AQA GCSE Physics | 8463

SPECIFICATION POINT 4.3.3.3

Increasing the pressure of a gas (physics only) (HT only)

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**5**
Available paper years	**2018–2024**

Using this booklet

1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

Name: _____ **Date:** _____

Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

4.3.3.3 Increasing the pressure of a gas (physics only) (HT only)

Answer 01 · Mark scheme

June 2018 | 8463/1H | Original Q7

Question	Answers	Extra information	Mark	AO/ Spec. Ref
07.1	any **two** from: • calculate a mean • reduces the effect of random errors • identify / remove anomalies	 reduces human error is insufficient allow to assess the repeatability of the data	2	AO3 4.3.3.2
07.2	random error (because) eye position would not be the same each time (relative to the liquid)	allow a parallax error human error is insufficient allow systematic error only if it is clear that the student always viewed liquid level from above meniscus (or below)	1 1	AO3 4.3.3.2
07.3	(a temperature increase would) increase the pressure in the tube (even if the volume was constant) (because a higher temperature would mean) higher (average) kinetic energy of molecules / particles	 allow higher (average) speed for higher (average) kinetic energy	1 1	AO1 4.3.3.3

4.3.3.3 Increasing the pressure of a gas (physics only) (HT only)

Answer 01 · Mark scheme

June 2018 | 8463/1H | Original Q7

Question	Answers	Extra information	Mark	AO/ Spec. Ref
07.4		an answer of 8.0 (cm^3) scores **3** marks		AO2 4.3.3.2
	$1.6 \times 10^5 \times 9.0$ (= 1.44×10^6)		1	
	$1.44 \times 10^6 = 1.8 \times 10^5 \times V$ **or** $V = \frac{1.44 \times 10^6}{1.8 \times 10^5}$	allow for **2** marks $V = \frac{1.6 \times 10^5 \times 9.0}{1.8 \times 10^5}$	1	
	$V = 8.0$ (cm^3)		1	
07.5	work is done on the air (in the tyre)		1	AO1 4.3.3.3
	so the temperature (of the air) increases	allow the (average) kinetic energy of the particles increases	1	
Total			**11**	

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Answer 02 · Mark scheme

November 2020 | 8463/1H | Original Q10

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	The particles move in random directions. The particles move with a range of speeds.		1 1	AO1 4.3.3.1
10.2	100 000 × 0.030 = 3000 p × 0.025 = 3000 $p = \frac{3000}{0.025}$ p = 120 000 (Pa)	allow a correct substitution using an incorrectly calculated value using pV = constant allow a correct rearrangement using an incorrect value of the constant allow a correct calculation using an incorrect value of the constant allow correct substitution into $p_1V_1 = p_2V_2$ for first 2 marking points	1 1 1 1	AO2 4.3.3.2
10.3	particles would have a higher (mean) kinetic energy (so) increased number of collisions with the walls of the balloon per second greater forces exerted in collisions (between particles and balloon walls) greater force exerted on same area	allow particles would have a higher (mean) speed do not accept particles vibrate more allow greater frequency of collisions with the walls of the balloon allow greater rate of change of momentum (of particles) allow description using p=F/A	1 1 1 1	AO1 4.3.3.1
Total			**10**	

4.3.3.3 Increasing the pressure of a gas (physics only) (HT only)

Answer 03 · Mark scheme November 2021 | 8463/1H | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	0(.0) to 12(.0)	allow 2(.0) to 12(.0) (N)	1	AO1 4.3.3.2
09.2	mass of gas (in the syringe) **or** temperature (of the gas)		1	AO3 4.3.3.2
09.3	constant = 60 × 45 **or** constant = 2700 2700 = p × 40 $p = \frac{2700}{40}$ p = 67.5 (kPa)	 allow 68 (kPa)	1 1 1 1	AO2 4.3.3.2

4.3.3.3 Increasing the pressure of a gas (physics only) (HT only)

09.4	there is more time between collisions of particles and the walls of the syringe **or** there are less frequent collisions between the particles and the walls of the syringe (causing) a lower (average) force on the walls of the syringe (and) pressure is the total force per unit area		1 1 1	AO1 4.3.3.2
Total			**9**	

4.3.3.3 Increasing the pressure of a gas (physics only) (HT only)

Answer 04 · Mark scheme

June 2023 | 8463/1H | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	random	allow all / any ignore many different	1	AO1 4.3.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	more (air) particles (in the tyre) greater number of collisions with tyre (walls) per second	 allow collisions with tyre (walls) are more frequent allow greater rate of collisions with tyre (walls) do **not** credit MP2 if linked to an increased air temperature or increased speed / E_k of particles ignore greater force per m^2	1 1	AO1 4.3.3.1 4.3.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3	(as temperature increases the) air particles have greater (mean) kinetic energy (so) more collisions with tyre (walls) per second (and) greater force in each collision greater (mean) force per square metre causes greater pressure (on wall of tyre)	allow particles move with greater speeds (on average) allow collisions with tyre (walls) are more frequent allow greater rate of collisions with tyre (walls) allow greater rate of change of momentum in each collision allow ‘on a given area’ for ‘per square metre’	1 1 1 1	AO1 4.3.3.1

Total Question 9	7

4.3.3.3 Increasing the pressure of a gas (physics only) (HT only)

Answer 05 · Mark scheme

June 2024 | 8463/1H | Original Q8

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	(air) particles are closer together	ignore reference to kinetic energy of particles ignore reference to concentration of air particles	1	AO1 4.3.3.2
	(so) frequency of collision between air particles and syringe walls increased	do not credit MP2 if linked to an increase in kinetic energy	1	
	larger (total) force on a smaller (surface) area	allow larger force per unit area if no other marks score allow 1 mark for pressure increases because volume decreases and pV = constant	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	the mean kinetic energy of the particles increases		1	AO1 4.3.3.1

