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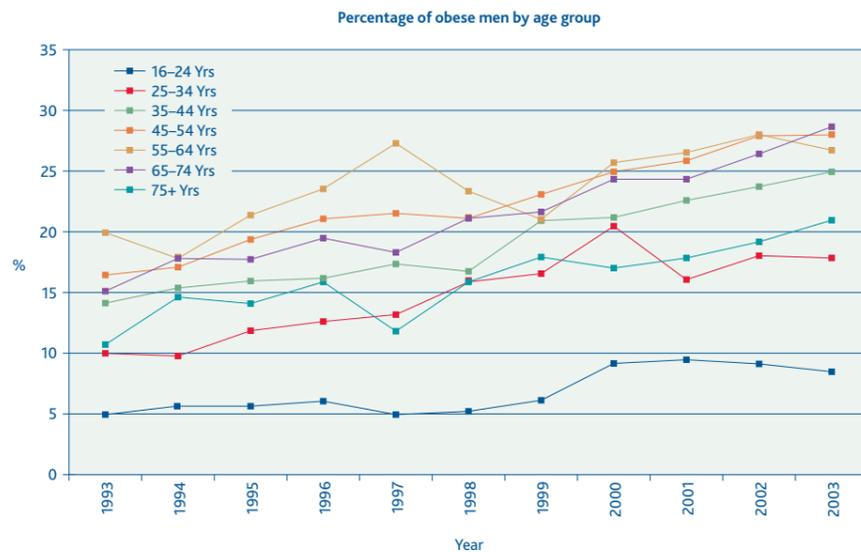


Fig. 1.2 Graph showing percentage of obese men by age group (1993–2003)

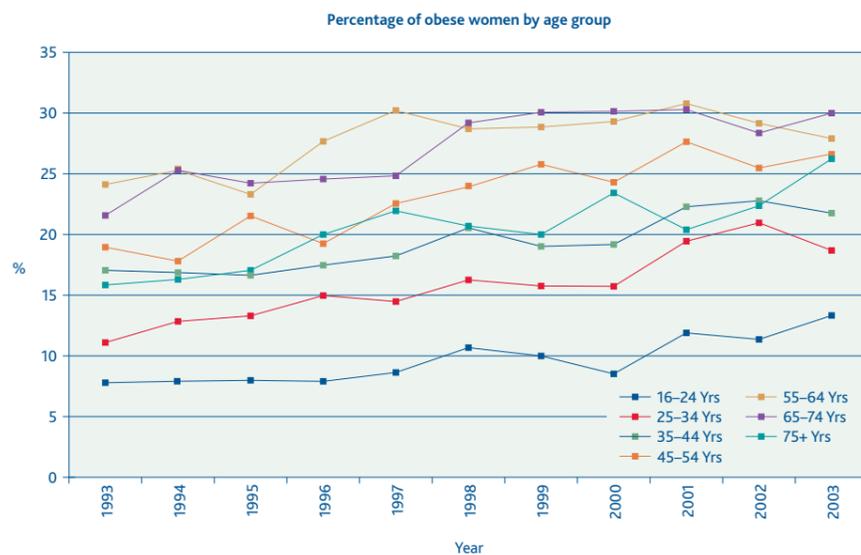


Fig. 1.3 Graph showing percentage of obese women by age group (1993–2003)

to control the contraction and relaxation of muscle fibres, thereby generating an infinite range of muscular tension, enabling limbs to be moved or held in a static or held position.

**Explosive strength**

Explosive strength is the rapid contraction of muscle fibre units to achieve a maximum generation of force. Sporting examples of explosive strength would be when jumping, throwing, sprinting, hitting – any time when maximum force is needed. Explosive strength is also related to power – the rapid application of maximal strength.

**Dynamic strength**

Dynamic strength is the repeated contraction and relaxation of a single muscle or group of muscles thereby causing a limb to repeat a movement over time. It should not be confused with muscular endurance.

**Static strength**

Static strength is the holding of a limb or part of the body in a static or immobile position. This is achieved by muscles maintaining a state of contraction or tension, often supported by a paired antagonistic muscle. Examples occur in both sporting and non-sporting situations.

**Strength and health**

It is not immediately obvious why there should be a connection between strength and health. Indeed most people do not need to engage in serious levels of resistance training to develop any of the forms of strength that have been identified. It is known however that a reasonable level of core body strength (abdominals, back) will do a great deal to avoid back injuries or back pain from degenerative or ageing processes. The use of Pilates or gentle strength conditioning exercises is now known to be a valuable element of maintaining fitness for health.

**Speed**

The health-related fitness concept of **speed** relates to whole body movement. Speed is achieved through the coordinated application of powerful, often maximal, muscular contractions. Speed is demonstrated by the sprinter, the games player racing down the touchline, the gymnast on the vault run-up in the floor exercise.

**Speed and health**

The link between speed and health only becomes obvious when you need to sprint up the stairs and muscle pulls and tendon twinges bring you to a halt. If there are times when you need to move quickly and you have not maintained muscular strength and flexibility, then injuries are far more likely. Regular flexibility exercises and gentle muscle conditioning can prevent that happening.

**Muscular endurance**

**Muscular endurance** is the repeated contraction and relaxation of a single muscle or group of muscles thereby causing a limb to repeat a movement over time. It should not be confused with muscular endurance, aerobic capacity, stamina, etc. You will often hear sport commentators and others refer to a performer having great endurance and it is not clear if they are referring to the ability to maintain a whole body activity or a repeated limb action. Whilst this may be acceptable in that situation you must be far more precise and use the terms appropriately.

**Muscular endurance and health**

Again it may not be immediately obvious that the ability to maintain repeated muscular contractions has a direct link to health. Muscular endurance is linked to the body's effectiveness at getting oxygen to the working muscle cells and removing the associated waste products (along with having a high proportion of slow twitch muscle fibres). This is related to both local and whole body aerobic efficiency. A deficiency in this localised muscular endurance may be an indicator of poor aerobic fitness and subsequent health issues.

**Flexibility**

**Flexibility** is the ability of a limb or part of the body to show a wide range of movement. It is linked to a range of motion around a joint and reflects the joint structure (type), the length of the related muscles and the limiting effect of the joint ligaments. Flexibility is a contributing factor to

**AQA Examiner's tip**

Make sure you can quote examples of each of the different types of strength.

**Key terms**

**Speed:** the rate at which the body is moved from one place to another.

**Muscular endurance:** the ability of a muscle or group of muscles to perform repetitive contractions over a period of time.

**Flexibility:** the range of movement around a joint.



Fig. 1.4 Group of adults improving core strength through Pilates

**Activity**

Find examples of the use of strength, speed, aerobic fitness, static strength, dynamic strength and muscular endurance in your own sport or activity.

**AQA Examiner's tip**

Develop a wide range of examples of all the different types of health- and skill-related fitness.

Do not confuse muscular endurance with cardio-respiratory endurance or aerobic capacity.

**Key terms**

**Antagonist:** acts to produce the opposite action of the prime mover.

**Synergists:** muscles that stabilise a joint to prevent unwanted movement.

**Isometric:** muscle contracts, but no movement occurs.

**Isotonic:** muscle changes length while contracting.

**Concentric:** muscle shortens as it contracts.

**Eccentric:** muscle lengthens as it contracts.

muscle is the prime mover. At the same time, another muscle, the triceps, called the **antagonist**, is relaxing.

The antagonist has the opposite effect to the prime mover. The roles of these two muscles are reversed when the action is changed to that of extension. As well as prime movers and antagonists, most movements involve muscles called **synergists**. The role of these muscles is to steady a movement and thus prevent unwanted movements whilst helping the prime mover function more efficiently.

Some synergists also act as fixators during movements, helping to stabilise the origin of the prime mover so that it can act more efficiently. For example, the scapula must be held in place by fixators so that the deltoid muscle can abduct the upper arm.

All muscle contractions are either **isometric** or **isotonic**. An isometric contraction happens when the muscle develops tension (force), but no movement occurs. These are sometimes called static contractions, and are often used in sport to hold the body in a fixed position, such as during gymnastic balances, or when a sprinter remains still in the 'set' position.

Isotonic contractions occur when there is tension produced within a muscle whilst it shortens or lengthens. They are sometimes called dynamic contractions, because movement occurs.

**Concentric** contractions occur when the muscle shortens during contraction. This happens when the muscle develops enough force to overcome a resistance as for example in the biceps during the flexion phase of a biceps curl.

**Eccentric** contractions involve the muscle lengthening under tension. These contractions occur when the muscle gradually lessens its tension to control movement that is happening because of gravity. This is what takes place in the biceps during the extension phase of the biceps curl.

**Planes of motion**

There are three planes of motion, which make the description of various joint movements easier to understand. As movements occur, the direction or line through which the part of the body moves is called a plane. At the same time, the joint moves or rotates around an axis that is at right angles to that plane. For simplicity, all movements are described as if the performer was standing upright with their arms by their sides and their palms facing forward, see Figure 6.1.

**Sagittal plane**

The **sagittal plane** splits the body into left and right halves. Movements in the sagittal plane could be described as forward and backward movements, and take place around a **transverse axis** that passes through the body from side to side. Generally, flexion and extension movements, such as biceps curls, sit-ups and knee extensions occur in the sagittal plane and around a transverse axis.

