A-level PHYSICS 7408/1

Paper 1

Mark scheme

June 2026

Version: 1.0 Final

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

No student should be disadvantaged on the basis of their gender identity and/or how they refer to the gender identity of others in their exam responses.

A consistent use of 'they/them' as a singular and pronouns beyond 'she/her' or 'he/him' will be credited in exam responses in line with existing mark scheme criteria.

Further copies of this mark scheme are available from aqa.org.uk

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Physics - Mark scheme instructions to examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1
In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2
A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3
Alternative answers acceptable for a mark are indicated by the use of **or**. Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.

3. Marking points

3.1 Marking of lists
This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of errors/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (often prefaced by 'Ignore' in the mark scheme) are not penalised.

3.2 Marking procedure for calculations

Full marks can usually be given for a correct numerical answer without working shown unless the question states 'Show your working'. However, if a correct numerical answer can be evaluated from incorrect physics then working will be required. The mark scheme will indicate both this and the credit (if any) that can be allowed for the incorrect approach.
However, if the answer is incorrect, mark(s) can usually be gained by correct substitution/working and this is shown in the 'extra information' column or by each stage of a longer calculation.

A calculation must be followed through to answer in decimal form. An answer in surd form is never acceptable for the final (evaluation) mark in a calculation and will therefore generally be denied one mark.

3.3 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.4 Errors carried forward, consequential marking and arithmetic errors

Allowances for errors carried forward are likely to be restricted to calculation questions and should be shown by the abbreviation ECF or *conseq* in the marking scheme.

An arithmetic error should be penalised for one mark only unless otherwise amplified in the marking scheme. Arithmetic errors may arise from a slip in a calculation or from an incorrect transfer of a numerical value from data given in a question.

3.5 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited (eg fizix) **unless** there is a possible confusion (eg defraction/refraction) with another technical term.

3.6 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.7 Ignore / Insufficient / Do <u>not</u> allow

'Ignore' or 'insufficient' is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

'Do **not** allow' means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

3.8 Significant figure penalties

Answers to questions in the practical sections (7407/2 – Section A and 7408/3A) should display an appropriate number of significant figures. For non-practical sections, an A-level paper may contain up to 2 marks (1 mark for AS) that are contingent on the candidate quoting the **final** answer in a calculation to a specified number of significant figures (sf). This will generally be assessed to be the number of sf of the datum with the least number of sf from which the answer is determined. The mark scheme will give the range of sf that are acceptable but this will normally be the sf of the datum (or this sf −1).

An answer in surd form cannot gain the sf mark. An incorrect calculation **following some working** can gain the sf mark. For a question beginning with the command word 'Show that…', the answer should be quoted to **one more** sf than the sf quoted in the question eg 'Show that X is equal to about 2.1 cm' – answer should be quoted to 3 sf. An answer to 1 sf will not normally be acceptable, unless the answer is an integer eg a number of objects. In non-practical sections, the need for a consideration will be indicated in the question by the use of 'Give your answer to an appropriate number of significant figures'.

3.9 Unit penalties

An A-level paper may contain up to 2 marks (1 mark for AS) that are contingent on the candidate quoting the correct unit for the answer to a calculation. The need for a unit to be quoted will be indicated in the question by the use of 'State an appropriate SI unit for your answer'. Unit answers will be expected to appear in the most commonly agreed form for the calculation concerned; strings of fundamental (base) units would not. For example, 1 tesla and 1 Wb m^{-2} would both be acceptable units for magnetic flux density but 1 kg m^2 s^{-2} A^{-1} would not.

3.10 Level of response marking instructions

Level of response mark schemes are broken down into three levels, each of which has a descriptor. The descriptor for the level shows the average performance for the level. There are two marks in each level.

Before you apply the mark scheme to a student's answer read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Determining a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer and not look to pick holes in small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level and then use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 2 with a small amount of level 3 material it would be placed in level 2.

The exemplar materials used during standardisation will help you to determine the appropriate level. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do not have to cover all of the points mentioned in the indicative content to reach the highest level of the mark scheme.

An answer which contains nothing of relevance to the question must be awarded no marks.

