BioMedical Admissions Test (BMAT)

Daniel Lawson (6th Year Medical Student)

What is the BMAT, and who uses it?

University	Course	BMAT session accepted
Brighton and Sussex Medical School	A100 Medicine	September or November
Imperial College London	A100 Medicine	September or November
Lancaster University	A100 Medicine & Surgery A104 Medicine & Surgery with a Gateway Year	September or November
University College London	A100 Medicine	September or November
University of Cambridge	A100 Medicine	September or November
University of Manchester Medical School (for some groups of international applicants only, check the University's website for full details)	A106 MBChB Medicine and A104 MBChB Medicine (with foundation year)	September or November
University of Leeds	A100 Medicine A101 Gateway Year to Medicine A200 Dentistry	September or November
University of Oxford	A100 Medicine BC98 Biomedical Sciences	November **only**
University of Oxford	A101 Graduate Medicine	September or November
Keele University Keele requires only 'overseas for fees' applicants to take BMAT.	A100 Medicine	September or November

A 2-hour test, with UK sittings in September and November, used by some universities for selection for Medicine, Dentistry and Biomedical Sciences courses.

N.B. September 2021 sitting has been cancelled due to Covid-19 so November is the only option

Structure of the BMAT

Section I (1 hour, 32 MCQs): Thinking Skills

Section II (30 mins, 27 MCQs): Scientific Knowledge/Applications

Section III (30 mins, 1 question): Writing Task

Section I (1 hour)

- 32 multiple-choice questions (5 options, 1 correct answer)
  - 16 ‘problem solving’
  - 16 ‘critical thinking’
- N.B. from 2020 Section I will no longer include questions that test ‘data analysis and inference’ (long passages with multiple questions that follow)
- BMAT Section 1 question guide

Section I: Problem Solving

- **Problem solving questions come in three types:**
  - **‘Relevant selection’**
  - **‘Finding procedures’**
  - **‘Identifying similarity’**

Section I: Problem Solving: Relevant Selection

In order to qualify for a bonus, employees must fulfil certain criteria:

£1,000 bonus:	Absences less than 5%
	Production targets exceeded by at least 10%
	Rejects are less than 5% of output
£500 bonus:	Absences less than 10%
	Production targets met
	Rejects are less than 8% of output

Workers performed as follows:

	Smith	*Jones*	*Patel*	*Owololu*	*McKay*
attendance (%)	95	90	100	96	97
over production target (%)	+5	+6	+12	0	-4
product accepted (%)	98	96	95	93	96

Who qualifies for a bonus?

A Nobody

B Smith

C Patel and Smith

D Owololu, Patel and Smith

E Jones, Owololu, Patel and Smith

Section I: Problem Solving: Relevant Selection

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Section I: Problem Solving: Finding Procedures

Three thermometers are each accurate to within 2 degrees above or below the temperature they actually read. One reads 7°, one reads 9° and one reads 10°.

What is the minimum range in which the true temperature lies?

A 5° - 12°

B 7° - 9°

C 8° - 10°

D 8° - 9°

E 7° - 10°

Section I: Problem Solving: Finding Procedures

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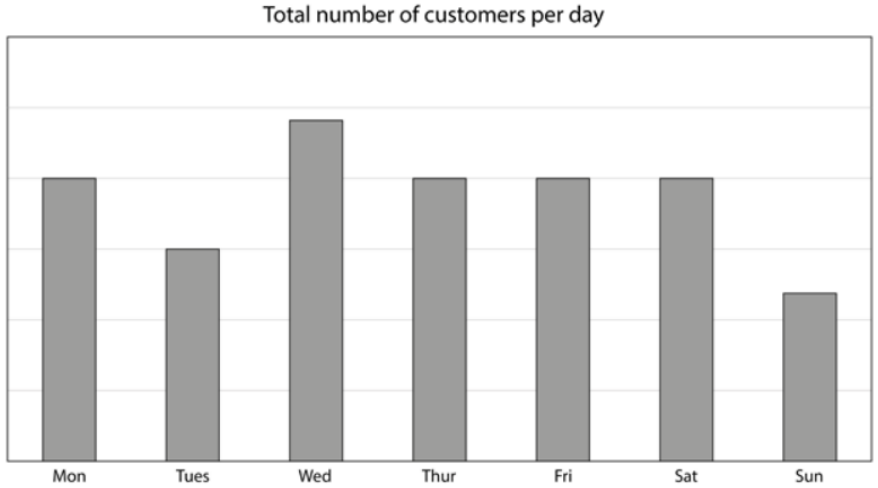
Section I: Problem Solving: Identifying Similarity

