GCSE
PHYSICS
8463/1F

Paper 1 Foundation Tier

Mark scheme

June 2023

Version: 1.0 Final

2 3 6 G 8 4 6 3 / 1 F / M S

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.

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Information 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 their judgement
- the Assessment Objectives and specification content that each question is intended to cover.

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 (for example, a scientifically correct answer that could not reasonably be expected from a student's knowledge of the specification).

2. Emboldening and underlining

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**.
Alternative words in the mark scheme are shown by a solidus eg allow smooth / free movement.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students 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 (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution?

[1 mark]

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name **two** magnetic materials.

[2 marks]

Student	Response	Marks awarded
1	iron, steel, tin	1
2	cobalt, nickel, nail*	2

3.2 Use of symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, or uses symbols to denote quantities in a physics equation, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Marks should be awarded for each stage of the calculation completed correctly, as students are instructed to show their working. At any point in a calculation students may omit steps from their working. If a subsequent step is given correctly, the relevant marks may be awarded.

Full marks are **not** awarded for a correct final answer from incorrect working.

3.4 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.

3.5 Errors carried forward

An error can be carried forward from one question part to the next and is shown by the abbreviation 'ecf'.

Within an individual question part, an incorrect value in one step of a calculation does not prevent all of the subsequent marks being awarded.

3.6 Phonetic spelling

Marks should be awarded if spelling is not correct but the intention is clear, **unless** there is a possible confusion with another technical term.

3.7 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.

3.8 Allow

In the mark scheme additional information, 'allow' is used to indicate creditworthy alternative answers.

3.9 Ignore

Ignore 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.

3.10 Do <u>not</u> accept

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

3.11 Numbered answer lines

Numbered lines on the question paper are intended to support the student to give the correct number of responses. The answer should still be marked as a whole.

4. Level of response marking instructions

Extended response questions are marked on level of response mark schemes.

- Level of response mark schemes are broken down into 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, if necessary, annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1: Determine 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. Do **not** look to penalise 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.

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 but be awarded a mark near the top of the level because of the level 3 content.

Step 2: Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. 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.

You should ignore any irrelevant points made. However, full marks can be awarded only if there are no incorrect statements that contradict a correct response.

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

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	switch		1	AO1 4.2.1.1 RPA4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	current potential difference	 allow p.d. allow voltage in this order only	1 1	AO1 4.2.1.4 RPA4

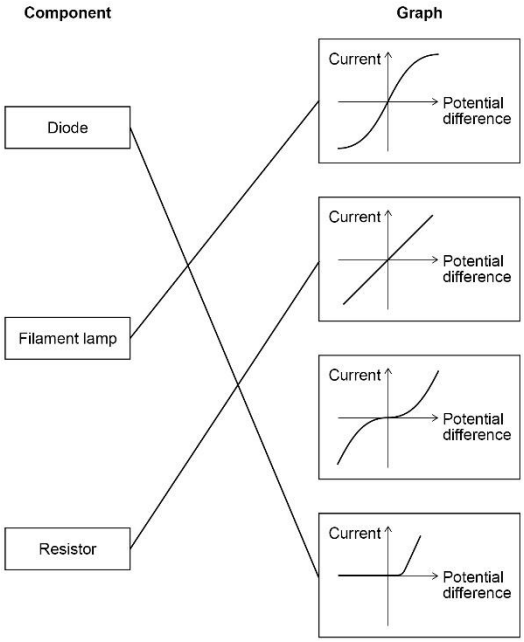
Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3				AO1 4.2.2 4.2.1.3 RPA4

Quantity	Decrease	Stay the same	Increase	
Current in the circuit	✓			1
Potential difference across the lamp	✓			1
Total resistance of the circuit			✓	1

any extra tick in a row negates the mark for that row

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	current = $\frac{15}{60}$ current = 0.25 (A)		1 1	AO2 4.2.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	$R = \frac{6.0}{0.12}$ R = 50 (Ω)		1 1	AO2 4.2.1.3

Question	Answers	Mark	AO / Spec. Ref.
01.6	 2 marks for all 3 correct 1 mark for 1 or 2 correct additional line from a box on the left negates the mark for that box	2	AO1 4.2.1.4 RPA4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	a zero error		1	AO3 4.2.1.4 RPA4