**Frontal plane**

The **frontal plane** splits the body into front and back halves. Movements in the frontal plane could be described as side to side movements, and take place around a **frontal axis** that passes through the body from front to back. Abduction and adduction movements such as raising and lowering of a limb to the side, which occur at the hip and the shoulder, take place in the frontal plane and around the frontal axis.

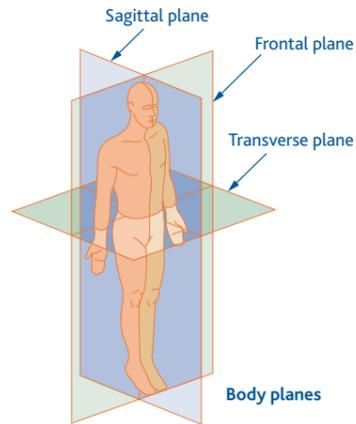


Fig. 6.1 Planes and axes

**Key terms**

**Sagittal plane and transverse axis:** directions for forward and backward movements.

**Frontal plane and frontal axis:** directions for side to side movements.

**AQA Examiner's tip**

One plane is only ever paired with one particular axis. The vast majority of movements that you need to know take place in a sagittal plane around a transverse axis; a few take place in a transverse plane around a longitudinal axis.

**Key terms**

**Transverse plane and longitudinal axis:** directions for turning/rotational movements.

**Ball and socket joint:** formed at the hip between pelvis and femur.

**Transverse plane**

The **transverse plane** divides the body into top and bottom halves. Movements in the transverse plane could be described as turning movements, and take place around a **longitudinal axis** that passes through the body from top to bottom. Rotational movements such as pronation and supination occur in the transverse plane around a longitudinal axis, as does horizontal flexion and extension.

**Analysis of specific movements**

**Running**

The leg action in running is one that takes place in a sagittal plane about a transverse axis. The actions are concerned with three joints: the hip, knee and ankle.

The hip joint is a large **ball and socket joint** that permits a large range of movement in many directions. The joint is formed between the ball, the spherical head of the femur (thigh bone), and the socket, a deep depression in the side of the pelvis. The ball and socket fit together to give a strong, stable joint with a good range of movements.

**Activities**

Locate and feel the hip joint at the side of the top of your thigh. The hip joint is three or four inches lower than the crest of your pelvis, and many people confuse the two. You'll find it easier to locate the hip if you move the leg. What you are actually feeling is the femur.

- 1 Move your leg forwards and backwards. Through which plane and what axis is this movement taking place in?
- 2 Move your leg out to the side. Through which plane and what axis is this movement taking place in?
- 3 Now keeping your leg locked straight, turn your foot outwards and inwards. Through which plane and what axis is this movement taking place in?

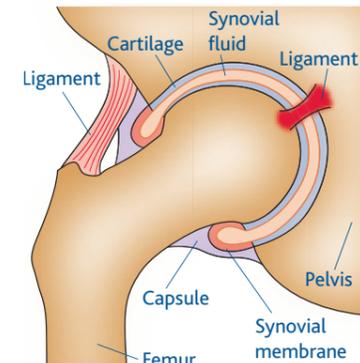


Fig. 6.2 Diagram of hip joint

Various ligaments and cartilages are involved with providing the knee with stability and these tend to make the knee the most complex and discussed joint in the body. But in simple terms the joint is relatively straightforward.

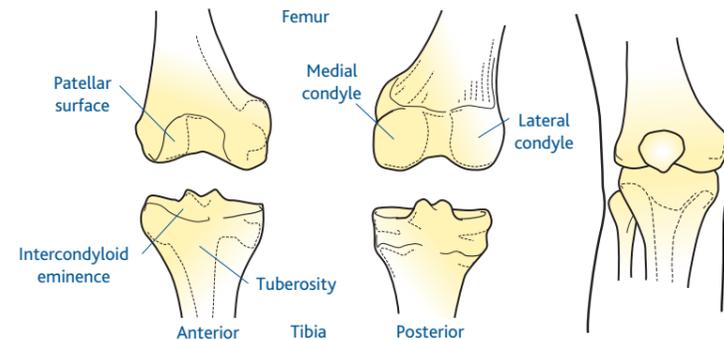


Fig. 6.3 Bones of the knee joint

# 1 Religion and conflict

## The Big Picture

- In this topic you will be addressing various ethical issues relating to religion and conflict.
- This topic covers three principal religions: Christianity, Islam and Buddhism.
- You will need to focus on at least two principal religions.

### You will look at:

- religious practices and teachings about peace and conflict
- the nature and purpose of suffering and what support is available to help those who suffer
- religious teachings about forgiveness and reconciliation
- the range of different beliefs and practices that exist with regard to conflict and war, including pacifism
- attitudes to non-violent protest.

You will also think about the different attitudes that exist towards these ethics and practices.

### What?

#### You will:

- develop your knowledge and understanding of issues of peace, reconciliation and conflict
- focus on peace, forgiveness and attitudes towards war
- explain how religious teachings can help us to understand forgiveness and reconciliation
- make links between these teachings and your own ideas and opinions.

### Why?

#### Because:

- these questions and issues are central to an understanding of human life and experience
- these are major areas of discussion and are important in the development of local, national and international relations in today's world
- there are different sides to how people view these subjects
- it is impossible to live in 21st-century Britain and not encounter these issues.

### How?

#### By:

- studying and recalling information about religious teachings on these issues
- exploring the relevance and practicality of religious beliefs, practices, values and traditions in the world today
- considering appropriate examples of religious charities/organisations and religious believers and how they work for peace
- reviewing evidence from various references and sources appropriate to these issues
- analysing others' points of view and comparing them to your own.

### Get started

**We want peace**  
by Lenny Kravitz

We're on the eve of destruction my friends  
We are about to go to war  
Politicians think that war is the way  
But we know that love has the power

We want peace  
We want it yes  
We want peace  
We want it yes  
We want peace  
And we want it fast

The solution is simple and plain  
There won't be peace if we don't try  
In a war there is nothing to gain  
When so many people will die

### Activities

- 1 Discuss the ideas the lyrics give about peace.
- 2 In no more than 20 words, write down what you believe is the meaning of peace.
- 3 Draw a picture or symbol that you believe represents peace.

Topic 1

# Develop Your Knowledge

This topic is about religion and conflict. Read the information below, which will help you to think about the issues, before you begin more detailed work.

### Key information

- Making peace can be difficult if there are differences of opinion or if people feel strongly about certain issues.
- All religious traditions have teachings about peace.
- Attempts to maintain peace have resulted in the formation of organisations and groups that work to achieve peace.
- Interfaith dialogue emphasises the need for different faith groups to work together and remove misunderstandings.
- People suffer in many different ways, for example through natural disasters, ill health or because of other people's actions.
- Suffering can be eased in many ways. Responding to those who suffer is at the heart of many religions.
- There are many religious teachings on forgiveness.
- The concept of 'forgiveness' varies from person to person and in each situation.
- War and conflict are facts of life and have been around from the earliest periods of history.
- A war should always be the last resort, once every method of resolving the situation has been explored.
- Various conditions and theories exist to say what constitutes a just war.
- There is a range of attitudes towards non-violent protest.

### Key words

- \***conflict** clashes and breakdowns of relationships
  - interfaith community** a community that makes possible religious respect and dialogue between and among all people
  - \***interfaith dialogue** exploring common grounds between different faith groups
  - \***just war** a war undertaken to protect the innocent or those being violated and to restore justice and peace
  - moral evil** suffering caused by other humans, for example the Holocaust
  - natural evil** suffering not caused by someone or something, for example volcanic eruptions or a tsunami
  - \***non-violent protest** showing disapproval without damaging property or causing any threat
  - \***pacifism** the belief that any form of violence or war is unacceptable
  - \***reconciliation** bringing harmony to a situation of disagreement and discord
  - suffering** patience, endurance: the bearing of (or undergoing) pain or distress
- \*We draw attention to these key words in particular because they are the ones that appear in the WJEC specification.

### Key questions

- How can peace be made and kept?
- How can good relationships be developed between people?
- How can communities work together?
- How can different religions support peace by talking to each other?
- Why do the innocent suffer?
- How can those suffering be helped?
- Is forgiveness possible?
- How important is forgiveness?
- How important is it to forgive?
- How do people learn to forgive?
- Is it ever right to fight?
- How can war/conflict be avoided?
- Can a war ever be 'just'?
- How can non-violent protest be used?

### For interest

#### Did you know?

- The shortest war on record took place in 1896, when Zanzibar surrendered to Britain after 38 minutes.
- The longest was the so-called Hundred Years War between Britain and France. It actually lasted 116 years, ending in 1453.
- In 1998, the United States spent more than \$35 billion on its nuclear war programme.

Adapted from [www.didyouknow.org/fastfacts/war.htm](http://www.didyouknow.org/fastfacts/war.htm)



### Important questions

- A large number of history's wars have been fought in the name of religion. Whose side is God on?
- Do you think there will ever be peace in the world?
- Why do we need nuclear weapons? Are they a cause or a preventative of war?

