

# International Baccalaureate Catalogue 2023

Resources for schools  
following an International  
Baccalaureate curriculum



Welcome!

# Pearson for International Schools

In this catalogue you will find details of our resources to provide your IB learners with everything they need for their IB journey, from PYP to MYP to Diploma and beyond.

## HIGHLIGHTS

### NEW

#### Sciences for the IB Diploma Programme –

Developed in cooperation with the IB, new editions of our popular Biology, Chemistry and Physics student books, fully revised in line with the new 2023 Subject Guides.



#### NEW Business Management for the IB Diploma –

A brand new student book for the 2022 Subject Guide and first assessments in 2024, using our tried-and-tested approach to the Diploma Programme in this subject for the first time.

#### Theory of Knowledge for the IB Diploma –

Full coverage of the 2020 Subject Guide with integrated support for exhibition and essay preparation.

#### Pearson Mathematics for the Middle Years Programme –

Student books and teacher guides developed by Ibrahim Wazir for an inquiry-led approach that gives learners the opportunity to explore concepts for themselves.



### Follow our social channels

Keep up to date with the issues that matter to international schools.

Read the latest news on our international schools blog:  
[blog.pearsoninternationalschools.com](http://blog.pearsoninternationalschools.com)

Follow us on Facebook for the latest updates  
[facebook.com/PearsonInternationalSchools](https://facebook.com/PearsonInternationalSchools)

Follow our LinkedIn page for news:  
[linkedin.com/showcase/pearson-international-schools/](https://linkedin.com/showcase/pearson-international-schools/)

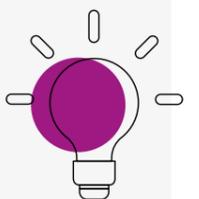
## Contents

Programme	Page
 <b>Primary Years Programme</b>	<b>2</b>
 <b>Middle Years Programme</b>	<b>4</b>
 <b>Diploma Programme</b>	
Overview	<b>7</b>
Theory of Knowledge	<b>10</b>
Studies in Language and Literature	<b>12</b>
Language Acquisition	<b>14</b>
Individuals and Societies	<b>16</b>
Business Management	 <b>18</b>
Economics	<b>19</b>
Sciences	  <b>20</b>
Mathematics	<b>24</b>
IB Power Starters	<b>26</b>
 <b>Career-related Programme</b>	<b>28</b>
BTEC	<b>28</b>

## GOOD TO KNOW

This catalogue contains a selection of our IB resources. To view the full range, please visit [pearson.com/international-schools](http://pearson.com/international-schools)

 All products are suitable for English Language Learners



\* Primary Years Programme (PYP), Middle Years Programme (MYP), Diploma Programme (DP), and Career-related Programme (CP) are trademarks of the International Baccalaureate Organisation (IB), which was not involved in the production of these products - excluding Pearson Sciences for the IB Diploma Programme, developed in cooperation with the IB.

All prices displayed in this catalogue are correct at time of printing and are subject to change.

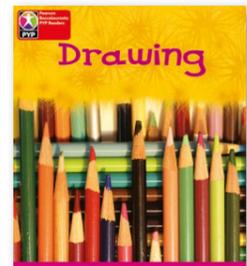
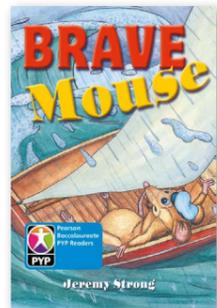
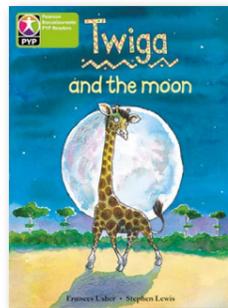
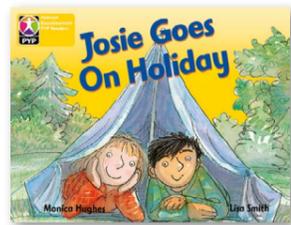
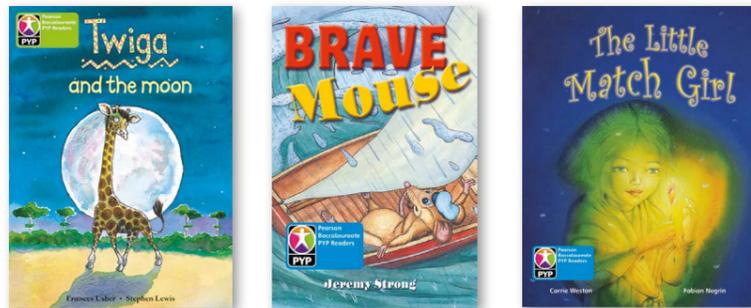


# Primary Years Programme Readers and Companions

Specially designed to motivate younger learners and help them develop vital inquiry-based reading strategies.

This collection of 120 inquiry-based Readers provides plenty to explore, in line with the IB PYP core principles.

The ready-made library is clearly categorised by age and organised into themes. These Readers span the six units of inquiry and come with nine Companions to support your PYP pupils with their learning.



A variety of fiction and non-fiction will motivate all learners.



The rain stopped. The giraffes came out from the trees and walked about by the river.  
Twiga looked up at the sky.  
'Look,' he said. 'The moon is back. When I am tall can I eat the moon?'

14

'You can't eat the moon,' said Twiga's father. 'But I will show you something that you can eat when you grow up.' He gave Twiga some beautiful fruit from the top of a very tall tree.  
'Mmmm, that's good,' said Twiga.

15

### Summary of components:

- 120 high-quality, inquiry-based Readers.
- Nine supporting Companions with activities to build up individual portfolios.
- Money-saving packs available, organised by grade/year and theme.
- To evaluate this series, visit [pearsoninternational-schools.com/pyp](http://pearsoninternational-schools.com/pyp)

### ELL

These books teach the higher-order skills and strategies that thinking readers need, and support comprehension and oral language.

Readers have a strong international approach and are all linked to the IB Learner Profile.

#### Cocoa beans

Cocoa beans grow in pods on cocoa trees. When the pods are ripe, the farmers cut them from the tree and take out the beans.




Workers spread out the beans in the sun to dry. They pack the dried beans into large bags. Then they send the beans to local companies. They send the beans to the chocolate company.

#### Who We Are

##### The heart

Explain how the heart pumps blood around the body, then label the diagram of the human heart, using these words to help you: left atrium, right atrium, left ventricle, right ventricle.

Write five tips for how to look after your heart and keep it healthy:

- ✓
- ✓
- ✓
- ✓
- ✓

8 Learner Profile Attributes: Well-balanced, Knowledgeable, Thinkers

Companions include tear-out sheets for inclusion in portfolios

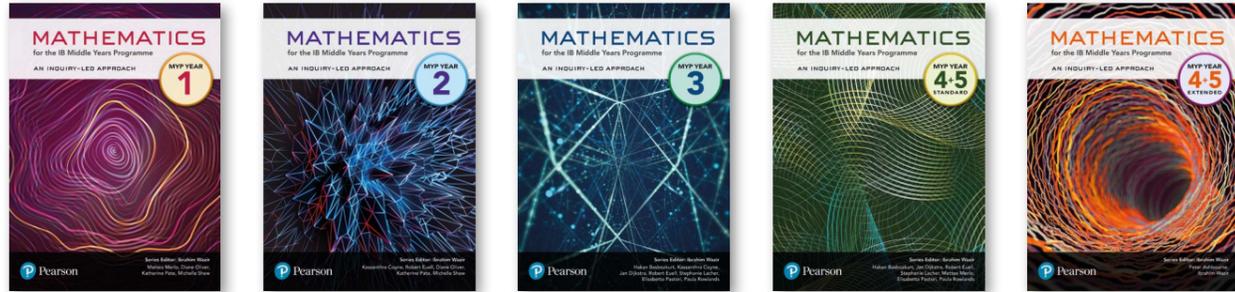
Download the PYP Readers and Companions Structure Chart [pearsoninternational-schools.com/pyp](http://pearsoninternational-schools.com/pyp)





# Mathematics for the Middle Years Programme

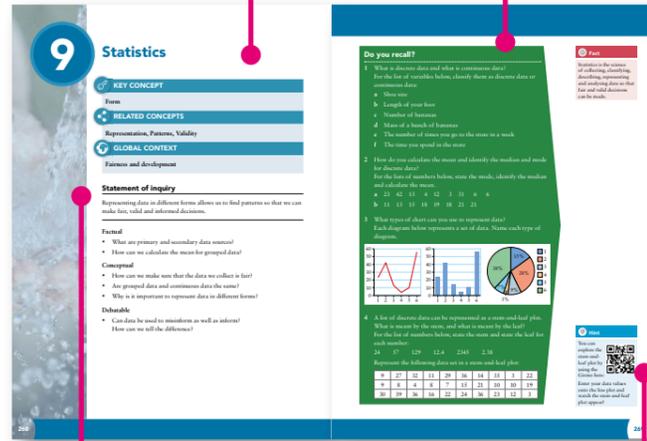
Put learners in charge with an exploratory inquiry-led approach to MYP Mathematics in our latest series, written for the 2020 curriculum.



- Each full-colour book and accompanying eBook contains detailed worked examples, ideas for investigations, reflections, differentiated exercises, and check your knowledge questions to put learning into practice.
- Clear links to key concepts, related concepts and global contexts in addition to statements of inquiry and inquiry questions for each chapter.
- ATLs identified throughout.
- Written by an international team of highly experienced authors and teachers, and led by Series Editor, Ibrahim Wazir, this series fully matches the 2020 Guide.

Key concept, related concepts and global context identified for each chapter.

Reminders of prior learning.



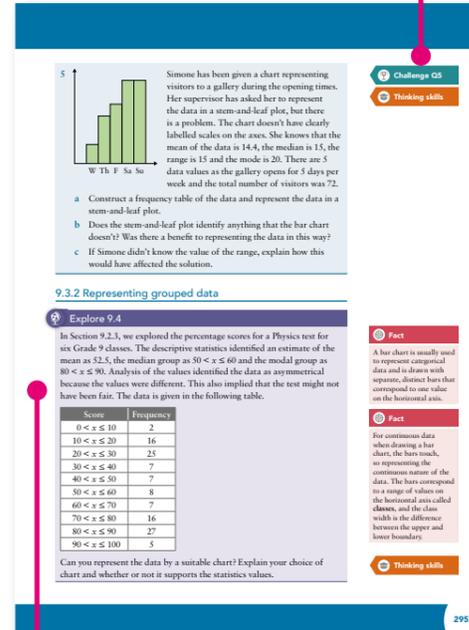
Statement of inquiry and inquiry questions for each chapter.