Total Question 1	**13**

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	electron		1	AO1 4.4.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	radius = 1.7 × 4.2 radius = 7.14 (femtometres)	 allow 7.1 (femtometres)	1 1	AO2 4.4.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	an alpha particle and a gold nucleus are both positively charged		1	AO1 4.4.1.1 4.4.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	a force of repulsion		1	AO1 4.2.5.1 4.2.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	A		1	AO3 4.2.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	tiny spheres that can't be divided		1	AO1 4.4.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	Bohr		1	AO1 4.4.1.3

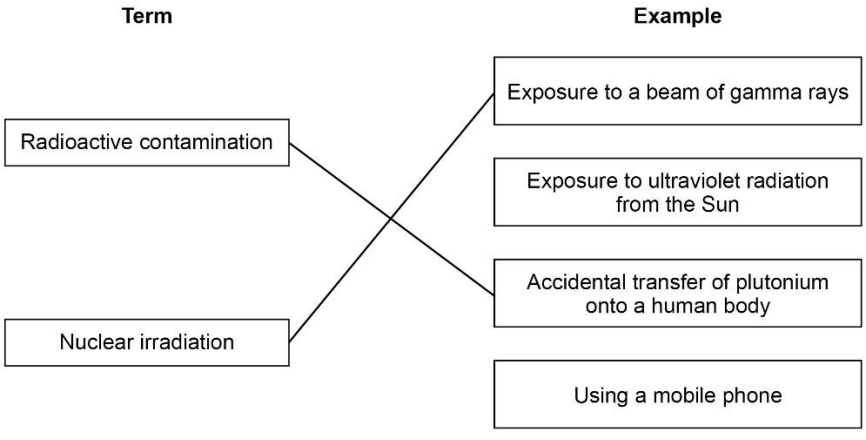
Total Question 2	**8**

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	protons neutrons	this order only	1 1	AO1 4.4.1.2

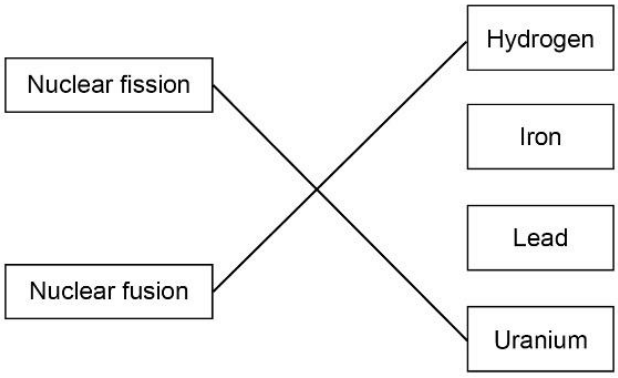
Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	the time taken for half the nuclei in a sample to decay		1	AO1 4.4.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	carbon-18		1	AO3 4.4.2.3

Question	Answers	Mark	AO / Spec. Ref.
03.4	 1 mark for each correct line additional line from a box on the left negates the mark for that box	1 1	AO1 4.4.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	to remove radioactive dust from their shoes		1	AO3 4.4.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	number of days = $\frac{0.072}{0.00050}$ number of days = 144		1 1	AO2 4.4.3.1

Question	Answers	Mark	AO / Spec. Ref.
03.7	**Process** **Fuel**  1 mark for each correct line additional line from a box on the left negates the mark for that box	1 1	AO1 4.4.4.1 4.4.4.2

Total Question 3	11

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	other energy resources = 95 (%) hydroelectric = 5 (%)		1 1	AO2 4.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	E_p = 2 500 000 × 9.8 × 15 E_p = 367 500 000 (J) **or** E_p = 3.675 × 10^8 (J)	 allow 370 000 000 (J) **or** E_p = 3.7 × 10^8 (J)	1 1	AO2 4.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	energy = power × time **or** $E = P \times t$		1	AO1 4.2.4.2 4.1.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	t = 3600 (s) E = 3000 × 3600 E = 10 800 000 (J) **or** E = 1.08 × 10^7 (J)	 allow a correct substitution using an incorrectly/not converted value for t allow an answer consistent with their incorrectly/not converted value for t allow a correct answer given to 2 s.f.	1 1 1	AO2 4.2.4.2 4.1.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	the level of the water in the river varies **or** the amount of rainfall varies		1	AO3 4.1.3
	and is lower in the summer months	allow specified months or range of months eg April to September MP2 dependent on scoring MP1	1	