FIGURE 1.8 Scale-Degree Names

FIGURE 1.9 Key Signatures—Minor Scales

Whereas the E minor scale has one sharp (F#), so B minor has two (F#, C#), F# minor has three (F#, C#, G#), C# minor has four (F#, C#, G#, D#), G# minor has five (F#, C#, G#, D#, A#), D# minor has six (F#, C#, G#, D#, A#, E#), and A# has seven (F#, C#, G#, D#, A#, E#, B#). And, the D minor scale has one flat (Bb), G minor has two flats (Bb, Eb), C minor has three (Bb, Eb, Ab), F minor has four (Bb, Eb, Ab, Db), Bb minor has five (Bb, Eb, Ab, Db, Gb), Eb minor has six (Bb, Eb, Ab, Db, Gb, Cb), and Ab minor has seven (Bb, Eb, Ab, Db, Gb, Cb, Fb). In the case of G#/Ab, D#/Eb, and A#/Bb, the key signatures are often spelled enharmonically. This is shown in Figure 1.9 by the arrows. We refer to the pair of major and minor keys that share the same number of sharps or flats in their key signatures as **relative keys**. For example, G major and E minor both have one sharp (F#), Ab major and F minor have four flats (Bb, Eb, Ab, Db).

**RHYTHM**

Music is notated with various rhythmic symbols that are proportionally related to one another. Figure 1.10 summarizes the basics of rhythmic notation.

FIGURE 1.10 Basics of Rhythmic Notation

CHAPTER 8

Chord-Scale Theory

CHAPTER SUMMARY

Chapter 8 establishes a relationship between the vertical and horizontal dimensions in jazz. The diatonic and chromatic modes are revisited and chord-scale relationships with four- and five-part chords, as well as the II-V-I progressions, are established.

CONCEPTS AND TERMS

- Chord-scale relationship
- Dominant category:
  - Mixolydian
  - Mixolydian #11
  - Mixolydian b13
  - Altered
- Gapped formation
- Intermediary category:
  - Dorian
  - Locrian
  - Locrian b2
- Major category:
  - Ionian
  - Lydian
  - Lydian Augmented
- Minor category:
  - Melodic Minor
  - Aeolian
  - Dorian
- Overtone series:
  - Fundamental note
  - Partial
- Overtones
- Quartal harmony
- Suspended dominant category:
  - Mixolydian
  - Mixolydian b13
  - Phrygian
  - Dorian b2
- Upper structures

OBJECTIVES OF CHORD-SCALE THEORY

In jazz, the relationship between chords and scales is explained using chord-scale theory. Chord-scale theory relates certain harmonies to melodies and melodies to harmonies. It also illustrates what kinds of harmonies and chord progressions can be derived from particular scales or modes. The terms *scale* and *mode* will be used interchangeably. By extension, chord-scale theory measures the harmonic identity of improvised lines and examines melodies for their harmonic clarity. Finally, chord-scale theory allows us to formulate rules of voice leading that govern the behavior of harmonic progressions and melodic lines.

In short, the relationship between scales and chords can be summarized with the following statement: *any melodic line can be represented by a chord and/or harmonic progression and, conversely, any chord or harmonic progression can be horizontalized as a melodic line.*

Since we will combine four- and five-part chords (as well as triads and extended tertian sonorities) that add up to some 52 harmonic formations, **chord-scale relationships** will involve many-to-one ratios. This means that certain scales can accommodate more than a single chord and certain chords can establish a chord-scale relationship with more than a single mode. The possibility that many chords can form a relationship with a single scale is of great importance to the improviser. A proper understanding of this relationship can influence our decisions in finding the most fitting harmonic match for a single scale or vice versa. Even though certain chords might not contain all the essential notes from a given mode, they can still form a convincing chord-scale relationship with that mode.

CHORD-SCALE RELATIONSHIP

A chord built entirely of thirds, so-called tertian formation, has seven notes that can be arranged in the form of a scale.<sup>1</sup> The notes within the scale, however, have very different melodic and harmonic behaviors. Any vertical or linear combination of notes derived from the scale has the potential to convey the sound of that scale. In order to express such a sound, the selection of pitches in a chord has to be very specific. Figure 8.1 illustrates a chord-scale relationship between CM13(#11) and the Lydian mode.

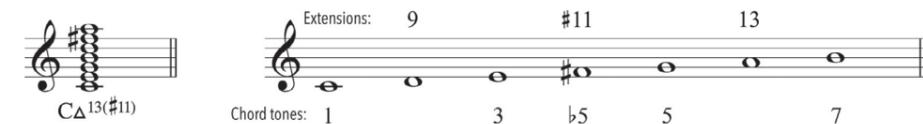


FIGURE 8.1 CM13(#11) and Lydian Mode

There are two ways of explaining the chord-scale relationship between CM13(#11) and Lydian. First, an extended tertian structure, CM13(#11), can be horizontalized as the Lydian mode. Second, Lydian can be verticalized as the CM13(#11) harmony. To project the Lydian sound, however, we do not necessarily need a complete seven-note chord; as few as three pitches, major 3rd, major 7th, and #11th (or b5th), may be used. The relationship between CM13(#11) and Lydian means that the vertical and horizontal dimensions exhibit the same voice-leading behaviors and one can be used to represent and/or complement the other. Just as the structure of CM13(#11) is representative of Lydian, so is the structure of other chords representative of other scales. Figure 8.2 represents the CM13(#11) chord as a melodic phrase with characteristic modal features.



FIGURE 8.2 Lydian Phrase

**Phrase Model 10**

**Phrase Model 10** features a chromatic phrase identifier tonicizing: the flat supertonic key area. More often than not, however, a  $[ii-V^7]/bII$  progression occurs in an incomplete form without resolving to  $bII$ . Figures 21.15a–21.15c illustrate a harmonic layout of **Phrase Model 10**, show a contrapuntal framework derived from a chromatic  $\hat{1}-b\hat{2}-\hat{1}-\hat{7}-\hat{1}$  melodic pattern, and realize the A section of “Darn That Dream” using jazz chorale texture in four voices.<sup>17</sup> In **Phrase Model 10**,  $b\hat{2}$  functions as a minor 7th of the underlying  $ii/bII$  harmony. The resolution to  $\hat{1}$  over  $V/bII$  satisfies the rules of voice leading.

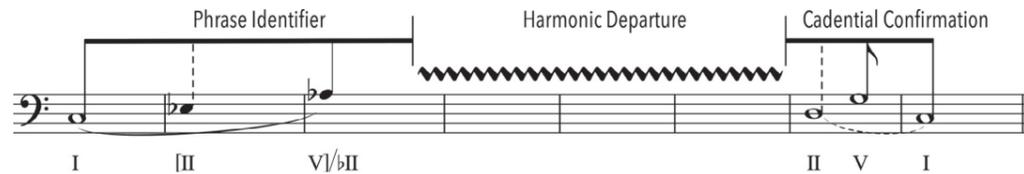


FIGURE 21.15a Phrase Model 10

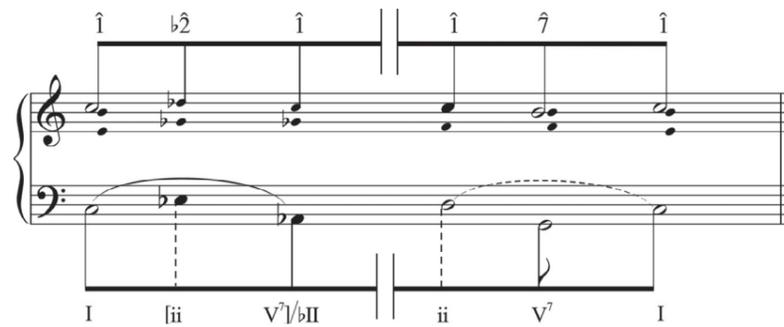


FIGURE 21.15b Phrase Model 10: Contrapuntal Framework



FIGURE 21.15c Phrase Model 10: “Darn That Dream”

What is interesting about the  $[ii-V^7]/bII$  progression is that it frequently functions as an effective harmonic substitution provided that the melody note establishes a convincing chord/scale relationship with the underlying harmony. After all, it is situated a minor 2nd away from the structural  $ii-V^7$  progression and, as discussed in Chapter 6, the  $[ii-V^7]/bII$  often functions as a chromatic sidestepping progression. In the context of “Darn That Dream” or “Out of Nowhere,” however, the  $[ii-V^7]/bII$  is fully integrated within the harmonic structure of these tunes. In “The Lady Is a Tramp” and “I Guess I’ll Hang My Tears Out to Dry” only the  $[ii]/bII$  is employed as a chromatic elaboration of the otherwise diatonic opening.