QR codes linking to additional digital resources.

2020 SYLLABUS			
Mathematics for the IB Middle Years Programme			
<b>Year 1</b>			
Print and eBook	978 1292367 40 8	£32.39	
eBook only	978 1292408 91 0	£27.00	
<b>Year 2</b>			
Print and eBook	978 1 292367 41 5	£37.89	
eBook only	978 1292408 92 7	£32.00	

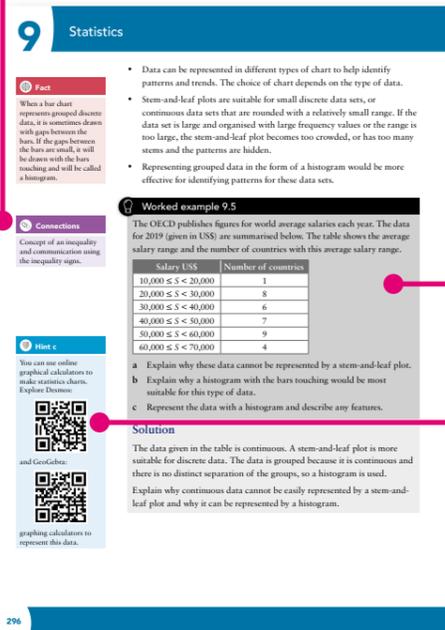
<b>Year 3</b>			
Print and eBook	978 1 292367 42 2	£43.29	
eBook only	978 1292408 93 4	£38.00	
<b>Years 4+5 Standard</b>			
Print and eBook	978 1 292367 43 9	£48.69	
eBook only	978 1 292408 94 1	£43.00	
<b>Years 4+5 Extended</b>			
Print and eBook	978 1 292367 44 6	£52.00	
eBook only	978 1 292408 95 8	£48.00	

Differentiated practice questions.



Learners are encouraged to explore concepts and problems.

Connections to other areas highlighted.



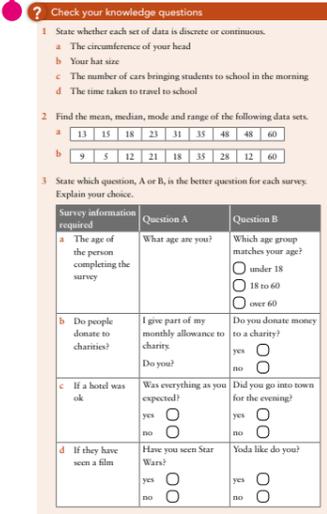
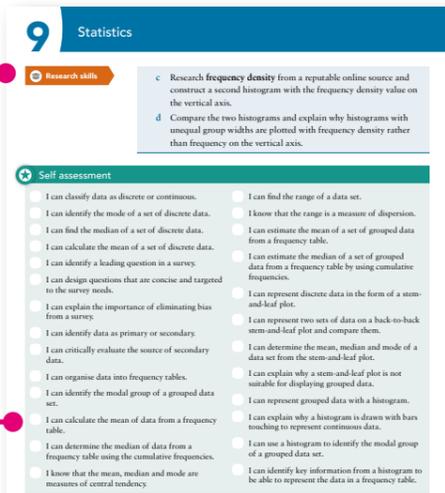
Clear and structured worked examples throughout.

Hint boxes help learners tackle problems.

Check your knowledge questions at the end of each chapter to check understanding and put learning into practice.

ATLs identified.

End of chapter checklists to help learners track their progress.



**Meet the Series Editor:**  
Ibrahim Wazir is a leading expert in IB mathematics. Watch him discuss using an exploratory approach in the classroom in an on-demand webinar.

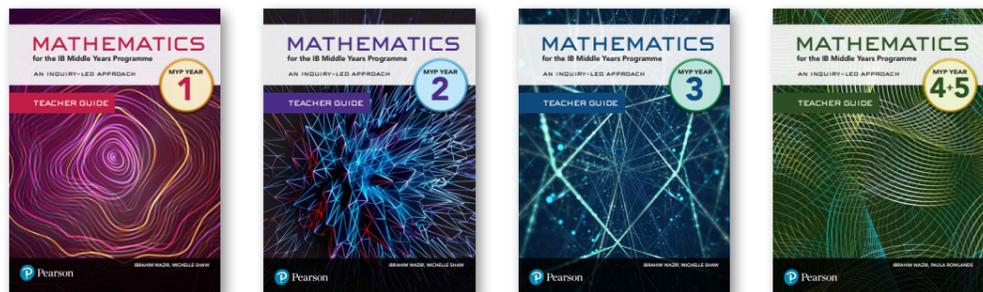


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# Mathematics for the Middle Years Programme Teacher Guides

Accompanying Teacher Guides include detailed unit plans, prerequisites, extra questions, ideas for group work and much more.



- Each book in our MYP Mathematics series is supported by a comprehensive Teacher Guide.
- Editable unit plans allow every school to adapt the series to their individual needs, with support for planning the content component of the course.

Take a look at a free Unit Plan for Year 1 at [pearsoninternational-schools.com/myp](https://www.pearsoninternational-schools.com/myp)

Unit summary including recommended teaching hours.

Editable format allows flexibility.

Interdisciplinary links highlighted where relevant.

**IB MYP Mathematics Year 1 Lesson Plan: Chapter 1**

**SUMMARY**

Teacher(s)	Subject group	Level	Standard level
Number review	MYP year 1	Mathematics	Standard level
<b>Unit title</b>		<b>Unit duration (hours)</b>	6

**Description**

In this chapter students will review the basics of the natural numbers, integers and real numbers. Within this, they will explore place value for whole and decimal numbers and use this to systematically compare numbers. Additionally, essential skills including the four number operations and the order of operations (excluding exponents) are reviewed.

**INQUIRY: ESTABLISHING THE PURPOSE OF THE UNIT**

Key concept	Related concepts
Relationships	Patterns, Quantity, Representation, Systems
<b>Conceptual understanding</b>	<b>Global context</b>
Number sense and operations are essential skills in mathematics. Students will need to have an understanding of the basic number concepts in order to model, interpret and analyse problems and situations.	Globalisation and sustainability

**Statement of inquiry**

Using number systems allows us to understand relationships that describe our climate, so we are able to acknowledge human impact on global climate change.

**Inquiry questions**

Factual	Conceptual	Debatable
What are negative numbers?	How do you add and subtract integers?	Why do we have directed numbers?
What is the order of operations?		Why is it important to have order of operations?

**Aims**

- To appreciate the international dimension of mathematics through an awareness of the universality of mathematics and its multicultural and historical perspectives.

Summative assessment tasks from the book outlined.

Key concept, related concepts, global context, statement of inquiry and inquiry questions listed for each unit.

Opportunities for students to exhibit ATL skills identified.

2020 SYLLABUS			
Mathematics for the IB Middle Years Programme			
Year 1 Teacher Guide	978 1 292400 92 1	£103.00	
Year 2 Teacher Guide	978 1 292400 93 8	£103.00	
Year 3 Teacher Guide	978 1 292400 94 5	£103.00	
Years 4+5 Teacher Guide	978 1 29240 095 2	£206.00	

**GOOD TO KNOW**

- Both our IB MYP Maths and IB Diploma Maths resources follow the same inquiry-led approach.
- Find Ibrahim Wazir's mapping document matching our MYP and DP mathematics resources to the US Common Core Standards on our website.



# For the IB Diploma

Everything you need to teach and study the IB Diploma curricula, including textbooks, eBooks and online support materials.



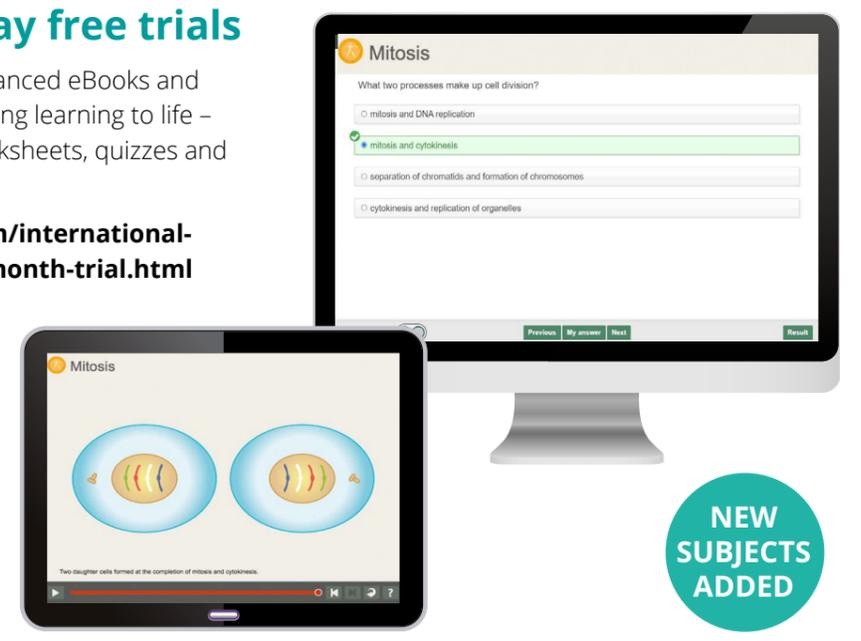
- A suite of textbooks, eBooks and online resources to support teachers and learners in the classroom, during independent study and for revision.
- Packed full of exam-style assessment opportunities using questions from past papers, as well as guidance from subject experts and examiners.
- Written by experienced IB teachers, workshop leaders and examiners, meaning you can rest assured that the need-to-know content will be covered clearly and completely.
- Each book covers the Subject Guide fully, for the most up-to-date syllabus.
- Clear links to TOK throughout, as well assessment advice.

## Sign up for 60-day free trials

Access free trials of our enhanced eBooks and see for yourself how they bring learning to life – with animations, videos, worksheets, quizzes and much more!

<https://www.pearson.com/international-schools/forms/free-two-month-trial.html>

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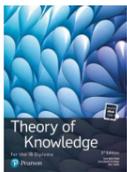
**NEW SUBJECTS ADDED**

# International Baccalaureate Diploma Programme Titles



Help your students develop the transferable and subject-specific skills they need to get off to a flying start with their IB Diploma courses with Power Starters. See page 26.