Total Question 4	**10**

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	using the funnel was a safety precaution		1	AO3 4.1.2.1 RPA2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	bottle **A** was the control		1	AO3 4.1.2.1 RPA2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	stopclock / stopwatch	allow clock / watch ignore timer	1	AO3 4.1.2.1 RPA2

Question	Answers	Mark	AO / Spec. Ref.
05.4	**Level 2:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	3–4	AO3 4.1.2.1 RPA2
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	
	No relevant content	0	
	Indicative content • use the same (start) temperature for each experiment • use the same number of layers of insulation **or** use the same thickness of insulation • so that temperature difference can be compared • use the same volume of water • so (total thermal) energy of water is the same (each time) **or** so the same area of the bottle surface is heated by the water • use a lid for each bottle • so evaporation is reduced / stopped **or** so energy loss from the water (surface) is reduced / stopped • repeat the investigation and calculate mean values • so anomalous results can be identified **or** so the effect of random errors is reduced		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	bar (chart / graph) (type of) insulation is not numerical values **or** (type of) insulation is labels / categories	 allow one variable is not numerical values allow one variable is not continuous allow (type of) insulation is not continuous allow one variable is labels / categories allow one variable is categoric allow (type of) insulation is categoric MP2 dependent on scoring MP1	1 1	AO2 4.1.2.1 RPA2

Total Question 5	**9**

Question 6

<table>
<tr><th>Question</th><th>Answers</th><th>Mark</th><th>AO / Spec. Ref.</th></tr>
<tr><td>06.1</td><td>
<table>
<tr><th>Energy store</th><th>Less than at A</th><th>The same as at A</th><th>More than at A</th></tr>
<tr><td>The student’s gravitational potential energy</td><td>✓</td><td></td><td></td></tr>
<tr><td>The student’s kinetic energy</td><td></td><td></td><td>✓</td></tr>
<tr><td>The bungee cord’s elastic potential energy</td><td></td><td></td><td>✓</td></tr>
</table>
additional tick in a row negates the mark for that row
</td><td>1
1
1</td><td>AO1
4.1.1.1</td></tr>
</table>

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	$E_e = 0.5 \times 78.4 \times 25^2$ $E_e = 24\ 500$ (J)		1 1	AO2 4.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	greatest spring constant	allow needs largest force (per metre) to stretch the cord	1	AO3 4.1.1.2

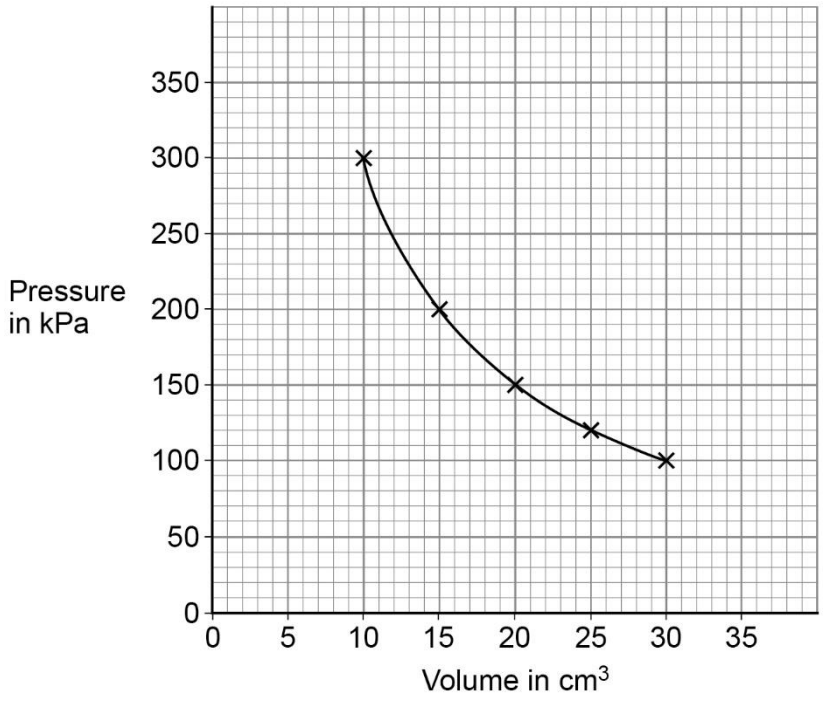
Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	A greatest extension before snapping	 MP2 dependent on scoring MP1	1 1	AO3 4.1.1.2