**STANDARD TUNES—PHRASE MODEL 10**

- |                                       |                         |
|---------------------------------------|-------------------------|
| Darn That Dream                       | The Lady Is a Tramp     |
| I Guess I’ll Hang My Tears Out to Dry | Three Little Words      |
| Out of Nowhere                        | We’ll Be Together Again |
| San                                   |                         |

**Phrase Model 11**

**Phrase Model 11** features a descending major 2nd cycle beginning on the tonic and—following the subsequent tonicizations of  $bVII$  and  $bVI$ —ending on  $bVI$ . Even though there are only a handful of tunes that use this progression in its entirety, an incomplete **Phrase Model 11** (with a partial descending major 2nd cycle) can occur in the context of different harmonic progressions. Figures 21.16a–21.16c show a chord structure of **Phrase Model 11**, illustrate a contrapuntal derivation from a  $\hat{1}-\hat{7}-\hat{1}$  melodic pattern, and realize the A section of “How High the Moon” using jazz chorale texture in five voices.<sup>18</sup>

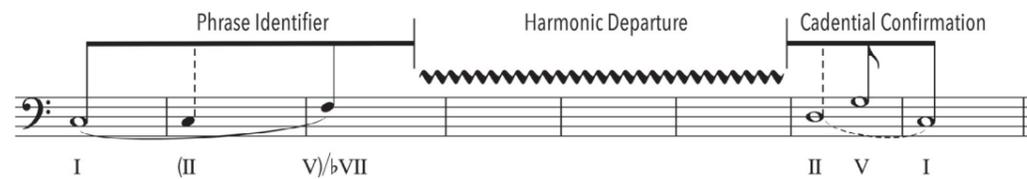


FIGURE 21.16a Phrase Model 11

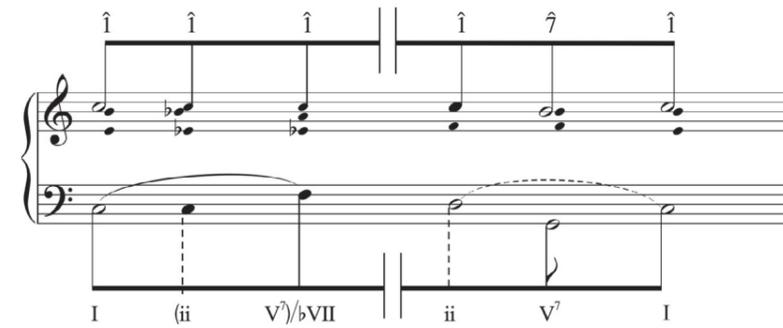


FIGURE 21.16b Phrase Model 11: Contrapuntal Framework



FIGURE 21.16c Phrase Model 11: “How High the Moon”

The United States, 1917–54: Boom, Bust and Recovery

**SKILLS BUILDER**

Using the information you have studied in this unit so far, create a diagram showing how the key factors of the slump interacted with each other to create the Depression.

- Government failed to increase demand by increasing spending sufficiently
- Shortage of money and credit
- Banking crisis – too many small banks and as they collapse they pull down others (20% collapse).
- Government follows a dear money policy from 1929 i.e. keeps interest rates high – adds to the banking crisis and discourages consumption.
- A victim of its own success

The technological revolution and mass production techniques were so successful in producing goods and services that they could not be absorbed within the USA and the rest of the world hit by tariffs and war debts could not afford them.

**What part did agriculture play?**

In 1929, American farmers' annual income stood at an average of \$273 a year, well below the national average of \$750 and their hard times as well as lack of purchasing power was an important factor in the Depression. In the 1920s, farmers did not share in the boom. They had benefited from the demand for agricultural produce during the First World War, but the 1920s brought severe problems. Investment in new equipment had loaded many farmers with high levels of debt. The debt level of \$3.2 billion in 1910, rose to \$8.4 billion in 1920 with annual interest payments alone totalling \$574 million.

As European agriculture recovered from the ravages of war, the 1920s became a period of overproduction which put smaller farmers under intense pressure. Their unit cost of production could not compete with the larger operators who had been able to invest in superior technology. Price levels fell and the mid-West was hit especially hard. A bushel of wheat cost \$2.19 in 1919 but had gone down to 90c in 1922.

Natural disasters, notably drought, also hit the rural communities of the mid-West and in some instances eliminated already declining income completely. Net farm income fell from \$6.1 billion in 1929 to \$2 billion in 1932. In Oklahoma, the wheat harvest which had an average annual yield of \$1 million produced only \$7,000 in 1933. Farmers felt the repercussions very badly. As incomes fell, they fell behind with mortgage repayments and their tax debts increased. Many also owed huge sums to cover the interest on equipment they had bought to improve their efficiency. The cotton and tobacco plantations suffered particularly badly. Again, natural disasters exacerbated an already desperate situation. The boll weevil hit cotton crops in the early 1920s, but then two good years produced record low prices. It seemed that whatever happened was bad for the producer. Many farms, for example, were devastated by the Mississippi flood of 1927. In the state of Mississippi income fell from \$239 per head in 1928 to \$117 in 1933. Over a third of the banks in the state failed. There were 3,500 **foreclosures** out of 5,280 farms.

**Definition**

**Foreclosures**

Foreclosures refers to banks who have lent money to farms or businesses on the security of the property and who are refusing to lend more or extend the period of the loan, taking over the property in compensation for the 'bad debt'.

Unit 5: The coming of slump and the Depression, 1929–33

The fate of the agricultural 'under classes' must not be forgotten. Farm labourers lost their jobs, **sharecroppers** became destitute and the smaller farmer had no opportunities as markets shrank. Many black people made their way from the South to the northern cities. It is important to realise that, for rural America, the Depression began well before the Wall Street crash in October 1929. The value of farmland dropped 30 per cent between 1920 and 1929. Already, by 1928–29, agriculture was in serious trouble throughout much of the South and West.

There are many evocative sources concerning the plight of rural America. The poverty of the rural South is vividly illustrated in literature of the time. The journalism of John Steinbeck is very powerful, as is the book *Let Us Now Praise Famous Men* by James Agee, which includes a large collection of photographs taken by Walker Evans.

**Definition**

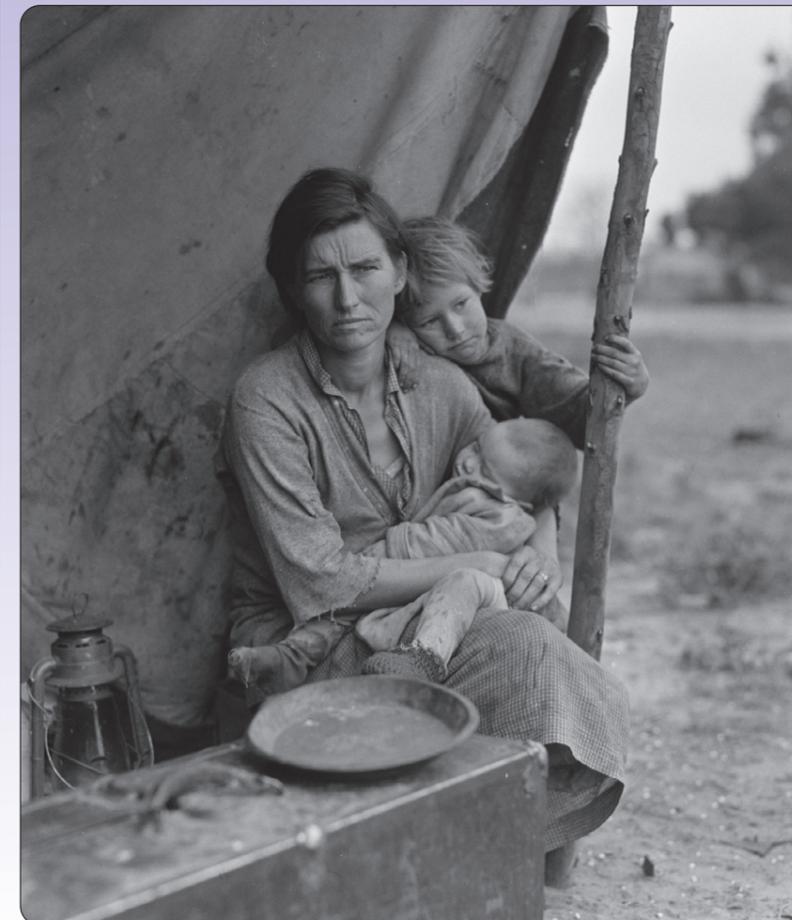
**Sharecroppers**

These were tenant farmers who paid part of their crops as rent to the land owner.

**SKILLS BUILDER**

Explain how agriculture was hit by – and helped to create – the slump.

**Source G**



**5.1** A woman and her children in rural America during the Great Depression.

The United States, 1917–54: Boom, Bust and Recovery

**Source JJ**

The Wilson Dam was used to provide vast quantities of cheap power to the fury of private sources, which had traditionally overcharged. The TVA rate was \$2 to \$2.75 a Kw-hour against a national average of \$5.5. This began the industrial and agricultural transformation of a huge area. It was also a spectacular piece of engineering – the flood control system is so well designed that the turbulent Tennessee River can be shut off instantly like a tap. The project thus received intense national and international coverage, all of it favourable, which persuaded many that state-capitalism worked and that it was all FDR’s idea.

From Paul Johnson, *A History of the American People*, published 1997

**Exam tips**

- Plan your answer before you start. You can use the advice about planning and structure which is given at the end of Unit 2 on pages 23–24.
  - You will need to analyse throughout the response, supporting your arguments with well chosen own knowledge.
  - Be very sure you know what ‘view’ is being expressed in all three sources.
- You should show that you understand the nature of the *debate* which lies at the heart of the question.
- Cross-reference between the sources by focusing on support and challenge.
- Use your *wider knowledge* both to reinforce and to challenge the points derived from the sources. The view of Source HH, which is negative as far as the impact of the New Deal on black Americans is concerned, can be challenged by reference to the shift in black American voting habits in favour of the Democrats. Other issues not referred to in the sources can be raised such as culture and the arts.
- Synthesise the arguments and points presented in the sources into your analysis.
  - Present a *substantiated judgement* as to the validity of the stated view and/or any alternatives in the light of your understanding of the issues of interpretation and controversy.

**Source KK**



6.3 A poster produced on behalf of the Works Progress Administration (WPA) in 1935.

**RESEARCH TOPIC**

How effectively do you feel the poster in Source KK captures what the WPA was seeking to achieve?