Question	Answers	Additional comments/Guidance	Mark	AO
01.1	Any **two** from: ✓✓ • 7 protons, 10 neutrons and 7 electrons • idea that nucleus contains protons and neutrons • idea that nucleus is surrounded by electrons/idea of electron shells	Allow answer in terms of quarks and electrons For answers that score only bullets 2 or 3, require 'nucleus' at least once. Do not accept 'p', 'n' 'e' for names unless defined.	2	AO1

Question	Answers	Additional comments/Guidance	Mark	AO
01.2	weak ✓ idea that this is beta-decay ✓	MP2 is contingent on MP1 being correct. Neutron changes to proton is insufficient for MP2. Accept idea that a quark change is involved or that the decay involves leptons Accept an equation as idea of beta-decay	2	AO2

Question	Answers	Additional comments/Guidance	Mark	AO
01.3	Idea that (strong nuclear force) acts on protons and neutrons/nucleons ✓ Idea that the force is repulsive at very short range **AND** the force is attractive beyond that ✓	In MP1 treat as neutral: • idea that force does not act on leptons as neutral. • references to electromagnetic force. Baryons or hadrons is insufficient for MP1. Accept 0.5 fm to 1 fm for lower limit and 3 fm to 5 fm for upper limit. **If no other mark awarded**, award MAX 1 for identifying the force as the strong nuclear force/interaction provided that any reference to electromagnetic force is correct.	2	AO1

Question	Answers	Additional comments/Guidance	Mark	AO
01.4	Electron **AND** (electron) antineutrino ✓	Do not accept symbols alone. Allow alternatives for electron Condone ‘antielectron neutrino’.	1	AO1

Question	Answers	Additional comments/Guidance	Mark	AO
01.5	Proton, which is (the only) stable (baryon) ✓	Do not accept any suggestion or implication that the proton is not completely stable. ‘Most stable baryon’ or ‘very stable’ is insufficient.	1	AO1
Total			**8**	

Question	Answers	Additional comments/Guidance	Mark	AO
02.1	Idea that it is the **minimum** energy (of a photon) that can cause the emission of an electron (from the surface of **M)** ✓		1	AO1

Question	Answers	Additional comments/Guidance	Mark	AO
02.2	energy = $5.01 \times 1.6 \times 10^{-19}$ seen **OR** $8(.02) \times 10^{-19}$ J seen **OR** Uses $E = hf$ with their E ✓ $1.2(1) \times 10^{15}$ based on correct working or evidence of correct procedure. ✓ s^{-1} ✓	Condone POT error in MP1 Do not accept "Ek_{max}" as part of their energy. Do not accept Hz. Condone correct unit without a calculated value.	3	1 × AO1 2 × AO2

Question	Answers	Additional comments/Guidance	Mark	AO
02.3	Idea that photon energy is related to / depends on / proportional to frequency / $E = hf$ ✓ Idea that only **photons** equal to or above a certain frequency have enough energy to release electrons / have energy equal to (or greater than) the work function ✓	Do not accept any incorrect relationship between E and f. Allow ϕ for work function.	2	AO1

Question	Answers	Additional comments/Guidance	Mark	AO
02.4	((photo)electrons will leave the metal surface so) idea that the gold leaf/cap/rod will become **more** positive ✓ therefore θ will increase ✓	**If no other mark given**, award MAX 1 for 'θ will increase because electrons are emitted' OR 'θ will stay the same when electrons are not emitted' MP2 is contingent on award of MP1. Alternative: Photoelectrons will not leave the surface, with reference to idea of stopping potential. This idea could be in terms of forces.✓ therefore θ will not change✓	2	AO2

Question	Answers	Additional comments/Guidance	Mark	AO
02.5	(All energy of photon is given to one electron) Shown by **two** from: ✓✓ • electron emission is instantaneous • increasing the intensity of light increases the number of electrons (released per second) / does not change the kinetic energy of the electron • increasing the frequency of the light increases the kinetic energy of the electrons / does not change the number of electrons (released per second) • one photon leads to the emission of one electron	Ignore references to threshold frequency. Accept speed or stopping potential for kinetic energy. Accept current for number of electrons (per second) For BP2 allow idea that decreasing intensity decreases number of electrons (per second). Do not accept 'one-to-one interaction' without further explanation.	2	AO1
Total			**10**	

Question	Answers	Additional comments/Guidance	Mark	AO
03.1	Idea that the central maximum is wider than subsequent maxima ✓	Accept reference to 'adjacent' or 'other' for 'subsequent'. Do not accept 'larger' or 'bigger' without reference to width.	1	AO1

Question	Answers	Additional comments/Guidance	Mark	AO
03.2	Wavelength would have to increase (to produce wider diffraction pattern) ✓ Idea that the necessary wavelength would be beyond the visible spectrum / in the infrared region (and therefore cannot be seen) ✓	For MP1, do not accept answer based on double-slit experiment. Accept reference to idea that 750 nm is the greatest wavelength that this student can see OR the idea that the required wavelength is outside (the range of) their vision.	2	AO3