Graham recorded the number of visitors to his shop each day last week and presented the results in the bar chart below:



When he calculated the number of customers per hour he found that he had the same number for five of the days, but the values for Tuesday and Friday were slightly higher. The opening hours of the shop are as follows:

Day	*Open*	*Close*
Monday	8am	6pm
Tuesday	?	?
Wednesday	8am	8pm
Thursday	8am	6pm
Friday	?	?
Saturday	8am	6pm
Sunday	10am	4pm

Which one of the following could be the opening hours of the shop for Tuesday and Friday?

A Tuesday 9.30am - 5.30pm, Friday 8.00am - 6.30pm

B Tuesday 9.00am - 4.30pm, Friday 8.30am - 6.00pm

C Tuesday 9.00am - 4.30pm, Friday 8.00am - 6.00pm

D Tuesday 9.00am - 5.00pm, Friday 8.00am - 6.30pm

E Tuesday 10.00am - 5.00pm, Friday 8.30am - 6.00pm

Section I: Problem Solving: Identifying Similarity

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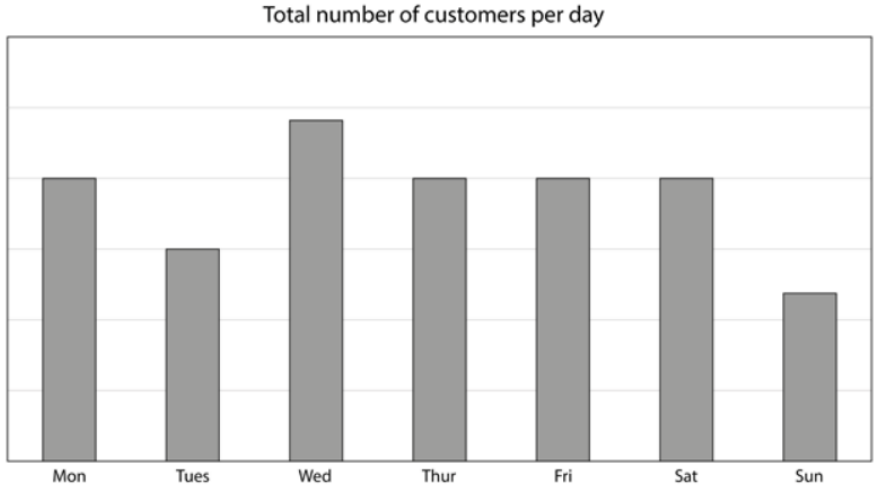

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Thursday	8am	6pm	10
Friday	?	?	
Saturday	8am	6pm	10
Sunday	10am	4pm	6

Which one of the following could be the opening hours of the shop for Tuesday and Friday?