Find other examples of posters and artwork designed to promote other aspects of the New Deal. What message does each of these posters try to get across?

UNIT

**7 Opposition to Roosevelt and the New Deal**

**What is this unit about?**

This unit offers a study of the opposition to the reforms introduced by the Roosevelt Administration to the end of 1941, when the United States entered the Second World War. It seeks to assess their impact in the shaping of the New Deal. Roosevelt and the New Deal were attacked from all sides; from the left who felt that he was going too slowly and too cautiously in reforming the United States and from the right, who felt that he was being too sweeping in his reforms and undermining traditional American values of self-reliance. Most histories of opposition to the New Deal tend to focus on the Supreme Court’s decisions of 1935–36, which threatened to undermine the whole legislative programme. These decisions can be seen as part of the attack from the right in so far as the majority on the Supreme Court were adopting a conservative position in challenging the new powers taken by the Federal Government. As was made clear in Unit 6, the New Deal did not fundamentally alter the distribution of wealth or substitute state enterprise for free-enterprise. It tried to bolster the existing system by extending security to all or at least most groups. This Roosevelt hoped would turn radicals and potential revolutionaries into the supporters of the ‘American way of life’.

**In this unit you will:**

- explore the nature and extent of opposition to the New Deal
- understand the reasons for the Supreme Court’s opposition
- examine the impact opposition had on the delivery of the New Deal.

**Key questions**

- Who opposed the New Deal from the right wing and from the left wing perspectives?
- How successful was opposition to the New Deal?
- What was the Supreme Court controversy?
- In what ways and to what extent did opposition shape the New Deal?

**Timeline**

1932	Nov	Roosevelt elected by a landslide
1933	Mar	Roosevelt’s Inauguration
1934		Congressional elections reinforce radical Democrats
	Aug	American Liberty League founded Father Charles E. Coughlin founds National Union for Social Justice Senator Huey P. Long launches Share our Wealth campaign

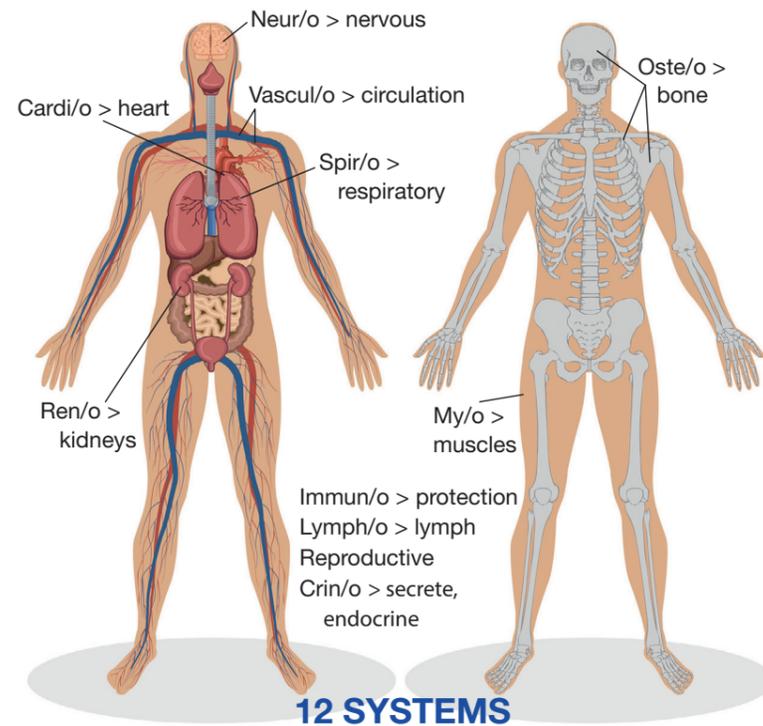


Figure 2.2

**The Coming and Going Systems** move something into the body such as oxygen or food AND move wastes out of the body such as urine and carbon dioxide (CO<sub>2</sub>). These systems include: Respiratory system, Urinary or Renal system, Digestive system, and the Lymphatic system.

- **Spir/o** > to breathe, to move gases > to respire (**res-pyre**) is to move oxygen in and push CO<sub>2</sub> out with each breath. Other terms: respirations, inspiration, expiration, and respiratory system.
- **Gest/o** > to carry; add di- > two, double > digest (**die-jest**) > to separate or dissolve as it is carried. Other terms: digestant, digestive tract, and digestive system.
- **Ur/o** > urine (**your-in**) > waste product of the kidneys (**ren/o**) which filters blood to remove excess water and waste products such as urea and creatinine. Another linking form for urine is **urin/o**.
- **Lymph/o** > life fluid > the lymphatic (**lim-fat-ik**) system helps defend the body against pathogens and other foreign material.

2.2

**LIKE TERMS!**

**Gest/o** means to carry or bear, and it forms the root of the word digestion, which means to break up and carry nutrients. **Di-** means two, in this case two ways to digest food: chemical and mechanical.

We also get 'gestation' to carry or bear a pregnancy.

It is essentially our vacuum cleaner pulling in debris and leftovers, cleaning them, and returning the clean fluid to the heart via the veins. Other terms: Lymphedema, lymphadenopathy, lymph nodes, and lymphatic system.

**The moving and grooving systems** allow stretching, reaching, and lifting; they also protect: Skeletal system, Muscular system, and Integumentary system.

- **Skelet/o** > dried up (bones) > skeletal (**skel-et-al**) system forms the basic framework for the body, protects, and supports our internal organs such as our brain, heart, and lungs.
- **Muscul/o** > muscle > muscular (**mus-Q-lar**) system is the highly specialized elastic tissue which binds our skeleton, allows movement, generates heat, and helps maintain body posture cushioning falls. There are three types: Skeletal, smooth, and cardiac. Other terms: Musculature, muscularity, and the musculoskeletal system. Other linking form: **my/o** or **myos/o** > muscle.
- **Dermat/o** > skin > also called the integumentary (**in-teg-U-men-tar-ee**) (covering or skin) system, which forms a relatively waterproof cover for our body regulating body temperature, keeping bugs out, and it contains part of our sensory net. Other linking forms are **derm/o**, **cutane/o**, and **cut/i**. Other terms: dermatitis, dermatology, dermatome, dermoplasty, and subcutaneous.

✓ Who is the scientist who discovered and first used X-rays?

✓ Which of the following terms is using two word roots, making a compound word?

- Lymphedema
- Urology
- Lymphadenopathy
- Muscular
- Inspiration

**Word building**



Using the word roots with the linking vowel to build as many valid terms with the suffixes given. Please define each term too.

- Dermat/o
- Urin/o or Ur/o
- Cardi/o
- logy
- scope
- graphy
- itis
- megaly
- plasty
- pathy

**Spir/o** > also means coil, or coil like: spirochete

2.3

Linking forms for skin include:

Dermat/o (Greek)

Derm/o

Cutane/o (Latin)

Cut/i

Integumentary is used almost exclusively to denote the system.

2.4

Wilhelm Röntgen

2.5

Lymphadenopathy

2.6

The instructor has the list!

**MORE NUMBERS**

**Kitchen lab**



*Look around your home and workplace and find all the measuring tools in your environment. What are the measurements listed for your over-the-counter liquid medications? What measuring system is being used for all the items you find? How do you keep it all straight?*

**NONE, ONE, and MANY**

There are several prefixes indicating none, one, or many. Some are interchangeable and others are used by convention.

- **Non-** > none, no, not, opposite, or negative. Not to be confused with **noni-** > 9.
  - **Noncompliance** (**non-come-ply-ants**) > person who fails to follow directions.
  - **Nonproductive** (**non-pro-duk-tiv**) > pertaining to a cough which is not getting the thick sputum up and out.
- **Null or Nulli-** > nothing, empty, absence of > a null cell has no significant landmarks; it looks empty.
  - **Nulligravida** (**nul-ee-grav-ee-da**) > woman who has never been pregnant.
  - **Nulliparous** (**nul-ip-ah-rus**) > woman who may have been pregnant but did not deliver a child.
- **Mono-** > single, one element > **Monocyte** (**mon-oh-sight**) > white blood cell with one, large nucleus.
  - **Mononeuralgia** (**mon-oh-nur-al-gee-ah**) > pain of one nerve.
  - **Monoplegia** (**mon-oh-play-gee-ah**) > paralysis of one or a single limb.
- **Uni-** > one, single, alone > **Unicellular** (**u-knee-sell-u-lar**) life has just one cell, e.g., the protozoa.
  - **Unilateral** (**u-knee-lat-er-al**) > occurring on one side of the body.

**2.30**

Share your findings with the instructor and class.

**2.31**

**Other NONE words:**

- Nonverbal
  - Nonavailability
  - Nonpenetrating
  - Nonpitting edema
- ‘Convention’ is the accepted usage of a term or process.