Question	Answers	Extra information	Mark	AO / Spec.
08.3	c = 1010 (J/kg °C)	allow full credit for a correct method using E = 0.0000130 (kJ)	1	AO2 4.1.1.3 4.3.2.2
	$0.0130 = 2.60\times10^{-8} \times 1010 \times \Delta\theta$	allow a correct substitution of an incorrectly / not converted value of c	1	
	$\Delta\theta = \dfrac{0.0130}{(2.60 \times 10^{-8} \times 1010)}$	allow a correct rearrangement of an incorrectly / not converted value of c	1	
	$\Delta\theta$ = 495 (°C)	allow an answer consistent with an incorrectly / not converted value of c allow a correct answer given to more than 3 sig figs	1	

Total Question 8	8

4.3.3.3 Increasing the pressure of a gas (physics only) (HT only)

Answer 02 · Examiner comments November 2020 | 8463/1H | Original Q10

Question 10 (High demand)

10.1 75% of students correctly identified two correct statements, while 23% of students identified one.

10.2 65% of students scored 4 marks. Students who understood that 'pressure × volume = a constant' were usually able to perform the calculation correctly. A few students made mistakes in copying down the quantities, eg missing off a 0 from, or adding an extra 0 to, the pressure. Many students who did not score marks thought that the relationship between the quantities was pressure/volume = a constant.

10.3 A good range of answers were seen and the question discriminated well between students. 1% of students scored all 4 marks, while 10% scored 3 marks, 25% scored 2 marks and 40% scored 1 mark. Most students realised that the answer involved the helium particles, and many referred correctly to the increase in kinetic energy or speed of these particles. However, few students were able to provide a coherent explanation beyond this. Whilst many referred to particle collisions, few indicated that the collisions were with the walls of the balloon and that the collisions would be more frequent. Many students seem to think that pressure is caused by particles colliding amongst themselves. A minority of answers went on to state that a greater force would be exerted on the balloon walls, but then failed to link this idea with the definition of pressure.

4.3.3.3 Increasing the pressure of a gas (physics only) (HT only)

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.

4.3.3.3 Increasing the pressure of a gas (physics only) (HT only)

Answer 03 · Examiner comments November 2021 | 8463/1H | Original Q9

Question 9

Questions **09.1** and **09.3** were well answered with 45% of students scoring 4 marks on **09.3**. Less than 10% of students scored a mark on **09.2,** with many students stating that either the volume or the equipment was kept the same, neither of which were creditworthy. Question **09.4** was poorly answered with few students demonstrating sufficient technical accuracy in their explanation. Common errors were to refer simply to 'more collisions' rather than the 'frequency of collisions' and not referring to the force exerted on the container walls.

Answer 04 · Examiner comments June 2023 | 8463/1H | Original Q9

Question 9 (High Demand)

09.1 80% of students correctly stated that the particels move in random directions.

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Answer 04 · Examiner comments June 2023 | 8463/1H | Original Q9

09.2 18% of students scored 2 marks, while 60% of students scored 1 mark.
If a student stated that there are a greater number of collisions with the tyre per second, but linkedthis to a spurious reason e.g .because the particles are moving faster, they did not score the score the 2nd mark. For the 2nd mark a microscopic description was needed, which is why 'greater force per m^2' was ignored.

09.3 This question was well attempted, but most students' explanations lacked the detail needed to score marks. 45% of students scored 1 mark. 26 % of students scored 2 marks. Only 10 % of students scored 3 or 4 marks.
The first 3 marking points were microscopic explanations, whereas the 4th marking point is a macroscopic explanation. Students who stated 'the particles vibrate more/faster' could not score the 1st marking point. For the 2nd marking point students needed to refer to more collisions with the tyre 'per second' or 'more frequently' or 'greater rate', the dependence on time is important. For the 3rd marking point te force referred to is the individual force experienced in a collision by a particle with the tyre wal, Students needed to state this so that it was clear whether they were talking about the total force or the individual force exerted by a particle. For the 4th marking point students needed to say both that the pressure is greater **and** why – that the force per square metre is greater. If a student said 'greater force and as pressure = force / area, greater pressure' that was just enough to score.

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Answer 04 · Examiner comments

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4.3.3.3 Increasing the pressure of a gas (physics only) (HT only)

Answer 05 · Examiner comments June 2024 | 8463/1H | Original Q8

Question 8 (High Demand)

08.1 Questions about the microscopic causes of pressure are difficult for GCSE students and this question was no exception. Many students repeated information given in the question which did not score any marks. A minority of students scored the first mark point, many students simply stating that the volume decreased which was insufficient. Students made a good attempt at explaining that there were more collisions between the particles and the container walls, but failed to score because they didn't refer to a specified time period e.g. per second, or rate or more frequent, etc. Some students stated that the kinetic energy of the particles had increased, which stopped them from scoring the second mark point. Very few students scored the third mark point which was the most demanding of the three. 9% of students scored 2 or 3 marks, while 43% of students scored 1 mark.

08.2 94% of students scored this mark, linking temperature increase to mean kinetic energy of particles.

08.3 A grade 6-7 calculation question which discriminated well between students. Many students failed to convert the specific heat capacity so scored 3 marks instead of 4. Some students tried to convert the energy into kJ but very few did this successfully, usually ending with a 'power of 10' error. 22% of students scored 3 marks while 62% of students scored 4 marks.