A Tuesday 9.30am - 5.30pm, Friday 8.00am - 6.30pm 8, 8.5

B Tuesday 9.00am - 4.30pm, Friday 8.30am - 6.00pm 7.5, 9.5

C Tuesday 9.00am - 4.30pm, Friday 8.00am - 6.00pm 7.5, 10

D Tuesday 9.00am - 5.00pm, Friday 8.00am - 6.30pm 8, 10.5

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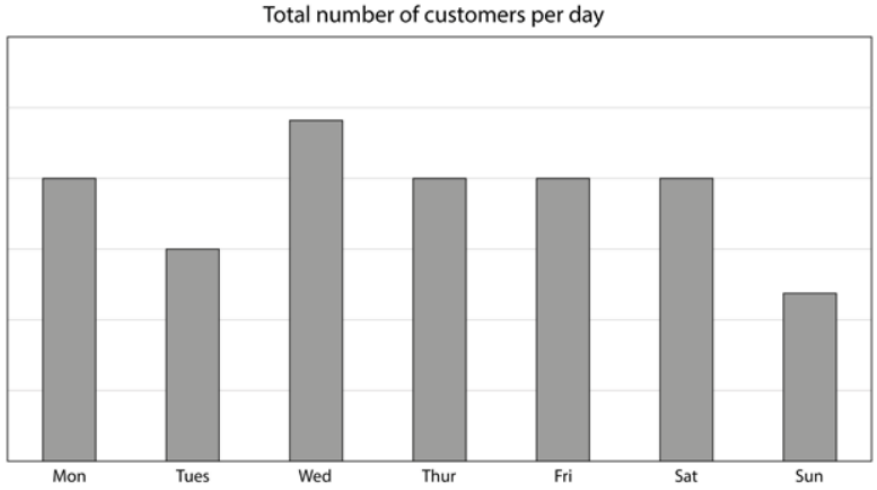

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C Tuesday 9.00am - 4.30pm, Friday 8.00am - 6.00pm **7.5, 10**

D Tuesday 9.00am - 5.00pm, Friday 8.00am - 6.30pm **8, 10.5**

E Tuesday 10.00am - 5.00pm, Friday 8.30am - 6.00pm **7, 9.5**

Section I: Critical Thinking

- Critical thinking questions come in several types:
  - Identifying the main conclusion
  - Drawing a conclusion
  - Identifying an assumption
  - Assessing the impact of additional evidence
  - Detecting reasoning errors
  - Matching arguments
  - Applying principles

Section I: Critical Thinking: Identifying Conclusion

Vegetarian food can be healthier than a traditional diet. Research has shown that vegetarians are less likely to suffer from heart disease and obesity than meat eaters. Concern has been expressed that vegetarians do not get enough protein in their diet but it has been demonstrated that, by selecting foods carefully, vegetarians are able to amply meet their needs in this respect.

Which of the following best expresses the main conclusion of the above argument?

A A vegetarian diet can be better for health than a traditional diet.

B Adequate protein is available from a vegetarian diet.

C A traditional diet is very high in protein.

D A balanced diet is more important for health than any particular food.

E Vegetarians are unlikely to suffer from heart disease and obesity.

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Section I: Critical Thinking: Reasoning Errors

Some people attempt to smuggle a pet into Britain because of the quarantine regulations which are aimed at preventing rabies from entering the country. If there were no such regulations, there would be no reason to smuggle pets. Since the most likely source of a rabies outbreak in Britain is a smuggled pet, if the quarantine regulations were abolished, the danger of a rabies outbreak would be reduced.

Which of the following is the best statement of the flaw in the argument above?

A Rabies is not likely to enter Britain in a wild animal.

B The quarantine regulations cannot prevent owners from smuggling their pets.

C If there were no quarantine regulations, pets with rabies could enter Britain easily.

D If people did not want to travel with their pets, there would be no need for quarantine regulations.

E If pets were inoculated against rabies, there would be no need for quarantine regulations.

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E If pets were inoculated against rabies, there would be no need for quarantine regulations.