**2.32**

- Mononucleosis
- Monoxide
- Unifocal
- Unilocular
- Unipolar

- **Multi-** > many, several, increased number > **Multiform** (**mul-tea-form**) > having many forms or shapes. It is used interchangeably with **polymorphic** (many shapes).
- **Multinodular** (**mul-tea-nod-u-lar**) > pertains to having many nodules; a kidney or ovary may be multinodular.
- **Multisynaptic** (**mul-tea-si-nap-tik**) > pertains to having many nerve connections.
- **Pan-** > all, entire, whole > a **panacea** (**pan-ah-see-a**) > something curing everything.
- **Pancolectomy** (**pan-co-lek-toe-me**) > surgical removal of the entire colon.
- **Pancytopenia** (**pan-sigh-toe-pee-knee-ah**) > a distinct decline in the number of all the blood cells: RBCs, WBCs, and platelets being produced by the bone marrow.
- **Poly-** > many, multiple, too many to count, increased > **Polyarticular** (**pol-ee-are-tik-u-lar**) pertains to multiple joints.
- **Polycythemia** (**pol-ee-sigh-thee-me-ah**) > abnormal and marked increase in the number of red blood cells.
- **Polycystic** (**pol-ee-sis-tik**) > presence of many cysts.

**Semi- and Hemi-** are prefixes which are often interchanged to mean ‘one half’, a measurement. Use **hemi-** to mean a precise ‘half’. Use **semi-** when the quantity or measure is less precise.

- **Hemi-** > Greek for one-half as in **hemisphere**, half the sphere (Earth). **Hemiplegia** (**hem-ee-play-gee-ah**) > paralysis of half the body.
- **Semi-** > Latin for one-half or partial > **semicomatose** (**sem-ee-ko-mah-tose**) > a vague term concerning the loss of consciousness or drowsiness. A **semipermeable** (**sem-ee-pur-me-able**) membrane lets only certain elements through by size.

✓ Hector has an inflammation involving many arteries. Construct the correct medical term: \_\_\_\_\_/\_\_\_\_\_/\_\_\_\_\_.

✓ Which measurement system is becoming the most common standard?

✓ What is the correct way to write or type a fraction? Give an example please.

**2.33**

Of the three prefixes meaning many, more often, increased, **poly-** is used most often:

- Polyuria
- Polydipsia
- Polyhidrosis
- Polyadenitis
- Polypharmacy
- Polyplastic
- Polymorphic
- Polypeptide
- Polyphagia
- Polysaccharide
- Polyspermia

**2.34**

**Semi-** depending on region may be pronounced

**sem-eye-ko-mah-tose** or **sem-ee-pur-me-able**

Both are seen.

**2.35**

Poly/arter/itis  
Multi/arter/itis

**2.36**

Metric

**2.37**

With a 0 before the decimal point, 0.05

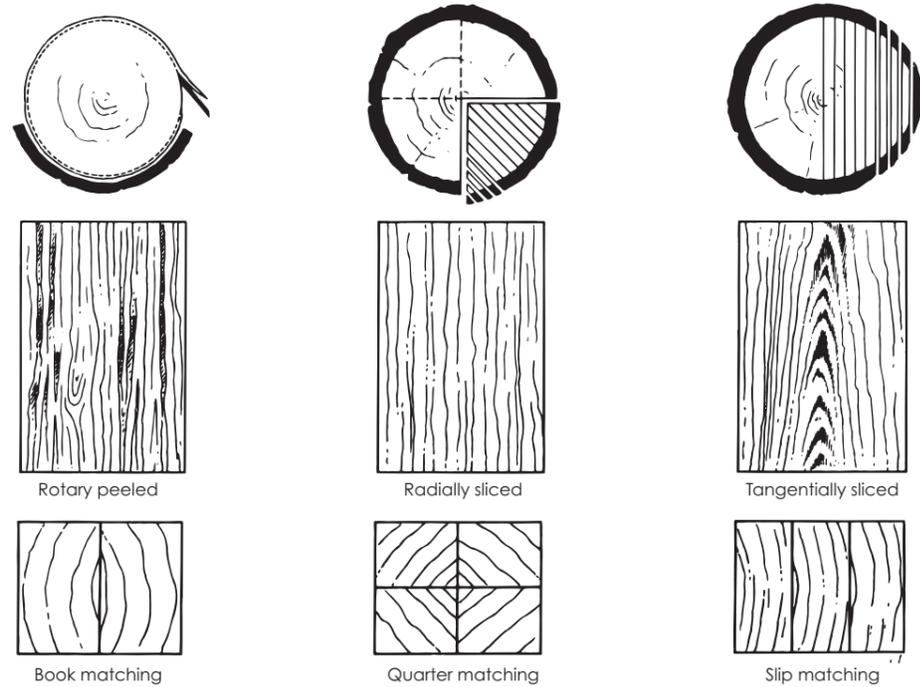


Figure 1.68 Veneer cutting and matching

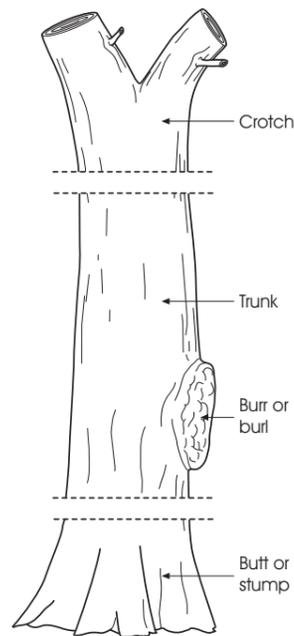


Figure 1.69 Tree parts used for veneers

Once sliced and dried the veneers are kept in multiples of four leaves and bundled into parcels of 16 to 32 leaves for matching purposes. Each bundle or parcel is taped together and re-assembled in consecutive order into its log form, ready for use.

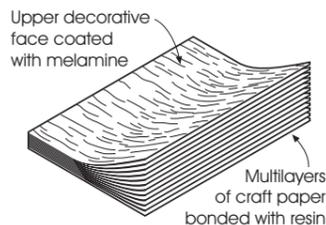
More exotic figured veneers are available by slicing from the butt, burr or crotch of a tree. These are highly prized for furniture and small wooden articles. These exotic pieces are normally much shorter in length or may be of an irregular shape. Burrs for example are irregular and typically from 150 mm x 100 mm to 1000 mm x 450 mm in size.

**Laminated plastic**

This is a thin synthetic plastic sheet, made from about ten layers of craft paper bonded and impregnated with a resin. A plain colour, patterned or textured paper or real wood veneer is used for the upper decorative face, which is coated with a clear coat of melamine formaldehyde to provide a hardwearing, hygienic, matt, satin or gloss finish. See Figure 1.70. Plain non-face sheets are also available for use as backing laminates.

Thicknesses range from 0.6 mm to 1.5 mm. Lengths range from 1830 mm to 3660 mm and widths from 600 mm to 1830 mm. The thinner sheets are used for post-forming and curved work and the thicker ones for flat working surfaces.

Figure 1.70 Laminated plastic



**Purchasing board material**

Board material is normally sold by the sheet, but may be priced by either the square metre (m<sup>2</sup>), 10 square metres (10 m<sup>2</sup>) or by the individual sheet. Typical information required when purchasing board material is:

- thickness of board;
- type of board;
- board finish;
- size of board – quote longest grain size first if applicable;
- number of boards.

**Example**

18 mm MDF Cherry veneered A/B 2400 x 1200 mm 25 No. off.

**Woodscrews**

Woodscrews are used for joining wood to wood. The clamping force they provide makes a strong joint that can be easily dismantled. Screws are also used to attach items of ironmongery, such as hinges, locks and handles.

Most screws are made of steel. They may be treated to resist corrosion and case hardened for additional strength. Chrome plated or black japanned steel screws are used for decorative purposes. Brass screws are more decorative and stainless steel screws are more resistant to corrosion. Both brass and stainless steel screws can be used with acidic hardwoods such as oak, which are stained by steel screws.

**Screw sizes**

The size of a screw is specified by the length of the part that enters the wood and the diameter of the shank (Figure 1.71). Metric shank sizes, are in millimetres and imperial sizes indicated by a gauge number (Figure 1.72).

**Screw threads**

**Conventional woodscrews** – These are threaded for about 60%, of their length, the plain shank acts as a dowel, and the larger head holds the two pieces of wood or the item of ironmongery in place.

**Twin-threaded woodscrews** – These have a coarser twin thread that provides a stronger fixing in wood-based boards such as chipboard and MDF compared with conventional woodscrews. More of the screw length is threaded and the steeper pitch enables the screw to be driven in quicker. In addition the shank is narrower to reduce the risk of splitting (Figure 1.73).

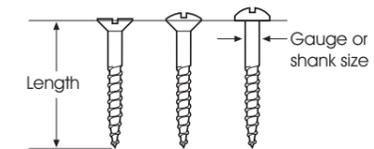


Figure 1.71 Screw size data

USE A  
TENON SAW WITH  
TEETH RECUT SQUARE  
ACROSS THE FACE FOR  
RIPPING FINE  
JOINTS



Wood Occupations

having its teeth re-cut square across their face for cutting along the grain.

**Dovetail saw** –Used for cutting dovetails, mouldings and other delicate work. Blade lengths range from 200 to 250 mm with 16–20 teeth per 25 mm (TPI).

**Gents saw** – For the finest cutting of mouldings, etc. Blade lengths range from 100 to 250 mm with up to 32 teeth per 25 mm (TPI).

**Frame saws**

These have in general a fine replaceable blade which is held in tension by a frame (Figure 2.19).

**Bow saw** – The traditional all-wooden version was once used as a general bench saw. Its blade could rotate in the frame and be used for ripping, cross-cutting and cutting curves. The modern metal frame saw with the same name, is really intended for cross cutting carcassing timber (floor joists, etc.) especially in damp timber as the narrow blade gives less resistance than a handsaw.