## Core Curriculum Theory of Knowledge



## Studies in Language and Literature



## Language Acquisition



PRINT ONLY

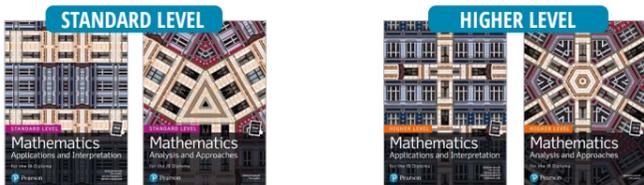
## Individuals and Societies



## Sciences **NEW**



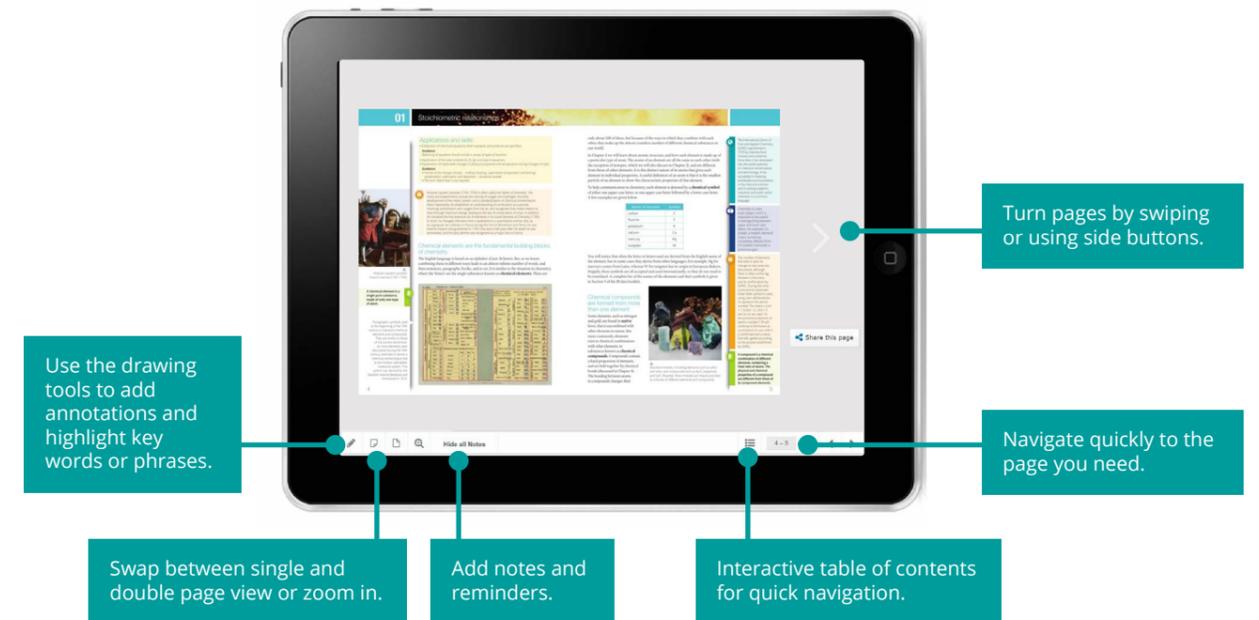
## Mathematics



All titles are available as a printed textbook with a free eBook, or as a standalone eBook. French and Spanish workbooks are print only.

## Our enhanced eBooks

- Student material is available as a printed book with four year free access to an online eBook or as a standalone eBook subscription.
- Access content anywhere and anytime – perfect for learning at home and on the move.
- Digital note-taking, sharing, highlighting and bookmarking make study and revision more effective.
- Search for key terms to speed up learning.
- Downloadable files for offline use.
- Auto-marked quizzes, worksheets, animations and more.

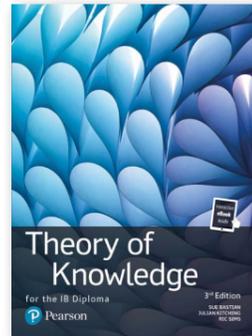




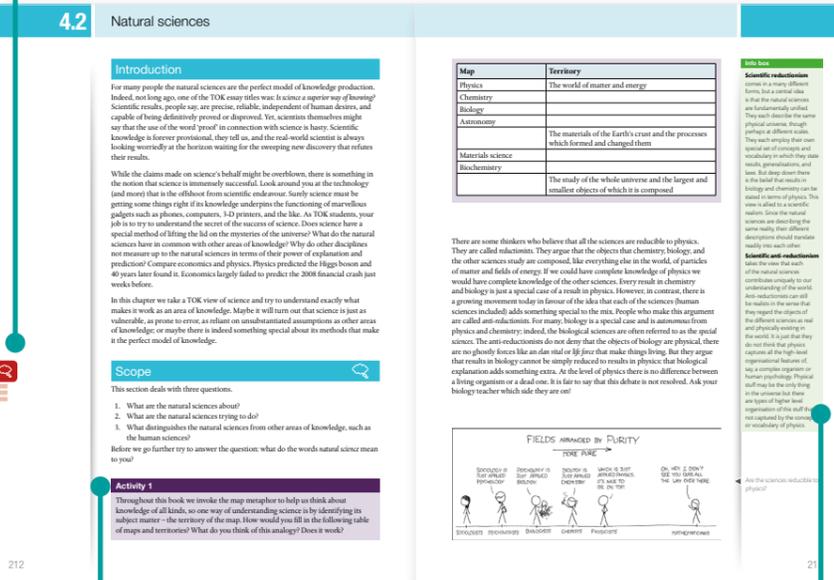
# Core Theory of Knowledge

## Support your learners as they explore the latest Theory of Knowledge Subject Guide with our newest edition, written by experts.

- Authoring team consisting of Julian Kitching and Ric Sims, highly regarded members of the curriculum review panel, and Sue Bastian, the architect of the original TOK curriculum.
- Provides full coverage of the 2020 Guide covering the Core, Optional Themes, and Areas of Knowledge.
- Structured to match the new knowledge framework.
- Examples of knowledge questions to help students recognise and decipher them.
- Support for the essay and the new exhibition assessment.
- Illustrations by TOK teacher Gary Goodwin, to add interest and humour.



Each chapter is structured to match the knowledge framework.



A wealth of ideas for individual and class activities.

Extra information for interest and further reading.



Scan this code to access free trials

**2020 SYLLABUS**  
**Theory of Knowledge 3rd edition**  
 Print and eBook £43.29  
 978 1 292326 00 9  
 eBook only £37.89  
 978 1 292326 01 6

Chapters dedicated to support for the essay and new exhibition assessments.

3

Assessment – Exhibition

Example E: Knowledge and religion  
IA Prompt #8: To what extent is certainty attainable?

Object 1: Grandmother's Bible

The first object in my exhibition is my grandmother's Bible. Sunday visits to church were common during my early childhood, and by the time I was 15 there was less from the minister leading up to confirmation. Throughout all of this, I was more confused than convinced. The stakes seemed high. I needed to know I could my doubts to my grandmother who led me to her Bible and placed her hands on the book, a very large book, and said, 'See. These words are a light unto my path. It says so right here: I didn't see. How was her certainty possible?' I read the book over the summer. I still was not certain. 'But grandmother,' I said, 'bad things happen.' She just looked at me.



Questions arise: what must it feel like to be certain? How and why does this condition elude others? How does one dimension of certainty, say, in religion, attach to a disposition to believe claims from elsewhere? What other high-stakes claims are impossible to believe except through an act of uncritical belief? Is there an afterlife? Am I a good person? Why? What created the universe? Is there a meaning to life? Why does it matter? What would count as evidence? Maybe it's all around me and I don't see it. That's what my grandmother said.

This object and the circumstances described above concern the pursuit or attainment of psychological certainty in which one is completely sure of something. An important feature of this kind of certainty is that it can be held even if the person who is certain is actually wrong.

Reference:  
centerforinquiry.org/blog/religious\_certainty\_in\_a\_dangerous\_world/

Object 2: Gödel's ontological proof of God

My second object in an ontological proof for the existence of God offered by the Austrian mathematician, Kurt Gödel, an ontological proof is one in which the conclusion is reached from starting premises arrived at by rational thought rather than empirical observation. These premises may be thought of as axioms in a similar fashion to those found in mathematics. Gödel claimed that his proof was motivated by his desire to construct a watertight argument rather than support any personal religious conviction that he may have harbored. The details of Gödel's argument are too complex and difficult to discuss in detail here, but it involved

Ax. 1:  $\exists x (G(x) \rightarrow \Box G(x)) \rightarrow \Box G$   
 Ax. 2:  $\Box G \rightarrow \Box G$   
 Pr. 1:  $\Box G \rightarrow \Box G$   
 Pr. 2:  $\Box G \rightarrow \Box G$   
 Pr. 3:  $\Box G \rightarrow \Box G$   
 Pr. 4:  $\Box G \rightarrow \Box G$   
 Pr. 5:  $\Box G \rightarrow \Box G$   
 Pr. 6:  $\Box G \rightarrow \Box G$   
 Pr. 7:  $\Box G \rightarrow \Box G$   
 Pr. 8:  $\Box G \rightarrow \Box G$   
 Pr. 9:  $\Box G \rightarrow \Box G$   
 Pr. 10:  $\Box G \rightarrow \Box G$   
 Pr. 11:  $\Box G \rightarrow \Box G$   
 Pr. 12:  $\Box G \rightarrow \Box G$

what is known as modal logic, the distinction between necessary and contingent truths, and the concepts of properties and essences. As with ontological arguments in general, critics of Gödel's argument understandably focus on the legitimacy of the axioms he used. If the starting points of an argument can be called into question, then the truth of the conclusions can be too.

This object is concerned with epistemic certainty – the attempt to arrive at knowledge that is demonstrably true whatever the feelings or allegiance may be to it of individuals. There have been numerous attempts to achieve this kind of certainty, often inspired by the apparent power of logical thought as applied to other fields of knowledge. The philosopher Bertrand Russell commented that our uneasiness with such arguments when applied to religion is often undermined by our difficulty in identifying exactly what is wrong with them. The implied question is whether logic is an appropriate vehicle for trying to support or reject claims in the field of religion.

Reference:  
plato.stanford.edu/entries/ontological-argument/

Object 3: Isotope-ratio mass spectrometer

The final object in this exhibition is an isotope-ratio mass spectrometer (IRMS). This device is used to determine the ratio of different isotopes in a sample. If the heavier isotope is radioactive, and the rate of its decay into the lighter isotope is known, then an estimate of the age of the sample can be made. For example, uranium-238 decays into lead-206 with a half-life of 4.47 billion years, meaning that half of the uranium will have converted into lead over that period. The age of a sample of zircon mineral, for example, which we know contains no lead at formation, can be estimated in this way. An isotope like uranium-238 with such a long half-life is useful for dating very old samples, such as those formed shortly after the formation of the Earth and solar system. It is true that the older the sample the greater the opportunity for error, as the proportion of remaining uranium diminishes and approaches zero. However, modern methods reduce the error to a maximum of around 1 per cent in terms of time.