Question	Answers	Additional comments/Guidance	Mark	AO
03.3	Move screen away from slit ✓ (Leading to the idea that) the angle of minima/maxima will be the same but further apart on a more distant screen ✓ Use a narrower slit ✓ (Leading to the idea that this) increases diffraction (angle)/angular separation of minima/maxima ✓	In MP2: • Condone use of Young double-slit equation in MP2. • Credit an appropriate diagram. In MP3 do not accept 'decrease the size of the slit'. Do not condone use of Young double-slit equation in MP4.	4	AO2

Question	Answers	Additional comments/Guidance	Mark	AO
03.4	Idea that source(s) need(s) to be/is coherent ✓ idea that the (central maximum of the) diffraction pattern/light (from the single slit) illuminates both slits **OR** idea that slit acts as single/point source (for both slits). ✓	Allow a description of coherence in terms of a **fixed** phase difference. Reject MP1 for idea that single slit makes the light monochromatic/polarised Accept idea that double slits are illuminated by (diffracted) light from the single slit. Allow 'same' for 'single'.	2	AO1

Question	Answers	Additional comments/Guidance	Mark	AO
03.5	Any **two** from: ✓✓ • determines number of fringes to be 12 • divides 8.2 cm by their number of fringes • substitutes their w into $s = \frac{\lambda D}{w}$ to arrive at their answer 1.3×10^{-4} (m) ✓	Look for 6.8×10^{-3} (m) Condone POT error in MP1 and MP2 (calculator value: 1.2512195×10^{-4} m) 11 fringes gives 1.1469512×10^{-4} m 13 fringes gives 1.3554878×10^{-4} m	3	AO2
Total			**12**	

Question	Answers	Additional comments/Guidance	Mark	AO
04.1	In equilibrium, (sum of) clockwise moments = (sum of) anticlockwise moments ✓		1	AO1

Question	Answers	Additional comments/Guidance	Mark	AO
04.2	determines weight of person **OR** $75g$ seen ✓ takes moments about **B** **OR** takes moments about any other point **AND** reaction at **B** seen as the sum of the forces $(912 + 75g)/1648$ ✓ further analysis with clear comparison of distances/moments/forces leading to the conclusion NO. ✓	Look for 736 N Expect to see $736 \times 1.22 = 912 \times x$ Look for 0.98 (m) Expect to see $0.85 + 1.35 - (3.72 \div 2)$ $= 0.34$ (m) eg 0.98 is not equal to 0.34 so plank CoM is not in the middle OR 1.22 (m from the left hand end) / 2.5 (m from the right hand end) is not equal to 1.86 (m)	3	AO3

Question	Answers	Additional comments/Guidance	Mark	AO
04.3	Straight line arrow drawn vertically downwards through lowest point of rope starting from around CoM of person ✓	Accept arrow starting from bend in rope	1	AO1

Question	Answers	Additional comments/Guidance	Mark	AO
04.4	Resolve forces horizontally / horizontal component of $T_2 = 406$ N ✓ Resolve forces vertically / vertical component of $T_2 = 531$N ✓ Solves to find $T_2 = 670$ (N) ✓ $\theta = 53^{\circ}$ ✓	$T_2 \cos\theta = T_1 \cos(15)$ $T_2 \sin\theta = 640 - T_1 \sin(15)$ Evidence for MP1 and MP2 may be seen in a drawn right angled triangle. Give full credit to answer for MP1 and MP2 using a scale diagram: T_1, T_2 and W drawn in proportion by eye ✓ evidence of triangle/parallelogram used ✓ Allow 50° – 55° range in θ for drawn solution.	4	AO2