**Coping saw** – Designed to make curved cuts in wood and board material. A fret saw is similar, but has a deeper bowed frame for cutting further from the edge of a piece.

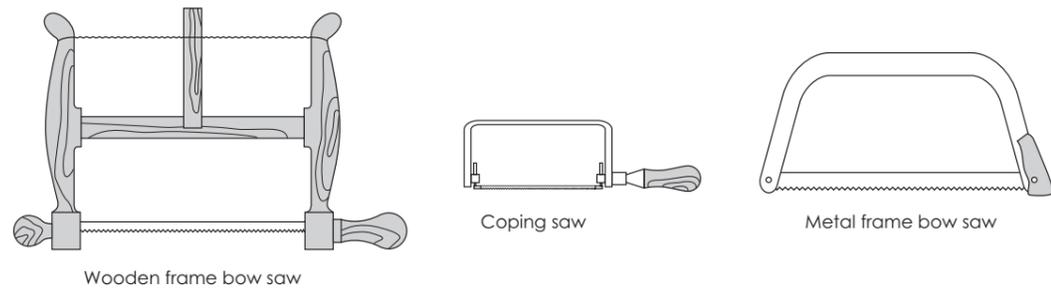


Figure 2.19 Frame saws

**Narrow-blade saws**

**Keyhole or padsaw** – As its name implies, it is mainly used for cutting keyholes and other small shapes and holes away from the edge of the timber (Figure 2.20).

**Compass saw** – This is mainly used for cutting larger shapes or holes away from the edge of the material.

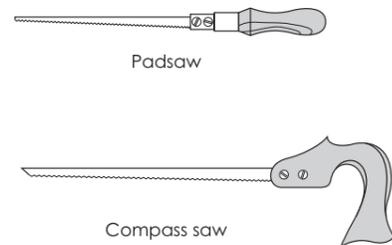


Figure 2.20 Narrow-blade saws

**Other types of saw**

**Japanese saws** – These are becoming popular for fine woodwork: they have long teeth, a thin blade, fine kerf and generally cut on the pulling stroke rather than the pushing one (Figure 2.21).

**Mitre saws** – A modern frame saw set in a metal jig that can be set to cut at predetermined angles. Often used for the mitring of picture framing and fine mouldings, also for the accurate general cross-cutting of small components.

Saws

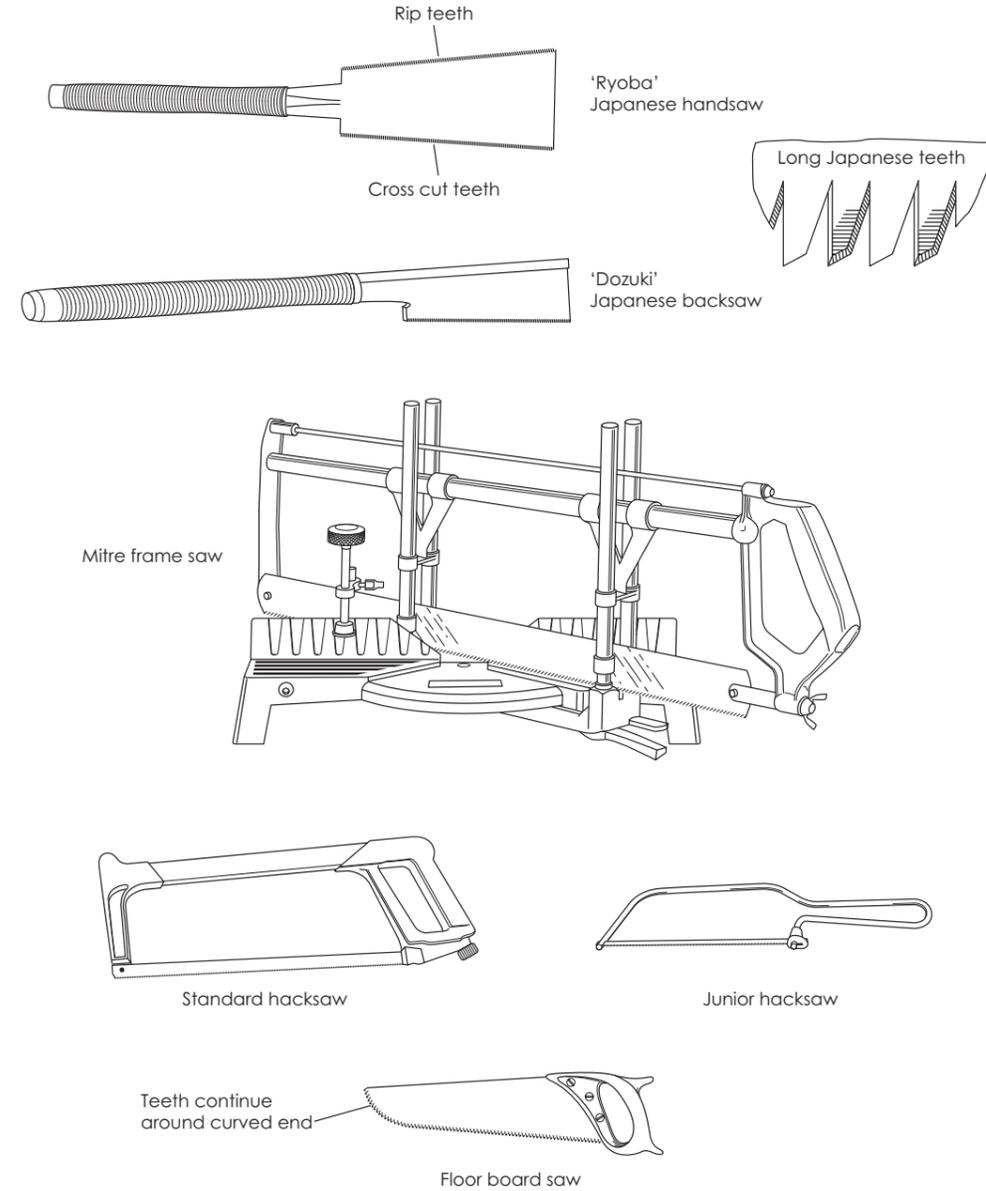


Figure 2.21 Other types of saw

**Hack saws** – Frame saws used by the woodworkers to cut metal sections.

**Floor board saw** – The front end of this saw is curved with teeth continuing round the curve. It can be used to start a cut in the middle of the work. Its main use is for cutting heading joints, when forming access points in existing timber-boarded floors.

**Figure 2.31**  
Oak tree



**Phylum: Spermatophytes**

These are seed-bearing plants. Classes are as follows:

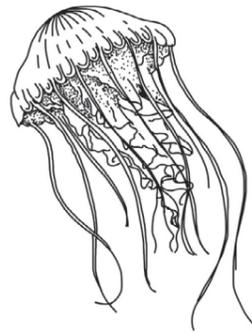
- gymnosperms: conifers: pines, spruces, firs, larches, yews
- angiosperms: monocotyledons, dicotyledons: iris, lily, bluebell, grasses, rose, dandelion, birch, oak

This classification is 'scientific' and is based on similarities between groups of like kind, arranged in ascending order of complexity. It also reflects an evolutionary series, evidence for which exists in the fossil record. However, it will be difficult for children to see the common sense behind a system that places grass plants from a meadow or playing field in the same group as oak trees, blackberry bushes or daffodils. They are, however, all examples of flowering plants!

**Kingdom: Animals**

**Phylum: Coelenterates**

Classes include *hydroids*, *sea anemones* and *corals*, *jellyfish*. They have two basic layers of cells with a single body cavity. Stinging cells help with food capture.



**Figure 2.32** A jellyfish

**Phylum: Nematodes**

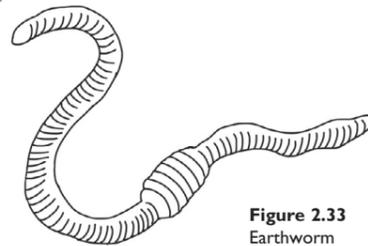
These are *unsegmented, cylindrical worms*. Many are parasitic and cause diseases in plants, animals and humans.

**Phylum: Platyhelminths**

These are *flatworms*. Many are parasitic and alternate between two hosts, causing disease in humans and animals.

**Phylum: Annelids**

These are *segmented worms* – *earthworms*, *lugworms*, *leeches*. Separation of the gut and body wall allows movement and digestion to take place independently. Earthworms are useful for improving soil aeration, drainage and nutrient availability.



**Figure 2.33**  
Earthworm

**Phylum: Arthropods**

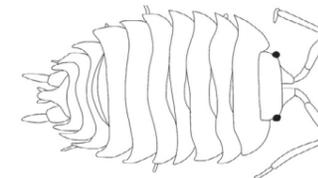
This is the largest and most successful animal phylum.

Classes include:

- *crustaceans* – *woodlice*, *barnacles*, *crabs*, *shrimps*;
- *centipedes* (carnivores) and *millipedes* (herbivores);
- *spiders* and *ticks* – two body regions, four pairs of legs; some are parasitic and carry disease;
- *insects* – three body regions, three pairs of legs; the power of flight has allowed worldwide colonization (adaptive radiation); insects can be helpful – honey bees, pollination of crop plants, control of harmful organisms (ladybirds eat aphids) – or harmful – destruction of crops (locusts), carrying disease (malarial mosquito), domestic pests (clothes moth, housefly, death watch beetle).