Radiometric dating provides a scientific basis on which claims about the age of the Earth can be evaluated. As with all scientific work, there has to be not only an acceptance of error but an attempt to quantify it. Science does not seek epistemic or psychological certainty as described above, but rather an approximation to certainty on the basis of available empirical evidence. By quantifying uncertainty, science can arrive with confidence at conclusions that rule out other claims that are well beyond credibility. This includes claims made by some religious adherents inferred from scripture that the Earth is only a few thousand years old. We all need to adjust to a world in which a degree of uncertainty is tolerated.

Reference:  
www.tulane.edu/~suno/enr12/radiometric\_dating.htm

Word count = 838

195

Virtual exhibition objects to give students ideas for their own exhibition.

### Free toolkit

Support your students with their essay and exhibition preparation with a FREE toolkit, which includes practical tips, planning ideas and guidance from our expert authors. Download it at [pearsoninternational-schools.com/tok](https://pearsoninternational-schools.com/tok)



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### Meet the expert authors



#### Sue Bastian – Series Editor

Sue Bastian has served the IB as a teacher, workshop leader, examiner, textbook author and Chief Assessor of TOK in the Philippines and at the UN School in New York City. She has recently completed a review and revision of the TOK Lessons From Around the World and is now concentrating on teaching others how to design lessons for their classroom.



#### Julian Kitching – Author

With over 30 years of involvement with the IB, Julian Kitching has taught TOK, contributed to four successive reviews of the course, and served as a workshop leader and examiner, including an 8-year period as Chief Assessor until 2018. He is the Divisional Head of Secondary at the Aves International Academy in Ghana.



#### Ric Sims – Author

Ric Sims has taught TOK for nearly three decades as well as Economics, Philosophy, Maths and Music for the Diploma. He has served on the senior examining team since the late 1990s, including more than a decade as Deputy Chief Assessor. He has participated in four curriculum reviews, led workshops for TOK teachers, and is a regular keynote speaker.

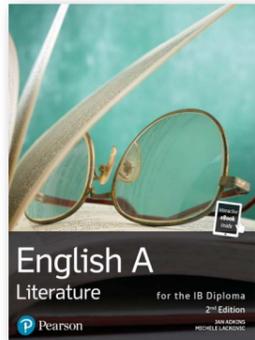


# Studies in Languages and Literature

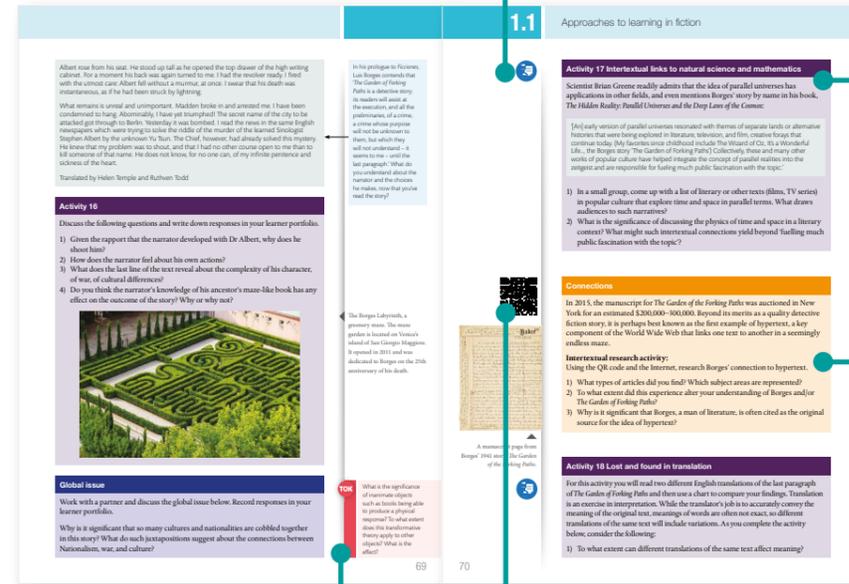
## English A Literature

Written by IB expert authors to provide you and your students with comprehensive coverage of the requirements of the latest Subject Guide.

- Key terms from the Guide are explained and highlighted including concepts, areas of exploration and global issues.
- Inclusion of carefully selected, up-to-date, diverse texts to inspire learners.
- Activities to help strengthen appreciation and understanding of different works.
- Chapter insight summaries of the main points.
- Clear learning objectives and links to TOK throughout.
- Detailed support for the assessments including the Higher Level essay and Extended Essay guidance.
- Intertextual connections and global issues highlighted.



Areas of exploration identified.



Ideas for individual and group activities throughout.

Connections boxes highlight aspects of the text that ask learners to make connections.

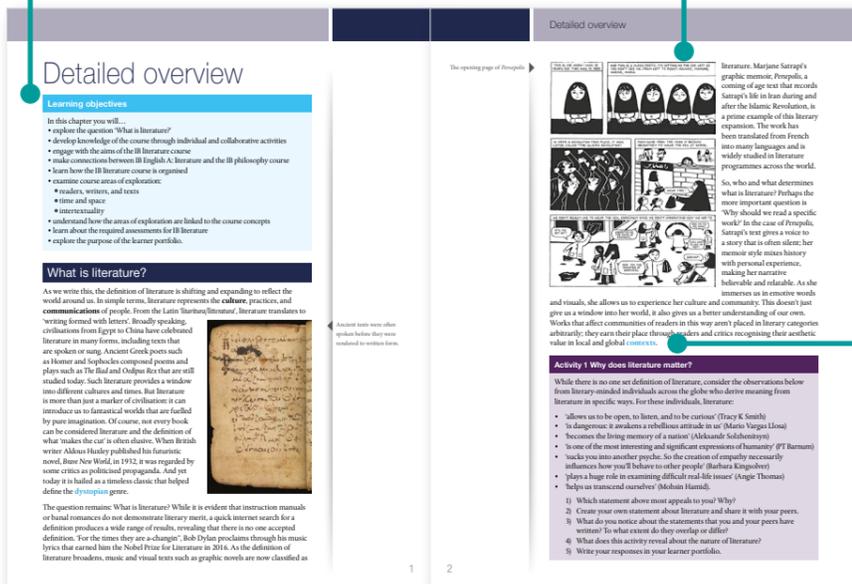
TOK links.

Links to additional resources.

2019 SYLLABUS	
English A (2nd Edition)	
Print and eBook	£43.29
978 1 292320 52 6	
eBook only	£39.00
978 1 292320 51 9	

Learning objectives at the start of every chapter.

Carefully selected, up-to-date, engaging and diverse texts from a huge range of works.



Key terms highlighted and defined.



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## Free independent study pack

Help your students develop the IB Learner Profile traits with a FREE independent study pack, written by our expert authors. Download it at [pearsoninternational-schools.com/diploma](https://www.pearsoninternational-schools.com/diploma)



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## About the authors

### Jan Adkins



Jan Adkins is now retired after teaching English for 40 years, including 24 years teaching IB English. Jan was an Assistant Examiner for 15 years and has led training workshops for 25 years. She is the recipient of the Robert O Lawton Award for Teaching Excellence at Florida State University, and the Teaching Excellence Award at Eckerd College.

### Michele Lackovic



Michele Lackovic currently teaches IB Diploma Programme courses, coordinates the CAS programme, and chairs the English Department at Suncoast Community High School in Florida. She also leads teacher training workshops and marks IB English A Literature exams as well as Extended Essays.



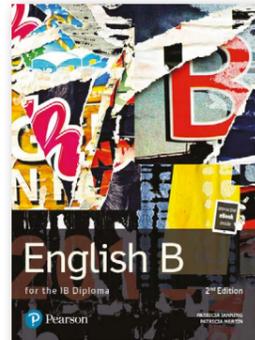
# Language Acquisition

## English, French and Spanish B

### English B

Our resources are fully tailored to the 2018 Subject Guide, to teach and practise the key skills required for the oral and written assessments.

- Contains authentic text extracts, accompanied by a broad range of exercises which will help students of all abilities prepare for their end of course assessment.
- Suitable for Standard Level and Higher Level students with clearly distinguished content.
- The eBook includes audio files for listening assessment practice.
- Support for the Internal Assessment.



TOK links throughout.

Tips for writing different text types.

**1 Identities**

**Grammar in context**

**-ing form**  
Complete these sentences using a suitable verb in the -ing form

- 1 Try to stop him \_\_\_\_\_ grammar to me.
- 2 I like my teacher \_\_\_\_\_ grammar to me.
- 3 He keeps the central heating \_\_\_\_\_ all winter.
- 4 The girl couldn't forgive the boy for \_\_\_\_\_ her phone.
- 5 I miss her \_\_\_\_\_ me to school in the mornings.

by Alegria Lores  
Below are the reflections of an educator who now lives in Costa Rica. Do you know where that is? Look online to find the location and see what else you can discover about Costa Rica.

**What it means to be a Cuban-American-Costa Rican**  
by Alegria Lores  
Answering the question "What is your native language?" is difficult for me. During my early years, my mother spoke to me in English and my father spoke to me in Spanish. She was from Minnesota, USA, and he was from Cuba. They lived in a Spanish-speaking area of Tangiers, Morocco, but we moved to New York City when I was three. There we lived among Hispanics, but school was in English. When I was nine my family moved to Costa Rica, where we settled. I married a Costa Rican and eventually adopted the Costa Rican citizenship in addition to my US citizenship.

My life has continued in this fashion, always immersed in a bilingual and bicultural environment. Depending on where it is, I become somewhat more fluent in that language – English or Spanish.

The advantages? Being equally comfortable attending school in either language, being able to translate and interpret in those languages, and the ability to have friends from many countries.

The disadvantages? Not identifying 100% with any one culture, feeling a bit like an outsider wherever I live, and people commenting "You have a different accent!"

Would I choose to have it any other way? Absolutely not! I consider myself extremely fortunate to have had the opportunity to live and learn in two cultures and, as a result, be comfortable in both almost effortlessly!

**Paper 1 practice task**  
Write a personal blog reflecting on your first language as it relates to your identity. Think about the following questions, plus any other ideas of your own when writing your blog.

- How does your life compare with Alegria's?
- How many countries have you lived in and how many languages have you learned?
- Do you agree with the advantages and disadvantages Alegria mentions? If not, explain your opinion.
- SL students should write 250 – 400 words. HL students should write 450 – 600 words.