Section II (30 mins)

- 27 multiple-choice questions (5-8 options, 1 correct answer)
  - 7 Biology
  - 7 Chemistry
  - 7 Physics
  - 6 Mathematics
- Speed as well as accuracy (aim for 1 minute per question)
- BMAT test specification

Specification (Assumed Knowledge)

- BMAT test specification
- Approximately GCSE level
  - But there still may be **some** unfamiliar content, depending upon your course/exam board

Candidates are expected to be familiar with the following SI prefixes:

nano-	10^{-9}
micro-	10^{-6}
milli-	10^{-3}
centi-	10^{-2}
deci-	10^{-1}
kilo-	10^{3}
mega-	10^{6}
giga-	10^{9}

B9. Animal physiology

B9.1 Respiration:

a. Understand the process of cellular respiration.

b. Understand the process of aerobic respiration, including the word equation.

c. Understand the process of anaerobic respiration in animals, including the word equation.

B9.2 Organ systems:

a. Nervous system:

i. Understand that the central nervous system comprises the brain and spinal cord.

ii. Explain the structure and function of sensory neurones, relay neurones, motor neurones, synapses and the reflex arc.

b. Respiratory system:

i. Explain the structure and function of the respiratory (breathing) system, including the structure of the thorax.

ii. Understand the processes of ventilation and gas exchange.

iii. Understand the importance of a high surface area : volume ratio for the gas exchange process.

c. Circulatory system:

i. Understand the structure and function of the circulatory system, including the heart, heart rate and ECGs, and the blood vessels (arteries, veins and capillaries).

ii. Understand the composition and function of the blood (red blood cells carry oxygen; white blood cells are involved in antibody production and phagocytosis; platelets are involved in blood clotting; and plasma is involved both in the transport of blood components and other dissolved substances including hormones, antibodies, urea and carbon dioxide, and in the distribution of heat).

iii. Understand the relationship with the gaseous exchange system.

iv. Understand the need for exchange surfaces and a transport system in multicellular organisms in terms of surface area : volume ratio.

d. Digestive system:

i. Understand the structure and function of the digestive system.

ii. Understand the processes of peristalsis, digestion, absorption and egestion.

e. Excretory system:

i. Understand the structure and function of the excretory system, including the kidney and the nephron.

ii. Understand the role of the kidneys in homeostasis.

C14. Metals

C14.1 Understand that the reactivity of a metal is linked to its tendency to form positive ions and the ease of extraction of the metal.

C14.2 Be able to use displacement reactions to establish the order of reactivity of metals and *vice versa*.

C14.3 Describe how the uses of metals are related to their physical and chemical properties, e.g. Al, Fe, Cu, Ag, Au, Ti, and understand that alloys can be formed to produce materials with specific properties.

C14.4 Know that most metal ores are the oxides of the metal, and that the extraction of metals always involves reduction processes.

C14.5 Know that common properties of transition metals include:

a. they are able to form stable ions in different oxidation states

b. they often form coloured compounds

c. they are often used as catalysts (as ions or atoms)

Section III (30 mins)

- 1 writing task (from a choice of 3)
- Topics are of ‘general, scientific or medical interest’

- Can make notes on question paper
- Answers limited strictly to one A4 page

Section III: Writing task

1 **People are often motivated to deny the existence of problems if they disagree with the solutions to those problems.**

Explain what you think is meant by the statement. Present a counter-argument. To what extent do you agree with the statement?

2 **'In science, there are no universal truths, just views of the world that have yet to be shown to be false.' (Brian Cox and Jeff Forshaw)**

Explain what you think is meant by the statement. Argue that scientists need to accept some things as 'truths' to advance their understanding. To what extent do you agree with the statement?

3 **Teamwork is more important for surgical innovation than the skills of an individual surgeon.**

Explain the reasoning behind this statement. Argue that the skills of individual surgeons are more important for surgical innovation or progress. To what extent do you agree with the statement?

BioMedical Admissions Test SECTION 3 Writing Task 4500/13

First name(s) Surname / Family name

BMAT candidate number Centre number Initials

B Task Chosen

Your answer must be contained within this area.

University of Cambridge Local Examinations Syndicate

Draft

In arriving at the score, you should consider:

- Has the candidate addressed the question in the way demanded?
- Have they organised their thoughts clearly?
- Have they used their general knowledge and opinions appropriately?

