scalar and follows an inverse law.**
The two are computed from the same charge and distance, so the wrong one is easy to write.
场强是矢量, 电势是标量 CED 10.4
- ✗ Saying the field inside a charged conductor is zero because there is no charge there.
- ✓ **It is zero because the charges rearrange until they cancel any internal field.**
The mechanism is the scored part; the potential inside is constant and NOT zero.
导体内部场强为零, 电势不为零 CED 10.6

11 · Electric Circuits 电路

- ✗ Adding parallel resistances directly.
- ✓ **Reciprocals add, and the result is smaller than the smallest resistance – check it against that.**
 - The check catches the error instantly and costs one line.
 - 并联电阻取倒数相加 CED 11.4
- ✗ Saying current is used up as it goes round a circuit.
- ✓ **Current is the same everywhere in a series loop; it is energy that is transferred.**
 - A named misconception that contradicts charge conservation.
 - 电流不会被消耗 CED 11.2

12 · Magnetism and Electromagnetism 磁学与电磁学

- ✗ Using the left hand for induction.
- ✓ **Left hand is the motor effect; the right hand is the generator effect.**
 - The rules are mirror images, so the wrong one gives a confident wrong direction.
 - 左手电动机, 右手发电机 CED 12.3
- ✗ Saying a stationary magnet in a coil induces an e.m.f.
- ✓ **The FLUX must change – by motion, by a changing field, or by a changing area.**
 - The rate of change is the whole content of Faraday’s law.
 - 必须磁通量变化才有感应 CED 12.5

13 · Geometric Optics 几何光学

- ✗ Guessing the sign convention for a lens or mirror equation.
- ✓ **State your convention before substituting, and keep it for the whole question.**
 - The image’s nature follows from the signs, so an unstated convention makes the answer unmarkable.
 - 先声明符号约定 CED 13.3
- ✗ Describing an image as real without checking which side it forms on.
- ✓ **A real image forms where the rays actually meet, and can be projected; a virtual one cannot.**
 - The three properties – real or virtual, upright or inverted, magnified or reduced – are scored separately.
 - 实像与虚像要分清 CED 13.2

14 · Waves, Sound, and Physical Optics 波、声音与物理光学

- ✗ Calling two sources coherent because they are equally bright.
- ✓ **Coherence needs the same frequency and a constant phase difference.**
 - Amplitude is irrelevant to coherence, and this is a standard discriminator.
 - 相干: 同频率、恒定相位差 CED 14.5

- ✗ Saying a standing wave transfers energy along the string.
- ✓ **It does not – that is the defining difference from a progressive wave.**
 - The property is what the question is testing.
 - 驻波不传递能量 CED 14.3

15 · Modern Physics 近代物理

- ✗ Saying brighter light gives photoelectrons more energy.
- ✓ **Intensity increases the NUMBER emitted; only frequency increases their kinetic energy.**
 - The distinction is the evidence for the photon model.
 - 强度增加数量, 频率增加能量 CED 15.2
- ✗ Explaining a nuclear decay as the nucleus ‘getting old’.
- ✓ **Decay is spontaneous and random, with a constant probability per unit time.**
 - The randomness is what makes the exponential law follow.
 - 衰变是随机的 CED 15.5
- Check that a mass-energy answer uses consistent units: joules with kilograms, or MeV with atomic mass units. Mixing them is the commonest slip in this unit.
- 质能计算单位要统一 CED 15.4

11 · Electric Circuits 电路

- ✗ Treating e.m.f. and terminal voltage as the same.
- ✓ **They differ by the potential difference lost across the internal resistance.**
 - The difference is what the topic is about, and the question always supplies enough to find it.
 - 电动势 ≠ 端电压 CED 11.3
- ✗ Saying a bulb is brighter because it has a larger resistance.
- ✓ **Brightness follows POWER, and which of I^2R or V^2/R applies depends on whether the current or the voltage is shared.**
 - Series and parallel give opposite answers, so the circuit has to be read first.
 - 亮度看功率, 要分串并联 CED 11.4

13 · Geometric Optics 几何光学

- ✗ Drawing a ray diagram with only one ray.
- ✓ **Draw at least two of the standard rays, and let the image form where they meet.**
 - One ray fixes nothing; the intersection is what locates the image.
 - 至少画两条特殊光线 CED 13.2

14 · Waves, Sound, and Physical Optics 波、声音与物理光学

- ✗ Confusing the path-difference condition with the phase-difference condition.
- ✓ **Constructive interference needs a path difference of a whole number of wavelengths, which is a phase difference of $2\pi n$.**

Both are stated in the topic and the question names one of them.

光程差与相位差要对应 CED 14.6

- ✗ Saying sound can be polarised.
- ✓ **Only transverse waves can be polarised; sound is longitudinal.**

The property distinguishes the two wave types and is a standard discriminator.

纵波不能偏振 CED 14.4