**Tips for writing a blog**

- A blog is an online journal or informational website. It is usually started by one person who may then invite others to add their thoughts or comments.
- Before you start, decide:
  - why you are writing
  - what you want to say
  - which facts you want to include.
- Organize your ideas into paragraphs with key information and supporting details.
- Give your blog a strong heading and remember that people write blogs because they feel strongly about the topic.
- A blog is written in formal or semi-formal English. You can use phrases such as 'I strongly feel' or 'It is my opinion' because the style is often like a newspaper article.
- You must remember to show your knowledge of English by thinking about your choice of vocabulary and your use of correct grammar.

**How is our identity formed?**

**Paper 2 practice listening task (1.1) - Alumni Speech Day**  
You will hear a speech made by an alumnus at his old school's Speech Day.

- 1 Complete the following gaps with words from his speech. Use no more than three words for each gap.
  - a Life in an office working at a desk is now (1).
  - I was shy, physically weak, rather overweight, and (2) any kind of self-confidence.
  - I grew older of course, but that alone wouldn't (4).
  - I would still have been the boy people laughed at, who wasn't (5) anything, and was afraid of everybody.
  - 'Sport' was really popular then, as it is now, but PE classes were (6) to put it mildly.
- 2 What has Martin been doing since he left school?
- 3 List three of the problems Martin had as a teenager.
- 4 What did Martin do to escape his problems?
- 5 What effect did running have on Martin's self-confidence?
- 6 What is the real lesson the friend taught Martin?

### 2018 SYLLABUS

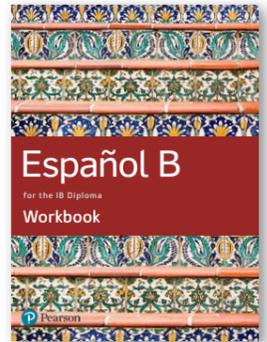
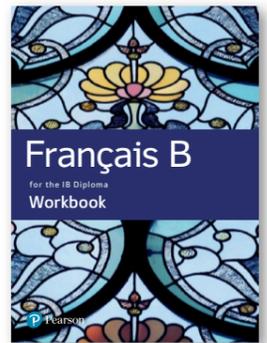
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**2 Expériences**

**2.2 L'immigration en question**

**Séance échauffement**

**Activité 1 : Immigration et vocabulaire**

Regardez ces photos.  
C'est où ? C'est quel ?  
Quels mots vous viennent à l'esprit ? Justifiez. (8 mots ou concepts)

Exemple : Un bidonville - Les personnes vivent dans des tentes de fortune et dans des conditions de vie insalubres. On divise un bidonville.

**Activité 2 : Immigration et définitions**

Reliez les mots de la colonne de gauche à leur définition dans le contexte de l'immigration.

1. sortir sans papiers	Exemple : d	a. Ligne d'immigration - qui sépare un pays d'un autre pays
2. faire son pays	b. Personne qui a obtenu une démission légale pour obtenir l'autorisation de résider dans un pays	
3. Tessil	c. Recueillir quelqu'un dans son pays d'origine	
4. sortir (religieux)	d. Personne qui est entrée illégalement et clandestinement dans un pays	
5. sortir (demandeur / demandeuse d'asile)	e. Situation de quelqu'un qui est forcé de quitter son pays	
6. sortir (expatrié)	f. Actions de quitter son pays, souvent pour des raisons humanitaires ou politiques	
7. accueillir	g. Personne qui fait le choix de s'installer pour des raisons professionnelles	
8. sortir (étranger / étrangère)	h. Il / elle peut être politique ou climatique. Il / elle a été contraint(e) de quitter son pays d'origine et ne peut pas y retourner	
9. une frontalière	i. Recevoir une personne / accepter un étranger sur son territoire	
10. expulser	j. Personne qui vient d'un autre pays, ou d'une autre communauté ou d'un autre groupe. Personne qui ne reçoit pas l'accueil	

2. Choisissez quatre des mots de l'exercice 1 et écrivez quatre phrases pour exprimer une opinion sur l'immigration.

**Activité 3 : Pourquoi partir ?**

1. Réfléchissez aux raisons qui poussent parfois les gens à quitter leur pays natal. Dressez une liste de huit raisons.

2. Avec un(e) partenaire, essayez de justifier ces raisons. Le rôle de votre partenaire est d'essayer de vous convaincre que ce n'est pas une bonne idée et de contester vos arguments.  
Exemple : En Europe, je pourrais trouver du travail et gagner de l'argent. Tu n'as pas les qualifications requises et le taux de chômage est élevé en Europe.

**2.2.1 Immigration : positive ou négative ?**

**Avantages et problèmes**

1. Faites une liste de cinq avantages et cinq problèmes que pose l'immigration :

- pour le pays où les personnes immigreront
- pour le pays dont les personnes sont originaires

À l'oral, justifiez / illustrez chacune de vos réponses.

Pour le pays où les personnes immigreront	
BIENFAITS	PROBLÈMES
Exemple : un surcroît de main-d'œuvre pour le pays d'accueil	

Pour le pays dont les personnes sont originaires	
BIENFAITS	PROBLÈMES
Exemple : La personne qui a émigré peut envoyer de l'argent à sa famille établie à son pays	

**New vocabulary explained.**

**ATLs identified.**

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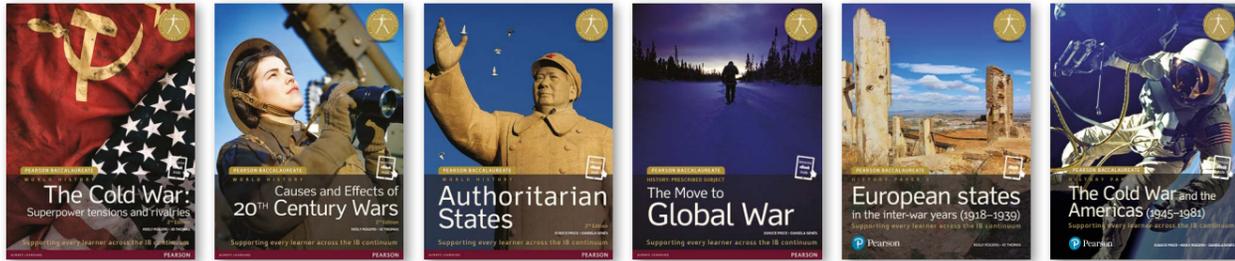
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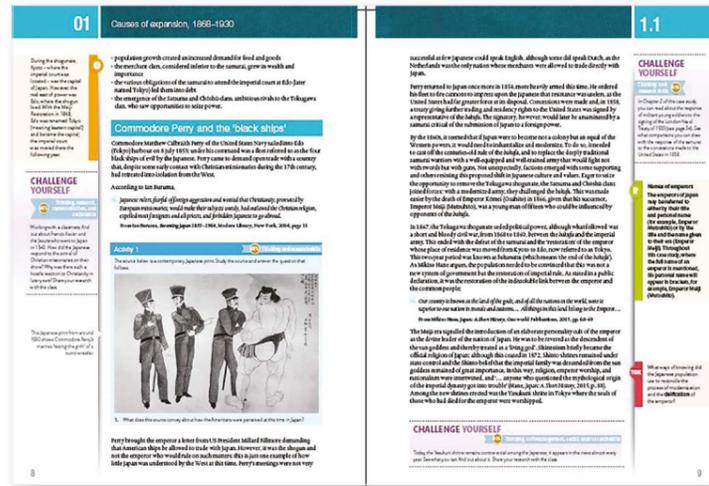
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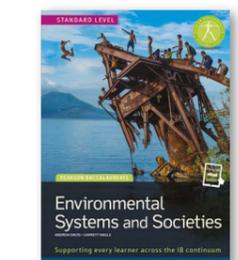
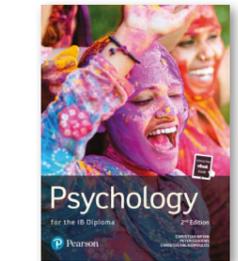
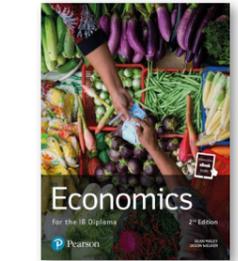
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**1 Introduction to business management**

**Primary sector**

- Extracts and uses natural resources
- Example: Forestry

**Secondary sector**

- Produces goods from natural resources
- Example: Furniture manufacturers and furniture stores

**Tertiary sector**

- Provides services
- Example: Carpentry services, such as making or repairing furniture

**Quaternary sector**

- Provides consultancy
- Example: Social media marketing for furniture store

**Case study - Repsol**

Repsol is a global energy company that operates in more than one sector across different countries.

One of the things the company does is to extract crude oil from the ground (primary sector) in places like South America and North America.

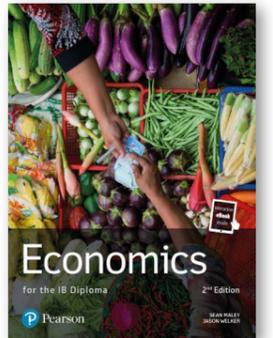
They then process the oil and transform it into fuel (secondary sector) in operations fields like the Shaw field located in the United Kingdom's North Sea.



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**15 Macroeconomic objective: low unemployment**

Examples of people who are part of the labour force include the following:

- A part-time retail sales clerk, who is also going to college, is part of the labour force because she is employed.
- A full-time nurse is part of the labour force because he is employed.
- A factory worker whose plant closed and who is applying for jobs at other firms is part of the labour force because she is unemployed.
- A recent college graduate interviewing at different companies for his first job is part of the labour force because he is unemployed.

Examples of people who are not part of the labour force include the following:

- A stay-at-home parent is not part of the labour force because he or she is not employed nor seeking employment.
- A college graduate who volunteers in a community centre is not part of the labour force because, although she is working, she is not formally employed nor is she seeking employment.
- A discouraged worker who has been looking for a job for 18 months but has given up the job search is not part of the labour force because he is no longer seeking employment.
- An engineer who goes back to school to earn a teaching degree is not part of the labour force because she is not currently seeking employment.

**Worked example 15.1**

In 2019, Brazil's labour force totalled approximately 106 million people. The number of people of working age but who were unable to find work (the unemployed) in Brazil totalled 12,751,800.

What is Brazil's unemployment rate?

$$\text{Unemployment rate (UR)} = \frac{\text{number of unemployed}}{\text{labour force}} \times 100$$

$$= \frac{12,751,800}{106,000,000} \times 100$$

$$= 12.0\%$$

**What are the difficulties in measuring unemployment?**

The source and method of calculating the unemployment rate can vary significantly, affecting the degree of comparability between countries. One method is to report unemployment claims. Another is to rely on survey data of thousands of people. Counting unemployment benefit claims may undercount the actual rate of unemployment, especially during prolonged recessions, which may last longer than the period of time government provides benefits to unemployed workers. Survey methods are often considered more reliable but may also miss marginal populations (immigrants, undocumented workers) that are unlikely to be captured by household surveys.