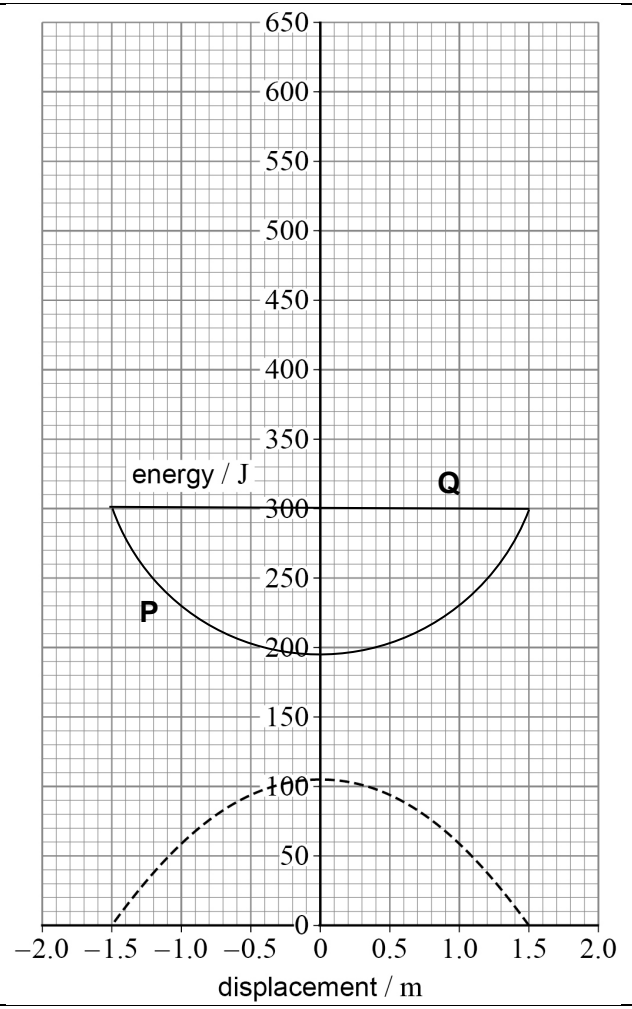
Question	Answers	Additional comments/Guidance	Mark	AO
04.5	θ increases ✓ (T_1 and) T_2 must decrease as W stays the same / as W = sum of vertical components ✓		2	AO3
Total			**11**	

Question	Answers	Additional comments/Guidance	Mark	AO
05.1	Calculates current through one lamp ✓ Calculates current for other lamp and adds to get 3.5×10^{-3} (A) ✓	Look for **L_1** current of 0.43 mA **OR L_2** current of 3.1 mA In MP1: • condone 1 sf values for current • **do not** condone POT errors Alternative: MP1: determine resistance of **L_1** - expect $13456\ \Omega$ MP2: evaluates total resistance of **L_1** and **L_2** – expect $1665\ \Omega$ and divides into 5.8 to give 3.5 mA	2	AO2

Question	Answers	Additional comments/Guidance	Mark	AO
05.2	Determines working resistance of **L_1** ✓ Compares working resistance of both lamps **OR** Idea that resistance of **L_2** is less than working resistance as pd across it is small ✓ **L_1** is operating nearer its working voltage because it has a (much) larger resistance and will have a greater share (of the emf). ✓	Expect to see $R = 5.8^2 \div 2.5 \times 10^{-3}$ **OR** $5.8^2 \div 18 \times 10^{-3}$ Expect **L_1** $= 13.5\ \text{k}\Omega$ For MP2 allow (assuming resistances stay constant) a calculation of pd across **L_1** $(5.1\ \text{V})$ Or a calculation of circuit current $(0.38\ \text{mA})$ (assuming resistance stays constant) For alternative MP3: Calculate voltage across **L_1** $(5.08\ \text{V})$ or across **L_2** $(0.72\ \text{V})$ together with comment that **L_1** is closer to working voltage. Note: using the parallel current from 5.1 leads to a pd of 0.72 V across **L1.** This route is unlikely to score any marks.	3	AO3
Total			**5**	

Question	Answers	Additional comments/Guidance	Mark	AO
06.1	Correct reading of $\Delta E = 105$ J from graph OR use of $E_k = ½ mv^2$ to determine their value of v to at least 3 sf. ✓ to give value that rounds to 2.9 m s^{-1} ✓	Do not credit reverse calculations Allow range of 103 J – 107 J check their calculator value Calculator value = 2.89828 m s^{-1} Answer must be at least 3sf	2	AO2

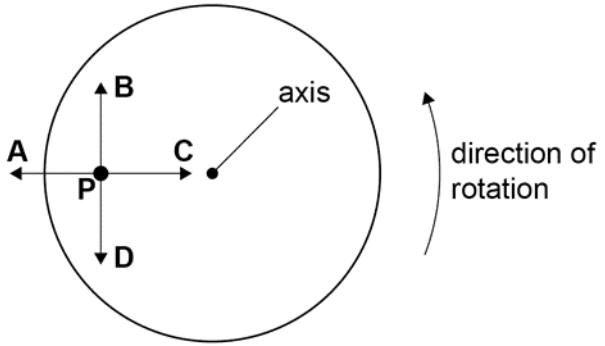
Question	Answers	Additional comments/Guidance	Mark	AO
06.2	Evidence of use of $v_{max} = \frac{2\pi A}{T}$ to find T **OR** Use of their time $T = 2\pi\sqrt{\frac{l}{g}}$ to determine their l✓ 2.63 (m) ✓	Do not credit reverse calculations *Expect to see* $T = 3.25$ s Accept 2.62 m to 2.64 m At least 3 sf	2	AO2