Scores are awarded on a scale from 1 to 5.

Score 1
An answer that has some bearing on the question but which does not address the question in the way demanded, is incoherent or unfocussed.

Score 2
An answer that addresses most of the components of the question and is arranged in a reasonably logical way. There may be significant elements of confusion in the argument. The candidate may misconstrue certain important aspects of the main proposition or its implication or may provide an unconvincing or weak counter proposition.

Score 3
A reasonably well-argued answer that addresses ALL aspects of the question, making reasonable use of the material provided and generating a reasonable counter-proposition or argument. The argument is relatively rational. There may be some weakness in the force of the argument or the coherence of the ideas, or some aspect of the argument may have been overlooked.

Score 4
A good answer with few weaknesses. ALL aspects of the question are addressed, making good use of the material and generating a good counter proposition or argument. The argument is rational. Ideas are expressed and arranged in a coherent way, with a balanced consideration of the proposition and counter proposition.

Score 5
An excellent answer with no significant weaknesses. ALL aspects of the question are addressed, making excellent use of the material and generating an excellent counter proposition or argument. The argument is cogent. Ideas are expressed in a clear and logical way, considering a breadth of relevant points and leading to a compelling synthesis or conclusion.

An answer judged to be irrelevant, trivial, unintelligible or missing should be given a score of **0**.

Section III: Example Task

1 "Computers are useless. They can only give you answers." (Pablo Picasso)

Explain what is meant by this statement. Argue to the contrary. What are the real limits of technology?

1. Computers can 'only give you answers' likely refers to them, at the basic level, being computational devices: they operate on binary digits (0s and 1s). They do not possess innate 'creativity'.
   [Picasso was a significant figure in the Cubist movement, which tended not to portray life as realistically as possible. He was probably more interested in interpretation than definitive answers.]
2. But to say that this is 'useless' is to misunderstand the complexity that can be built upon binary operations. Picasso was likely familiar with computers being used for administrative tasks such as calculating/scheduling [he died in 1973], but computers and technology have advanced exponentially since then. Technology can now be applied creatively: digital art, social networking, blogging etc allow ideas not just to be expressed, but shared.

Ensure you PLAN.

Approach the question using the parts they have provided in the prompt, and use their order to guide general structure.

3. Artificial intelligence (AI) developments have also brought computers further away from calculating machines closer to 'human' levels of perception, decision-making etc. AI may even have applications in medicine, being able to use machine learning and pattern recognition to examine X-rays, microscope slides etc. to make diagnostic decisions.
4. Limitations of technological advancement are often said to be physical: related to transistors on integrated circuits [Moore's law not being sustainable]. The real limitation of technology is how humans apply it. In situations where AI could replace human decision-making, do we trust computers enough?

A (suggested) plan of attack for the BMAT

1. Choose a sitting (September/November)
2. Register!
3. Review specification
4. Brush up scientific (section II) knowledge
5. Practise (past/example papers)

http://admissionstesting.org/bmat-preparation

1. Choose a sitting

N.B. September 2021 sitting has been cancelled due to Covid-19 so November (3rd) is the only option

	September 2020	November 2020
Test date	Saturday 5 September	Wednesday 4 November
Test centres	Can only be taken at certain authorised test centres in the UK and internationally. See our website for details.	Can be taken at your school/college if they are a centre, or at one of our authorised test centres worldwide.
Which institutions/ courses accept results?	View a list of participating institutions/courses on our website: admissionstesting.org/bmat-september	View a list of institutions/courses on our website: admissionstesting.org/bmat-november
Registration fee Fees may be payable in Euros or US Dollars depending on centre location.	£85 within the UK/EU £122 outside the EU No late fee applies.	£49 standard fee within the UK/EU £83 standard fee outside the EU £35 additional late fee.
Registration opens	22 June	1 September
Standard registration deadline	9 August at 23.59 BST	1 October at 17.00 BST
Late registration deadline	No late registration available.	15 October at 18.00 BST
Results release date	25 September	27 November
How do I get my results?	Log into the Metritests account you created when registering. For information about how institutions get your results, please visit our website.	Log into Metritests. Details will be given to you on the day of the test. For information about how institutions get your results, please visit our website.