**Disparities by group**

Subgroups within the broad population may have higher or lower unemployment rates than the overall national figure.

- **Regional disparities:** Larger countries tend to have greater variance than smaller ones. Turkey is among the countries with the largest variance, with a 20-point difference between regions with the lowest and highest rate.
- **Ethnic/racial disparities:** Unemployment rates are typically higher among ethnic minorities, especially those that have experienced formal and informal discrimination. Countries that identify indigenous populations typically also report higher unemployment rates among those populations.

**Figure 15.1** Average unemployment rates for selected developed and developing countries, 2018–20

Country	Unemployment Rate (%)
Japan	2.4
Germany	3.1
France	7.5
United Kingdom	3.7
India	1.7
China	3.8
USA	4.2
South Korea	4.4
Spain	9.1
Italy	9.6
Canada	11.2
UK	13.2
USA	13.9
China	16.6
South Africa	29.8

**Areas for further inquiry or research highlighted.**

**Worked examples show how to carry out calculations in detail.**

**TOK integrated throughout.**

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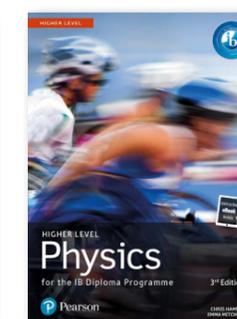
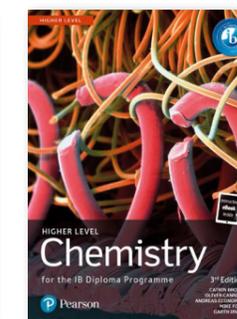
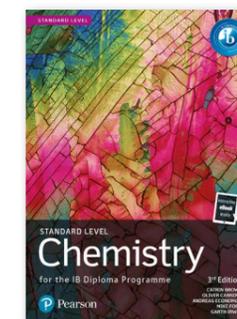
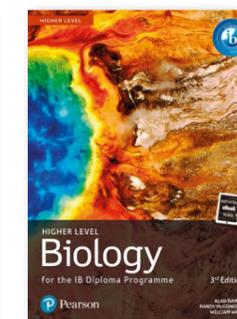
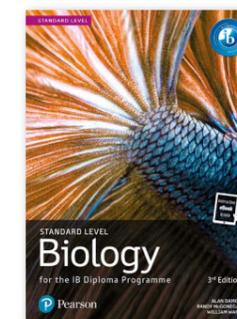
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**CONTINUITY AND CHANGE D4.1** Ecosystems

Humans can breed organisms to increase what we see as desirable characteristics, for example higher yields in crops such as wheat, or greater milk production in cattle. This process, known as **artificial selection**, is performed by selective breeding: humans decide which organisms have the most desirable traits and breed them together, hoping for offspring with enhanced features.

**Natural selection and antibiotic resistance**

Antibiotic resistance in bacteria is a modern example of natural selection. What is striking is its rapidity. Although evolution is generally considered to be a long-term process, the mechanism of natural selection can sometimes be quick, taking place over months, years or decades, rather than millennia. As you read the description below, see if you can identify the main features of how natural selection works.

**Antibiotics** are medications such as penicillin that kill or inhibit the growth of bacteria. They are given to patients suffering from bacterial infections. However, overuse of antibiotics has led to resistant strains of bacteria.

Antibiotic resistance in bacteria develops over several steps. Consider the following scenario.

1. A woman gets tuberculosis, which is a bacterial infection.
2. Her doctor gives her an antibiotic to kill the bacteria.
3. She gets better because the vast majority of bacteria are destroyed.
4. Thanks to a pre-existing variation in its genetic makeup, however, one bacterium is resistant to the antibiotic.
5. That bacterium is not killed by the antibiotic and it later multiplies in the patient's body, making her sick again. With all the other bacteria dead, there is little competition for space and food so the mutant strain is able to flourish.
6. She feels unwell again and goes back to the doctor and gets the same antibiotic.
7. This time, the antibiotic does not make any difference: she is still sick and asks her doctor what is wrong.
8. The doctor prescribes a different antibiotic that (hopefully) works. But if the population of bacteria continues to contain mutants, new strains could display resistance to all the antibiotics available.

Notice how, unlike a weedy plant that has been intentionally artificially bred to have beneficial characteristics such as high protein yields, the production of antibiotic resistant bacteria has happened by natural selection because decisions humans made: the intention had not been to generate superbugs.

The development of antibiotic-resistant bacteria has happened more than once. New strains of typhoid, for example, have adapted to antibiotics and show multiple resistances. Some strains of tuberculosis are resistant to so many or nine different antibiotics. There may be no cure for people who get sick from such super-resistant germs; they may have to rely on their own immune system to recover.

Finding new antibiotics is only a temporary solution, and pharmaceutical companies cannot find new medications fast enough to treat these super-resistant germs. As a result, the best way to stop their expansion is to make sure that doctors minimize the use of antibiotics and that patients realize that antibiotics are not always the best solution to a health problem.

**Nature of Science**

A *Staphylococcus* bacterium discovered in a hospital is suspected of being resistant to a certain number of antibiotics. To test this hypothesis, the bacterium is introduced into a Petri dish along with small discs of paper that are soaked in different types of antibiotics. In an experiment like this, when the colonies of bacteria grow close to the discs, they show resistance to the antibiotic, whereas when wide, clear circles of inhibited bacterial growth are present, they show that the antibiotic is stopping the bacteria the way it should. Can you interpret the results of the experiment shown in the photo?

Doctors use such tests to help decide which medications to prescribe. In this case, they should prescribe the antibiotics that the bacteria do not show a resistance to, preferably the three at the bottom of the image. This resistant bacterium is part of a growing number of super bugs, among which we find MRSA, which stands for methicillin-resistant *Staphylococcus aureus*. Resistant bacteria have evolved because of the way humans use antibiotics.

In some countries, there is an intense debate about whether the concept of evolution should be taught in schools. To support the critics of evolution, there are thousands of websites, and publications that carefully try to dismantle and dispute the arguments of evolutionary biologists. What criteria are used to determine whether these criticisms are valid or not? What kind of evidence would be necessary to refute Darwin's theory?

**Guiding question revisited**

What processes can cause changes in allele frequencies within a population?

In this chapter you have learned that:

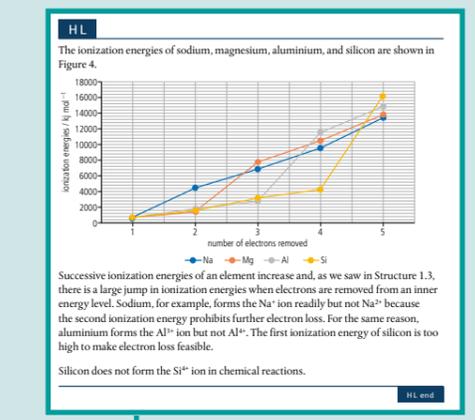
- which versions of genes (alleles) are present in a population and the proportions in which they are found can change over time
- if the environment changes or there is another selective pressure on a population, the frequencies of alleles can be modified by natural selection
- abiotic changes, such as in temperature, humidity or pH, can contribute, as can biological factors, such as the presence of predators.
- Organisms within a species compete with each other for resources – this is intraspecific competition.
- The individual which is best suited to the environment is more likely to survive to reproduce and pass on its genes.

Skills boxes link to ideas for lab work and activities to support learning and help prepare for the Internal Assessment.

Global application boxes emphasise the importance of science in an international context.

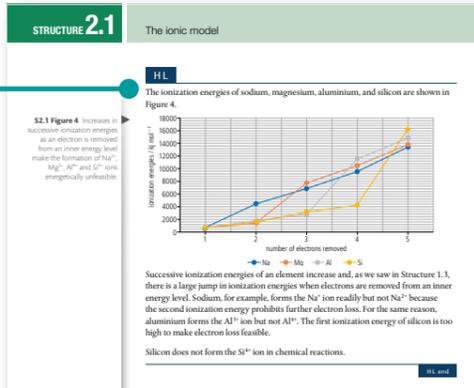
TOK boxes stimulate thought and consideration of knowledge issues as they arise in context.

Key fact boxes identify key learning points.



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The high ionization energies of the noble gases and their complete energy levels make them unreactive.

We saw in Structure 1.3 that the noble gases have very high first ionization energies. The nucleus of a noble gas holds on tightly to its outer electrons making them unavailable for any chemical activity. The noble gases also have complete outer shells with no vacancies to accommodate extra electrons so any added electron would have to occupy an empty outer energy level when they would experience an effective nuclear charge of zero. These factors explain the non-reactivity of the group. The full outer energy level of the noble gases can be thought of as the 'ultimate goal' for all atoms. The noble gases do not react as they have already achieved this goal. Inert atoms lose electrons to achieve the stable electron configuration of the preceding noble gas and non-metals gain electrons to achieve the stable electron configuration of the succeeding noble gas. As we saw earlier, when sodium reacts it loses an electron to achieve the electron configuration of neon and the chloride ion has the electron configuration of argon.

The charge on the ion can be predicted from an element's position in the periodic table.

Metals have a small number of electrons in their outer shells (groups 1, 2, and 13) and will lose these electrons and form cations. Non-metals that have higher numbers of electrons in their outer shells (groups 15, 16, and 17) will gain electrons and form anions.

We are now able to summarize how the position of an element in the periodic table enables us to predict the ion it forms. The table shows the ions formed by the elements in period 3.

Group number	Element	Electron configuration of atom	Number of valence electrons	Number of electrons transferred	Charge on ion formed	Electron configuration of ion	Type of element
1	Na	[Ne]3s <sup>1</sup>	1	1 lost	1+	[Ne]	metal
2	Mg	[Ne]3s <sup>2</sup>	2	2 lost	2+	[Ne]	metal
13	Al	[Ne]3s <sup>2</sup> 3p <sup>1</sup>	3	3 lost	3+	[Ne]	metal
14	Si	[Ne]3s <sup>2</sup> 3p <sup>2</sup>	4	—	—	—	metalloid
15	P	[Ne]3s <sup>2</sup> 3p <sup>3</sup>	5	3 gained	3-	[Ne]3s <sup>2</sup> 3p <sup>6</sup> = [Ar]	non-metal
16	S	[Ne]3s <sup>2</sup> 3p <sup>4</sup>	6	2 gained	2-	[Ne]3s <sup>2</sup> 3p <sup>6</sup> = [Ar]	non-metal
17	Cl	[Ne]3s <sup>2</sup> 3p <sup>5</sup>	7	1 gained	1-	[Ne]3s <sup>2</sup> 3p <sup>6</sup> = [Ar]	non-metal

When writing the symbols for ions, note the charge is written as a superscript with the number first and the charge next, e.g. Na<sup>+</sup>. When an ion X carries a charge of 1+ or 1- it is written just as X<sup>+</sup> or X<sup>-</sup>.