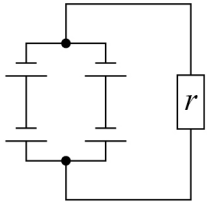
Question	Answers	Additional comments/Guidance	Mark	AO
06.3	General shapes correct, ie a horizontal line (labelled **Q**) and a curve with minimum in the centre (labelled **P**)✓ line labelled **P** correct: min point at 195 J at displacement = 0 AND maximum at 300 J at displacement = ±1.5 m ✓ line labelled **Q** correct: straight horizontal at 300 J between ±1.5 m ✓ Allow half a grid square tolerance. **Max 1** if lines are not labelled or labelled incorrectly		3	1 × AO1 2 × AO2

Question	Answers	Additional comments/Guidance	Mark	AO
06.4	Any **four** from: ✓✓✓✓ • idea that maximum tension = weight + centripetal force (at bottom of swing) • evidence of cross-sectional area = 7.85×10^{-5} m^2 • evidence of maximum tension = E × strain × *their area* • mass = *their maximum tension* ÷ $\left(g + \frac{v^2}{r}\right)$ • max weight = *their mass* × g × *a safety factor* Answer = 1470 (N) × *their safety factor* allow any safety factor <100% OR quoting a value less than 1470 (N) with reference to 1470(N) and a safety factor✓	Condone POT errors in bullet points Expect to see $T = mg + \frac{mv^2}{r}$ Allow l for r Expect maximum tension = 1960 N Expect mass = 150 kg Allow any safety factor less than 100% Alternative if there is no reference to circular motion **MAX 4**: MP1: evidence of cross-sectional area = 7.85×10^{-5} m^2✓ MP2 evidence of maximum tension = E × strain × *their area*✓ MP3: F = 1960 N ✓ MP4: 1960 N × *their safety factor:* allow any safety factor <100% OR quoting a value less than 1960 (N) with reference to 1960(N) and a safety factor ✓	5	AO3

Question	Answers	Additional comments/Guidance	Mark	AO
06.5	(In standing position) centre of mass higher/raised so l is smaller ✓ Therefore, T is **less** from $T = 2\pi\sqrt{\frac{l}{g}}$ or $T \propto \sqrt{l}$✓	Throughout could express in terms of frequency, $f = \frac{1}{2\pi}\sqrt{\frac{g}{l}}$	2	AO1
Total			**14**	

Question	Key	Answer	AO
7	**D**	account for conservation of energy in beta decay.	AO1
8	**B**	$\pi^0 + \pi^0$	AO2
9	**D**	mercury atoms become excited and then emit ultraviolet light.	AO1
10	**A**	1.65×10^8 | 1.82	AO1
11	**B**	significant | negligible	AO1
12	**B**	36 | 40	AO2
13	**D**	1.51×10^8 N	AO2
14	**D**	The resultant force on the rocket is zero.	AO1
15	**C**	$e^- + \nu_\mu + \bar{\nu}_e$	AO1
16	**B**	$u\bar{d}$	AO1

17	**A**	<table><tr><td>0.10</td><td>to the left</td></tr></table>	AO2
18	**A**	0.72 J	AO2
19	**D**	J s C^{-2}	AO1
20	**C**	When the resistance is 1.0 Ω, the power developed in the lamp is 2.25 W.	AO3
21	**C**	6%	AO3
22	**C**		AO1
23	**C**	0.069 N	AO2
24	**B**	<table><tr><td>0.15</td><td>5</td></tr></table>	AO2
25	**A**	a constant magnitude and constant direction.	AO1

<table>
<tr><td>26</td><td>C</td><td>
</td><td>AO2</td></tr>
<tr><td>27</td><td>A</td><td>1.4 mm</td><td>AO2</td></tr>
<tr><td>28</td><td>D</td><td>1874 nm</td><td>AO2</td></tr>
<tr><td>29</td><td>A</td><td><table>
<tr><td>sound wave</td><td>longitudinal</td><td>parallel to direction of energy propagation</td></tr>
</table></td><td>AO1</td></tr>
<tr><td>30</td><td>C</td><td>P and R are in antiphase.</td><td>AO2</td></tr>
<tr><td>31</td><td>D</td><td>5.3×10^{-4} kg</td><td>AO2</td></tr>
</table>

Total: 25 marks