NOTE

1. **You can only take the BMAT once per admission cycle in EITHER September or November**

1. **Oxford will only accept the November sitting of BMAT, so even if you are apply to other universities that accept September, you must only sign up for the November sitting if applying to Oxford**

2. Registration

For BMAT in September:
You need to register yourself.

You choose your test centre and pay for the test online at www.metritests.com (select Shop at the top of the page).

Registration deadline usually early August

(not applicable in 2021)

For BMAT in November:
Your school/college/test centre needs to register you.

Please ask the Exams Officer to register you. Also ask for your candidate entry number as proof that your registration is complete. Please note, you may be charged an administration fee in addition to the test fee.

You must take BMAT – November at a registered test centre. Your school or college may already be a test centre – check with your Exams Officer.

If your school or college is not already registered as a centre, they can apply to become a test centre. The deadline for applications to become a centre is 30 September. Once they are a test centre, they will then need to register you as a candidate separately.
admissionstesting.org/become-a-centre

If you are not able to take the test at school or college, you need to find an authorised open test centre instead.
admissionstesting.org/find-a-centre

Registration deadline usually 1 October

2021 registration: 1 Sept – 1 Oct (standard fee)
Final deadline: 15 Oct (late fee)
Test date: 3 November 2021

Do NOT rely on your school to register you for the BMAT, or to know when the deadline is! They may have little or no experience of entering students for it.

Speak to them early on (ideally before summer in Y12) to work out if your school is a registered test centre, if they can become one, or if you need to find an authorised open test centre for yourself.

Fee should not be a barrier to taking the BMAT:
Reimbursement application form

3. Review specification

- BMAT test specification
- Have a look through the four scientific sections of the specification
- Make a list of any areas you are unfamiliar with, or want to revisit
- If you are unsure where certain content appears in your school curriculum, you can ask your teacher

BIOLOGY

B1. Cells

B1.1 Know and understand the structure and function of the main sub-cellular components of both animal and plant eukaryotic cells to include:

a. cell membrane
b. cytoplasm
c. nucleus
d. mitochondrion
e. cell wall (plant only)
f. chloroplast (plant only)
g. vacuole (plant only)

CHEMISTRY

C1. Atomic structure

C1.1 Describe the structure of the atom as a central nucleus (containing protons and neutrons) surrounded by electrons moving in shells/energy levels.

C1.2 Know the relative masses and charges of protons, neutrons and electrons, and recognise that most of the mass of an atom is in the nucleus.

C1.3 Know and be able to use the terms *atomic number* and *mass number*, together with standard notation (e.g. $^{12}_{6}C$), and so be able to calculate the number of protons, neutrons and electrons in any atom or ion.

C1.4 Use the atomic number to write the electron configurations of the first 20 elements in the Periodic Table (H to Ca) in comma-separated format (e.g. 2,8,8,1 for a potassium atom).

C1.5 Know the definition of isotopes as atoms of an element with the same number of protons but different numbers of neutrons (so having different mass numbers). Use data, including that from a mass spectrometer, to identify the number and abundances of different isotopes of elements.

C1.6 Know and use the concept of relative atomic mass, A_r, including calculating values from given data.

PHYSICS

P1. Electricity

P1.1 Electrostatics:

a. Know and understand that insulators can be charged by friction.
b. Know and understand that charging is caused by gain or loss of electrons.
c. Know and understand that like charges repel and unlike charges attract.
d. Understand applications and hazards associated with electrostatics, including the role of earthing.