**Negative ions are more attractive with increased charge**

The group 17 elements have one vacancy in their outer energy level and a high effective nuclear charge so they can accept one electron readily into their outer energy level and form the halide X<sup>-</sup> ion. Group 16 elements, such as oxygen, have two vacancies but the outer electrons only experience an effective nuclear charge of +6. They can form X<sup>2-</sup> ions but do not attract electrons as strongly as the halogens. Phosphorus has three vacancies and so can accommodate three additional electrons and form the P<sup>3-</sup> ion. The outer electrons in phosphorus only experience an effective nuclear charge of +5 so it forms ionic compounds less readily than chlorine or sulfur. The addition of electrons becomes more difficult with increasing negative charge of the ion due to increased electron-electron repulsion. The formation of the silicon Si<sup>2-</sup> is not feasible for this reason.

Sparks fly as an argon welder joins two metals together. The unreactive argon gas provides an inert environment which prevents the hot metals from reacting with the air.

**SPACE, TIME AND MOTION A.3** Work, energy and power

**Challenge yourself boxes encourage students to think in more depth.**

**Explosions**

Explosions can never be elastic since, without doing work, the parts that fly off after the explosion would not have any kinetic energy and would therefore not be moving. The energy to initiate an explosion often comes from the chemical energy contained in the explosive.

**Example**

Consider an exploding ball (shown in Figure 18). How much energy was supplied to the ball by the explosive?

According to the law of conservation of energy, the energy from the explosive equals the gain in kinetic energy of the ball.

$$E_k \text{ gain} = E_k \text{ after} - E_k \text{ before}$$

$$E_k \text{ gain} = \frac{1}{2} \times 0.02 \times 25^2 + \frac{1}{2} \times 0.1 \times 5^2 - 0 = 6.25 + 1.25 = 7.5\text{J}$$

**Exercise**

**Q12.** Two balls are held together by a spring as shown in the figure. The spring has a spring constant of 10N cm<sup>-1</sup> and has been compressed a distance 5 cm.

- (a) How much work was done to compress the spring?
- (b) How much kinetic energy will each gain?
- (c) If each ball has a mass of 10 g, calculate the velocity of each ball.

**Q13.** Two pieces of modeling clay as shown in the figure collide and stick together.

- (a) Calculate the velocity of the lump after the collision.
- (b) How much kinetic energy is lost during the collision?

**Q14.** A red ball traveling at 10 m s<sup>-1</sup> to the right collides with a blue ball with the same mass traveling at 15 m s<sup>-1</sup> to the left. If the collision is elastic, what are the velocities of the balls after the collision?

**Power**

We know that to do work requires energy, but work can be done quickly or it can be done slowly. This does not alter the energy transferred but the situations are certainly different. For example, we know that to lift one thousand 1 kg bags of sugar from the floor to the table is not an impossible task – we can simply lift them one by one. It will take a long time but we would manage it in the end. However, if we were asked to do the same task in 5 seconds, we would either have to lift all 1000 kg at the same time or move each bag in 0.005 s; both of which are impossible. Power is the quantity that distinguishes between these two tasks.

Power is defined as:

$$\text{power} = \text{work done per unit time}$$

The unit of power is the (J) s<sup>-1</sup> which is the same as the watt (W). Power is a scalar quantity.

**Example 1: The powerful car**

We often use the term power to describe cars. A powerful car is one that can accelerate from 0 to 100 km h<sup>-1</sup> in a very short time. When a car accelerates, energy is being transferred from the chemical energy in the fuel to kinetic energy. To have a big acceleration, the car must gain kinetic energy in a short time; hence be powerful.

**Example 2: Power lifter**

A power lifter is someone who can lift heavy weights, so should we not say they are strong people rather than powerful? A power lifter certainly is a strong person if they are good at it but they are also powerful. This is because they can lift a big weight in a short time.

**Worked example**

A car of mass 1000 kg accelerates from rest to 100 km h<sup>-1</sup> in 5 seconds. What is the average power of the car?

**Solution**

$$100 \text{ km h}^{-1} = 28 \text{ m s}^{-1}$$

$$\text{gain in kinetic energy of the car} = \frac{1}{2} m v^2 = \frac{1}{2} \times 1000 \times 28^2 = 392 \text{ kJ}$$

If the car does this in 5 s, then:

$$\text{power} = \frac{\text{work done}}{\text{time}} = \frac{392}{5} = 78.4 \text{ kW}$$

Hints for success boxes give advice on how to approach questions, identifying common pitfalls.

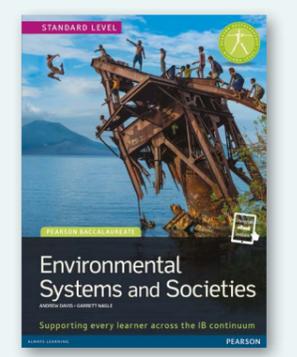
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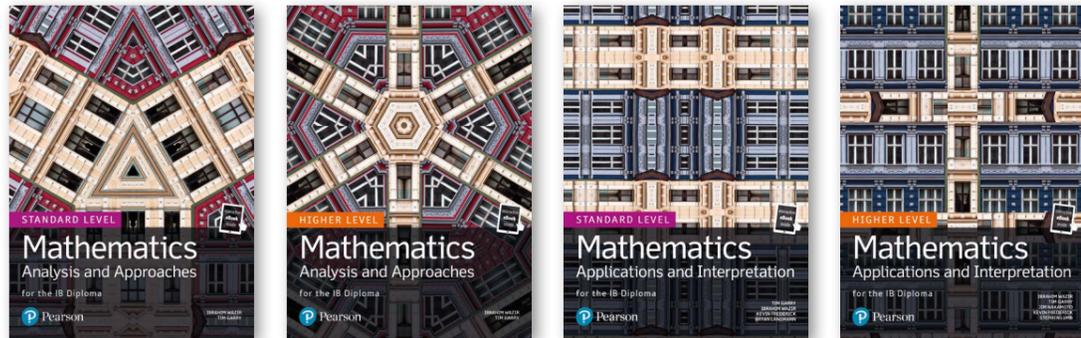
**Environmental Systems and Societies**

See Page 17





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**6 Trigonometric functions and equations**

**Example 6.1**  
The diagram shows a circle of centre O with radius  $r = 6$  cm. Angle ACB subtends the minor arc AB such that the length of the arc is 10 cm. Find the measure of angle ACB in degrees, accurate to 3 significant figures.

**Solution:**  
Rearrange the arc length formula,  $s = r\theta$ , giving  $\theta = \frac{s}{r}$ . Remember that the result for  $\theta$  will be in radians. Therefore, angle  $ACB = \frac{10}{6} = 1.67$  radians. Now, we convert to degrees:  $1.67 \times \frac{180}{\pi} = 95.49247^\circ$ . The degree measure of angle ACB is approximately  $95.5^\circ$ .

**Geometry of a circle**

**Sector of a circle**  
A sector of a circle is the region bounded by an arc of the circle and the two sides of a central angle (Figure 6.7). The ratio of the area of a sector to the area of the circle ( $\pi r^2$ ) is equal to the ratio of the length of the subtended arc to the circumference of the circle ( $2\pi r$ ). It is the arc length  $s$  and  $A$  is the area of the sector, we can write the following proportion:

$$\frac{A}{\pi r^2} = \frac{s}{2\pi r}$$

Solving for  $A$  gives:

$$A = \frac{rs}{2}$$

From the formula for arc length we have  $s = r\theta$ , with  $\theta$  the radian measure of the central angle. Substituting  $r\theta$  for  $s$  gives the area of a sector to be  $A = \frac{1}{2}r^2\theta$ .

- Worked examples to show how to tackle problems.
- Key facts for emphasis of important points.
- Hints and tips to help learners answer questions.

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Learning objectives at the start of every chapter.

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**6 Trigonometric functions and equations**

**Learning objectives**  
By the end of this chapter you should be familiar with...

- angles measured in radians
- computing the length of an arc and the area of a sector
- the unit circle and the definitions for  $\sin$ ,  $\cos$  and  $\tan$
- knowing exact values of  $\sin$ ,  $\cos$  and  $\tan$  for  $0, \frac{\pi}{6}, \frac{\pi}{4}, \frac{\pi}{3}, \frac{\pi}{2}$  and their multiples
- the Pythagorean identities and double angle identities for sine and cosine
- the relationships between  $\sin$ ,  $\cos$  and  $\tan$
- the graphs of  $\sin$ ,  $\cos$  and  $\tan$ , and their amplitude and period
- transformations of graphs in the form  $\sin(x + c) + d$  and  $\cos(x + c) + d$
- applying trigonometry to real-life problems
- solving trigonometric equations in a finite interval
- the reciprocal trigonometric ratios  $\sec$ ,  $\csc$  and  $\cot$
- the Pythagorean identities involving  $\sec$ ,  $\csc$  and  $\cot$
- the inverse functions arcsine, arccosine, arctangent, and their domains, ranges and graphs
- the compound angle identities for  $\sin$  and  $\cos$
- double angle identity for  $\tan$
- relationships between trigonometric functions and the symmetry of their graphs.

Trigonometry developed from the use and study of triangles in surveying, navigation, architecture, and astronomy to find relationships between lengths of sides of triangles and measurement of angles. As a result, trigonometric functions were initially defined as functions of angles — that is, functions with angle measurements as their domains. With the development of calculus in the 17th century and the growth of knowledge in the sciences, the application of trigonometric functions grew to include a wide variety of periodic (repetitive) phenomena such as wave motion, vibrating strings, oscillating pendulums, alternating electrical current, and biological cycles. These applications of trigonometric functions require their domains to be real numbers without reference to angles or triangles. Hence, trigonometry can be approached from two different perspectives: **functions of angles or functions of real numbers**. This chapter focuses on the latter — viewing trigonometric functions as defined in terms of a real number that is the **length of an arc** along the unit circle.