Total Question 6	**8**

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	random directions		1	AO1 4.3.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	a range of speeds		1	AO1 4.3.3.1

Question	Answers	Mark	AO / Spec. Ref.
07.3	 2 marks for plotting 4 points correctly 1 mark for plotting 2 or 3 points correctly 1 mark for line of best fit	3	AO2 4.3.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	300 × 10 = constant constant = 3000	allow use of any correct pair of values	1 1	AO2 4.3.3.2

Question	Answers	Mark	AO / Spec. Ref.
07.5			AO1 4.3.3.2

Quantity	Decreases	Stays the same	Increases	
Mean time between collisions of the particles with the tube			✓	1
Mean distance between the particles			✓	1
Mean speed of the particles		✓		1

additional tick in a row negates the mark for that row

Total Question 7	10

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	increase decrease	must be in this order	1 1	AO1 4.2.4.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	$P = I^2R$		1	AO1 4.2.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	$1.60 \times 10^9 = 2000^2 \times R$ $R = \frac{1.60 \times 10^9}{2000^2}$ $R = 400\ (\Omega)$		1 1 1	AO2 4.2.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	efficiency = $\frac{\text{useful energy output}}{\text{total energy input}}$ **or** efficiency = $\frac{\text{useful output energy transfer}}{\text{total input energy transfer}}$		1	AO1 4.1.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.5	$0.992 = \frac{\text{useful energy output}}{34.2}$ useful energy output = 0.992 × 34.2 useful energy output = 33.9 (GJ)	 allow a correct answer given to more than 3 s.f.	1 1 1	AO2 4.1.2.2

Total Question 8	10

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	so the thermometer temperature was the same as the temperature of the iron block		1	AO3 4.1.1.3 RPA1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	$\Delta\theta = (54 - 28) = 26$ (°C)		1	AO2 4.1.1.3 RPA1
	$26\,000 = 2.0 \times c \times 26$	allow a correct substitution using an incorrect value of $\Delta\theta$ obtained from the graph	1	
	$c = \frac{26\,000}{2.0 \times 26}$	allow a correct rearrangement using an incorrect value of $\Delta\theta$ obtained from the graph	1	
	$c = 500$ (J/kg °C)	allow an answer consistent with their value of $\Delta\theta$ obtained from the graph	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3	the calculated specific heat capacity will be more accurate		1	AO3 4.1.1.3 RPA1
	the iron block will transfer thermal energy to the surroundings at a lower rate		1	

Total Question 9	**7**

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	polarity of the potential difference doesn't change	allow direction of the potential difference doesn't change	1	AO1 4.2.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.2	$E = QV$		1	AO1 4.2.4.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.3	$5010 = Q \times 12$ $Q = \frac{5010}{12}$ $Q = 417.5$ (C)	 allow 418 (C)	1 1 1	AO2 4.2.4.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.4	$5010 = 0.015 \times L$ $L = \frac{5010}{0.015}$ $L = 334\,000$ (J/kg)		1 1 1	AO2 4.3.2.3

Question	Answers	Mark	AO / Spec. Ref.
10.5	**Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO1 4.3.1.1 4.3.2.1
	Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	
	No relevant content	0	
	Indicative content • particles in a solid are in a regular pattern • particles in a liquid are in a random arrangement • particles in a solid are vibrating about fixed positions • particles in a liquid are moving freely • as the ice changes to water the temperature remains constant • because as the ice changes to water the potential energy of the particles increases • as the water warms the particles move faster • so the kinetic energy of the particles increases • internal energy is the total kinetic and potential energy of all the particles ignore any references to density of ice vs liquid water ignore any references to spacing of particles		

Total Question 10	**14**