P1.2 Electric circuits:

a. Know and recognise the basic circuit symbols and diagrams, including: cell, battery, light source, resistor, variable resistor, ammeter, voltmeter, switch, diode.
b. Understand the difference between alternating current (ac) and direct current (dc).

MATHEMATICS

M1. Units

M1.1 Use standard units of mass, length, time, money and other measures.

Use compound units such as speed, rates of pay, unit pricing, density and pressure, including using decimal quantities where appropriate.

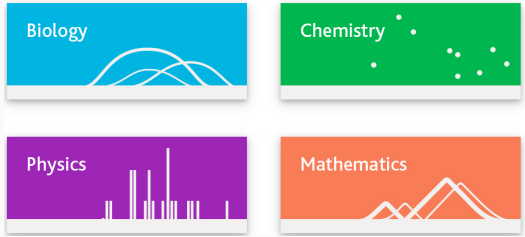
M1.2 Change freely between related standard units (e.g. time, length, area, volume/capacity, mass) and compound units (e.g. speed, rates of pay, prices, density, pressure) in numerical and algebraic contexts.

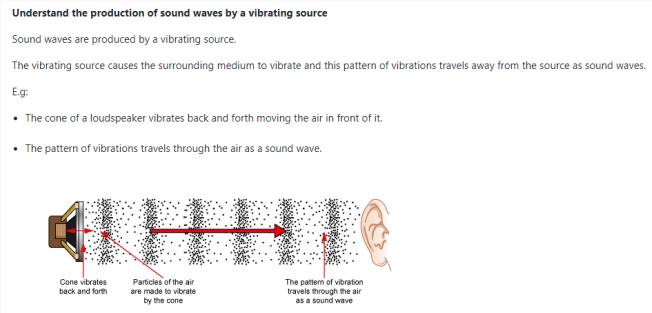
4. Brush up scientific (section II) knowledge

- Using the list of topics you produced from the specification
- Refer to your GCSE (or equivalent) notes
- Some topics may relate to your A-level notes

- A free online revision guide has been produced that should cover the material for BMAT section 2: [BMAT section 2 guide]

- You may want to refer to your preferred course textbooks or teachers for particular areas

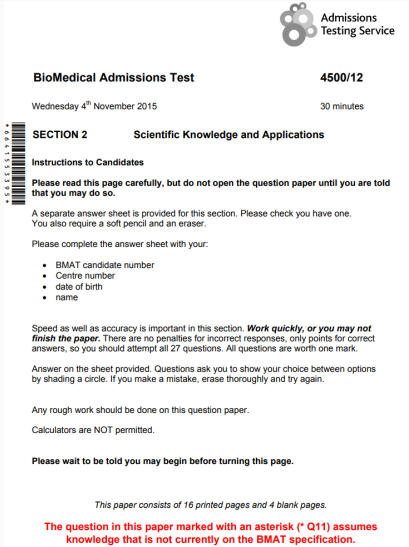




5. Practise - past/example papers

- BMAT practice papers
- Past papers dating back to 2003 (plenty!)
- Specimen/sample papers (with explained answers)

- **Warning: section I** was updated for 2020 (so only the new sample papers and the 2020 papers have the current format)
- **Warning: section II specification** content has changed over time, so some past papers may have questions on no longer examinable content
  (past papers have helpfully been marked to show where this is the case)
- **Warning: section III** between 2010-2016 had a choice of 4 writing tasks; it has now reverted back to a choice from 3



Admissions Testing Service

BioMedical Admissions Test **4500/12**

Wednesday 4th November 2015 30 minutes

SECTION 2 **Scientific Knowledge and Applications**

Instructions to Candidates

Please read this page carefully, but do not open the question paper until you are told that you may do so.

A separate answer sheet is provided for this section. Please check you have one. You also require a soft pencil and an eraser.