**6.1 Angles, circles, arcs and sectors**

An angle in a plane is made by rotating a ray about its endpoint, called the vertex of the angle. The starting position of the ray is called the initial side and the position of the ray after rotation is called the terminal side of the angle (Figure 6.1). An angle with its vertex at the origin and its initial side on the positive  $x$ -axis is in **standard position** (Figure 6.2a). A **positive angle** is produced when a ray is rotated in an anticlockwise direction, and a **negative angle** when rotated in a clockwise direction. Two angles in standard position that have the same terminal sides regardless of the direction or number of rotations are called **coterminal angles**. Greek letters are often used to represent angles, and the direction of rotation is indicated by an arc with an arrow at its endpoint. The  $x$  and  $y$  axes divide the coordinate plane into four quadrants (numbered with Roman numerals). Figure 6.2b shows a positive angle  $\alpha$  and a negative angle  $\beta$  that are coterminal in quadrant III.

**Measuring angles: degree measure and radian measure**

A unit of one degree ( $1^\circ$ ) is defined to be  $\frac{1}{360}$  of one anticlockwise revolution about the vertex. There is another method of measuring angles that is more natural. Instead of dividing a full revolution into an arbitrary number of equal divisions (e.g. 360), consider an angle that has its vertex at the centre of a circle (a central angle) and subtends for intercepts a part of the circle, called an arc of the circle. Figure 6.3 shows three circles with radii of different lengths ( $r_1 < r_2 < r_3$ ) and the same central angle  $\theta$  subtending (intercepting) the arc lengths  $s_1, s_2$  and  $s_3$ . Regardless of the size of the circle (i.e. length of the radius), the ratio of arc length  $s$  to radius  $r$ , for a given angle will be constant. For the angle  $\theta$  in Figure 6.3,  $\frac{s_1}{r_1} = \frac{s_2}{r_2} = \frac{s_3}{r_3}$ . Because this ratio is an arc length divided by another length (radius), it is just an ordinary real number and has no units.

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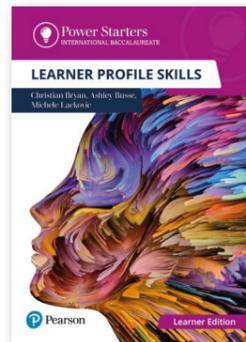
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**LEARNER PROFILE SKILLS** **ACTIVITIES** 1

**Learner Profile Trait: Thinkers**

**Skill:** Creativity

**Activity 1: Creativity: what it is and what it isn't**

Watch [this video](#), which explains the concept of creativity and debunks some myths about it.

Now answer the following questions:

1. What did you think when you were asked to list ideas for using that brick? Did you immediately come up with some ideas? Did you 'shut down' and think, 'Oh, they'll tell me what to do: Did you think, 'I can't do that - I'm not creative! Did you come up with some ideas? Think about what your reaction can tell you about your mindset.
2. What does it mean to think of 'alternative uses' for something? How could the 'brick' exercise be applied to real-life situations?
3. Look around you right now and select an object with a specified use. Now, give yourself 3 minutes to jet down - without adding or improving - alternative uses for that object.
4. Reflect on this exercise: what was challenging? What was rewarding? How did you think about yourself and your abilities while you were also thinking of ideas?
5. Have you ever found a solution to a problem when you let your mind wander, as the speaker in the video recommends? Is there something in your life right now that could be helped by you approaching it more creatively?

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**Observation**

Choose the correct answer and then click Check answers.

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- using technology makes us more disorganised

Question 2 of 10

Check answers

Auto-marked quizzes identify strengths and weaknesses within a particular skill.



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Diagnostic tests identify any gaps in the skills and knowledge learners need to start their new course successfully.

**TOPIC 2: STOICHIOMETRY AND ANALYSIS** **SKILLS CHECK** 1

This test is designed to check skills and knowledge in this topic. It should be completed without any outside assistance and should take no longer than 30 minutes. After completion, the mark scheme will help you decide what intervention is needed.

1. Give the relative formula mass for the following compounds:
  - a.  $\text{CO}_2$  (1 mark)
  - b.  $(\text{NH}_4)_2\text{SO}_4$  (1 mark)
2. Balance the following equations:
  - a.  $\text{C}_2\text{H}_6 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$  (1 mark)
  - b.  $\text{N}_2 + \text{H}_2 \rightarrow \text{NH}_3$  (1 mark)
3. a. Determine the number of carbon atoms in 0.025 moles of pentane,  $\text{C}_5\text{H}_{12}$ . (1 mark)
- b. Calculate the mass of 0.0045 moles of aluminium oxide,  $\text{Al}_2\text{O}_3$ . (1 mark)
4. Give the empirical formula for the following compounds:
  - a.  $\text{N}_2\text{O}_5$  (1 mark)
  - b.  $\text{P}_2\text{O}_5$  (1 mark)
  - c.  $\text{Al}_2\text{O}_3$  (1 mark)
5. a. Phenylendamine, a compound used to make polymers such as Kevlar, has the following percentage composition: C, 66.6%; H, 7.5%; N, 25.9%. Use this data to determine the empirical formula for phenylendamine. (3 marks)
- b. The relative formula mass of phenylendamine is 158.18. Use this information to determine the molecular formula of phenylendamine. (2 marks)
6. The reaction of zinc sulfide,  $\text{ZnS}$ , with oxygen,  $\text{O}_2$ , at high temperatures can produce zinc oxide,  $\text{ZnO}$ , and sulfur dioxide,  $\text{SO}_2$ .
 
$$2\text{ZnS} + 3\text{O}_2 \rightarrow 2\text{ZnO} + 2\text{SO}_2$$
 Determine the number of moles of zinc oxide that will be formed in a reaction where:
  - a. 0.45 moles of  $\text{O}_2$  is reacted with excess zinc sulfide. (1 mark)
  - b. 1.75 moles of sulfur dioxide is formed. (1 mark)
7. Copper oxide,  $\text{Cu}_2\text{O}$ , can be formed by combining copper metal with oxygen,  $\text{O}_2$ , at high temperatures:
 
$$2\text{Cu} + \text{O}_2 \rightarrow \text{Cu}_2\text{O}$$
 a. If 4.75 g of copper is reacted with 4.00 g of oxygen, what is the mass of copper oxide that can be formed? (4 marks)
- b. When the reaction was conducted with the masses given in part a an experimental yield of 5.31 g of copper oxide was obtained. What was the percentage yield for the reaction? (1 mark)
8. If 33.0 g of sugar (sucrose,  $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ ) is dissolved in water to make 355  $\text{cm}^3$  of solution, determine the concentration in  $\text{mol dm}^{-3}$ . (3 marks)
9. 25.00  $\text{cm}^3$  of a potassium hydroxide solution,  $\text{KOH(aq)}$ , of unknown concentration was titrated with a sulfuric acid solution,  $\text{H}_2\text{SO}_4(\text{aq})$ , that had a concentration of 1.06  $\text{mol dm}^{-3}$ :
 
$$2\text{KOH(aq)} + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{K}_2\text{SO}_4(\text{aq}) + 2\text{H}_2\text{O(l)}$$
 Determine the concentration of the potassium hydroxide solution if the equivalence point was reached after the addition of 19.85  $\text{cm}^3$  of the sulfuric acid solution. (3 marks)
10. A solution of hydrogen peroxide ( $\text{H}_2\text{O}_2$ ) has a concentration of 9.8  $\text{mol dm}^{-3}$ .
  - a. Determine the concentration of 63.0  $\text{cm}^3$  of this solution is diluted to a volume of 1.000  $\text{dm}^3$  by adding water. (1 mark)
  - b. What volume of the original hydrogen peroxide solution must be used to make 250.0  $\text{cm}^3$  of a solution with a concentration of 0.00100  $\text{mol dm}^{-3}$ . (1 mark)

Total = 29 marks

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Intervention lesson plans and content written by IB subject experts.

**TOPIC 2: STOICHIOMETRY AND ANALYSIS** **TEACHING GUIDE** 1

**Lesson 1: Compounds and balancing equations**

**Skills:**

- To be able to calculate the relative formula mass for a compound from relative atomic masses.
- To understand the significance of subscripts and coefficients in chemical formulas and chemical equations.
- To be able to balance chemical equations.

**Timing:** 1 hour

**25 min**

- Ask learners to read the sections on **Chemical compounds and Relative formula mass** in the **Support notes**, including the worked example.
- Ask learners work in groups or pairs and assign each a simple reaction of two elements to form a compound, such as  $\text{Mg} + \text{Cl}_2 \rightarrow \text{MgCl}_2$  or  $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$ . Confirm through their investigation of these reactions that learners understand the key concepts:
  - Chemical compounds are formed when different elements bond/combine in fixed ratios.
  - Chemical compounds have different properties from the elements they are made from.
  - Compounds are described using chemical formulas that use the atomic symbols of the elements in the compound.
  - Subscripts are used in the chemical formula to show when more than one atom of an element is present in the compound.
- Ask learners determine the relative atomic or relative formula masses for the reactants and products in the assigned reaction to confirm that they understand the key concepts:
  - The relative formula mass of a compound is calculated by adding the relative atomic masses of all the elements present in the compound.
  - Ask learners to confirm their understanding by completing **question 1** at the end of the **Support notes** and checking their answers.

**35 min**

- Ask learners to read the section on **Balancing chemical equations** in the **Support notes**, including the worked example.
- Confirm through discussing with the class, or directing questions, that learners understand from the examples in the text, and/or the worked example, that they understand the key concepts:
  - Reactants are on the left side and products are on the right side of the arrow in a chemical equation.
  - Balanced chemical equations have the same number of atoms for each element on the reactants side and the products side.
  - State symbols can be included in chemical equations to provide extra information about the states of reactants and products.
  - Ask learners to confirm their understanding by completing **question 1** at the end of the **Support notes** and checking their answers.
- If time allows, ask learners to summarise through class discussion the key understandings they have gained from the lesson.

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Identify and tailor lesson plans to learner needs.

Check that the skills and knowledge from the lessons have been embedded with end of topic tests.

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15–16	Year 11		Grade 10	
16–17	Year 12	Key Stage 5 AS/ A Level / International A Level	Grade 11	Diploma
17–18	Year 13		Grade 12	

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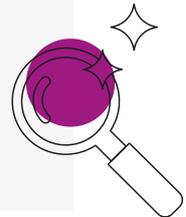
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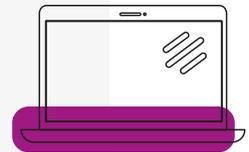
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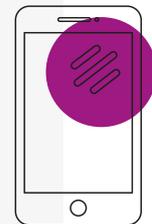
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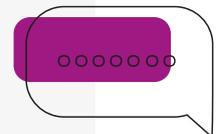


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