Please complete the answer sheet with your:

- BMAT candidate number
- Centre number
- date of birth
- name

Speed as well as accuracy is important in this section. ***Work quickly, or you may not finish the paper.*** There are no penalties for incorrect responses, only points for correct answers, so you should attempt all 27 questions. All questions are worth one mark.

Answer on the sheet provided. Questions ask you to show your choice between options by shading a circle. If you make a mistake, erase thoroughly and try again.

Any rough work should be done on this question paper.

Calculators are NOT permitted.

Please wait to be told you may begin before turning this page.

This paper consists of 16 printed pages and 4 blank pages.

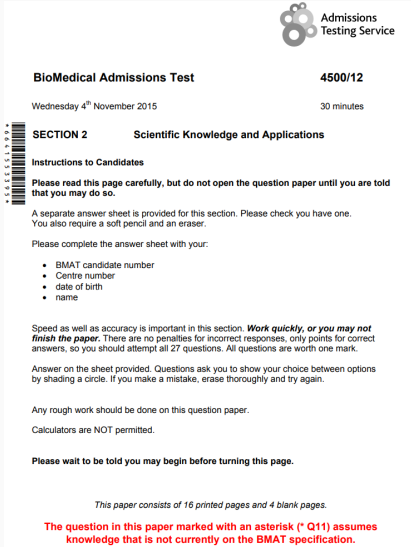
The question in this paper marked with an asterisk (* Q11) assumes knowledge that is not currently on the BMAT specification.

5. Practise - past/example papers

- Practise past papers **under timed conditions**
  - Especially for section II, the time pressure (30 mins) is a key part

- After marking past paper attempts, make a note of any section II areas that seem to be problematic - you can then review the relevant material for these areas

- **Do** practise the section III writing tasks
  - Again, under timed conditions (30 mins)
  - Always do a **plan** even when you practise (5-10 minutes)
  - If you don't have time to fully write out each task, just do a plan for it
  - Ask a teacher (e.g. biology, or even English) or friend if they would look over your writing task - even if they aren't a specialist in the subject they can point out if it is coherent, the argument is rational etc.



Admissions Testing Service

BioMedical Admissions Test **4500/12**

Wednesday 4th November 2015 30 minutes

SECTION 2 **Scientific Knowledge and Applications**

Instructions to Candidates

Please read this page carefully, but do not open the question paper until you are told that you may do so.

A separate answer sheet is provided for this section. Please check you have one. You also require a soft pencil and an eraser.

Please complete the answer sheet with your:

- BMAT candidate number
- Centre number
- date of birth
- name

Speed as well as accuracy is important in this section. ***Work quickly, or you may not finish the paper.*** There are no penalties for incorrect responses, only points for correct answers, so you should attempt all 27 questions. All questions are worth one mark.

Answer on the sheet provided. Questions ask you to show your choice between options by shading a circle. If you make a mistake, erase thoroughly and try again.

Any rough work should be done on this question paper.

Calculators are NOT permitted.

Please wait to be told you may begin before turning this page.

This paper consists of 16 printed pages and 4 blank pages.

The question in this paper marked with an asterisk (* Q11) assumes knowledge that is not currently on the BMAT specification.

Additional resources

- BMAT preparation guide (the official BMAT preparation guide is very useful!)
- BMAT videos (official videos from former BMAT candidates and, usefully, section 3 examiners!)
- BMAT Tips series (advice from a former Cambridge medical student, current doctor and YouTuber)
- Section 3 marking criteria (official marking criteria used in assessing writing task)

Finally...

- BMAT is only **one** piece of information Cambridge has about you
  - amongst GCSE results, personal statement, predicted grades, teacher references (and later, interview)

- The vast majority of BMAT candidates score in the 4.0 to 6.0 range in the first two sections (scores of 7.0 or more are **incredibly rare**)
- The vast majority of successful applicants score in the 4.0 to 6.0 range also

- It is **very** unlikely you would not receive an interview solely due to your BMAT score
- It is **very** unlikely you would not receive an offer solely due to your BMAT score

Good luck!