**Figure 2.34**  
Centipede



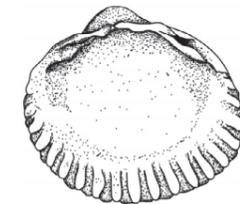
**Figure 2.35** Woodlouse

**Phylum: Molluscs**

These are animals with shells (which may be absent or internal).

Classes include:

- *gastropods* – *snails*, *winkles*;
- *bivalves* – *cockles*, *mussels*, *oysters*, *octopus* and *squid*.



**Figure 2.36**  
Cockle

**Phylum: Echinoderms**

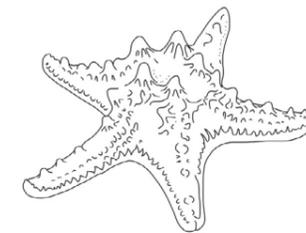
*Starfish* and *sea urchins* have five-way symmetry.

**Phylum: Chordates**

Subphylum: *vertebrates* – animals with backbones.

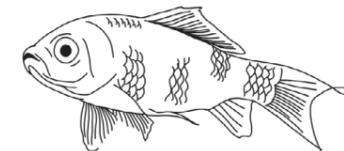
Classes include:

- *fish*:
  - cartilaginous – *sharks*, *rays* and *dogfish*
  - bony – *cod*, *herring*, *mackerel*.



**Figure 2.37**  
Starfish

Fish live all their lives in water and breathe through gills (lungfish represent the evolutionary 'move on to land'). They are cold-blooded, use external fertilization, have a body covering of bony scales and their limbs are fins.



**Figure 2.38** Fish

Year group	Programme of study	Statutory requirements
Year 5	Living things and their habitats	Describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird ( <i>Reproduction</i> ) Describe the life process of reproduction in some plants and animals ( <i>Reproduction</i> )
Year 5	Animals, including humans	Describe the changes as humans develop to old age ( <i>Growth</i> )
Year 6	Animals, including humans	Identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood ( <i>The cardio-vascular system</i> ) Describe the ways in which nutrients and water are transported within animals, including humans ( <i>Nutrition systems</i> )
Key Idea 2.3: Optimum conditions for survival		
Year 2	Plants	Find out and describe how plants need water, light and a suitable temperature to grow and stay healthy ( <i>Healthy plants</i> )
Year 2	Animals, including humans	Find out about and describe the basic needs of animals, including humans, for survival (water, food and air; <i>Healthy animals</i> ) Describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene ( <i>Healthy animals</i> )
Year 3	Plants	Explore the requirements of plants for life and growth (air, light, water, nutrients from soil, and room to grow) and how they vary from plant to plant ( <i>Healthy plants</i> )
Year 3	Animals, including humans	Identify that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food; they get nutrition from what they eat ( <i>Diet</i> )
Year 4	Animals, including humans	Identify the different types of tooth in humans and their simple functions ( <i>Teeth</i> )
Year 6	Animals, including humans	Recognize the impact of diet, exercise, drugs and lifestyle on the way bodies function ( <i>Lifestyle</i> )
Key Idea 2.4: The variety of life		
Year 1	Plants	Identify and name a variety of common wild and garden plants, including deciduous and evergreen trees ( <i>The classification of plants and animals</i> ) Identify and describe the basic structure of a variety of common flowering plants, including trees ( <i>The classification of plants and animals</i> )
Year 1	Animals, including humans	Identify and name a variety of common animals, including fish, amphibians, reptiles, birds and mammals ( <i>The classification of plants and animals</i> ) Describe and compare the structure of a variety of common animals (fish, amphibians, reptiles, birds and mammals, including pets; <i>The classification of plants and animals</i> )

Year group	Programme of study	Statutory requirements
Year 4	Living things and their habitats	Recognize that living things can be grouped in a variety of ways ( <i>The identification of plants and animals using keys</i> ) Explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment ( <i>The identification of plants and animals using keys</i> )
Year 6	Living things and their habitats	Describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including micro-organisms, plants and animals ( <i>The basis of classification</i> ) Give reasons for classifying plants and animals based on specific characteristics ( <i>The basis of classification</i> )
Key Idea 2.5: Adaptation to the environment		
Year 2	Animals, including humans	Identify that most living things live in habitats to which they are suited and describe how different habitats provide for the basic needs of different kinds of animal and plant, and how they depend on each other ( <i>Adaptation to environment</i> )
Year 4	Living things and their habitats	Recognize that environments can change, and that this can sometimes pose dangers to living things ( <i>The mechanisms of natural selection</i> )
Year 6	Evolution and inheritance	Recognize that living things have changed over time, and that fossils provide information about living things that inhabited the Earth millions of years ago ( <i>The mechanisms of natural selection</i> ) Recognize that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents ( <i>The sources of variation in plants and animals</i> ) Identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution ( <i>Adaptation to environment</i> )
Key Idea 2.6: The transfer of energy		
Year 1	Animals, including humans	Identify and name a variety of common animals that are carnivores, herbivores and omnivores ( <i>Food chains and food webs</i> )
Year 2	Living things and their habitats	Describe how animals obtain their food from plants and other animals, using the idea of a simple food chain, and identify and name different sources of food ( <i>Food chains and food webs</i> )
Year 4	Animals, including humans	Construct and interpret a variety of food chains, identifying producers, predators and prey ( <i>Food chains and food webs</i> )

**REFERENCE**

DfE. (2013) National curriculum in England: Primary curriculum. Department for Education. Available at: [www.gov.uk/government/publications/national-curriculum-in-england-primary-curriculum](http://www.gov.uk/government/publications/national-curriculum-in-england-primary-curriculum) (accessed 9 April 2017).

## Plant hormones

### Tropism

A **tropism** is a plant's response to a **stimulus** (a change in the environment) by growing. A **positive tropism** is when the plant grows **towards** the stimulus.

- Plant shoots show **positive phototropism** because they grow towards light.
- Plant roots show **positive gravitropism** because they grow downwards – towards the pull of gravity. (Gravitropism is also called **geotropism**.)

### Plant hormones

**Plant hormones** or **plant growth substances** are chemicals that cause changes in plants.

- **Auxins** are **plant hormones** that make cells grow longer.
- **Gibberellins** can make plant shoots grow longer. They also control when seeds germinate.

### EXAM ALERT!

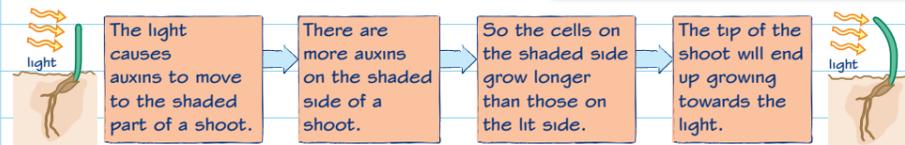
If a question asks about the direction of growth in a shoot, you should describe the effect of light on auxin and how this changes cell elongation, not just link the direction of light to the curvature of the shoot.

Students have struggled with this topic in recent exams – **be prepared!** **ResultsPlus**

### Auxins and tropisms

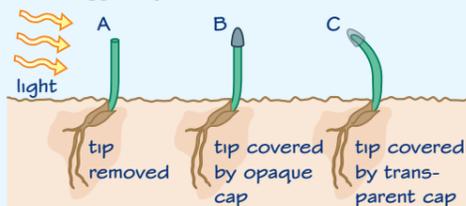
Auxins cause phototropism in shoots because they are affected by light.

In a shoot, where light is coming from one side:



### Worked example

The diagram shows the results of an experiment growing shoots in light from one direction. Explain what is happening to the auxins in each shoot.



A shows that when the shoot tip is removed, the shoot doesn't grow, so that is where the auxins are made. B shows that when the shoot tip gets no light, it grows but doesn't bend because the auxins are not affected. C shows that as long as the shoot tip gets light, the shoot will grow towards the light. This is because the auxins are affected by light and move to the dark side of the shoot.

### Now try this



- (a) Describe positive phototropism in a shoot. (2 marks)  
(b) State whether gravitropism in a root is positive or negative. Explain your answer. (2 marks)



- Name two types of plant growth substances. (2 marks)
- Explain how auxin helps a shoot to grow towards light shining from one side. (3 marks)

## Biology extended writing 3

### Worked example

#### Question 1

The human body needs to keep at a fairly constant temperature of 37 °C in order to stay healthy. Keeping the body at this temperature is one of the roles of the hypothalamus. The hypothalamus brings about changes in the skin to help maintain body temperature.

Explain how these changes in the skin help the body to maintain its temperature. (6 marks)

#### Sample answer 1

If we get too hot, then we start to sweat. Sweat is made in glands in the skin. The hypothalamus sends messages to make this happen. Also, if we get too cold, the hairs on our skin stand on end.

This is a basic answer. It gives a basic description of two of the processes that control the temperature of the body. One improvement would be to mention more of the processes that happen, such as the changes in blood flow in the skin. The other problem is that the question said 'Explain...' but this answer does not explain how these processes help to maintain body temperature.

#### Sample answer 2

Sweating is an important way that the body controls its temperature. If we get hot, then sweat glands start to produce sweat. When sweat evaporates from the skin, it removes heat energy from the skin, which cools us down. Sweating stops if we are cool enough. The blood vessels in the skin also help to keep us cool. If we are hot, more blood flows near the surface of the skin. If we are cold, blood vessels change to keep the blood further below the skin surface.

This is a good answer. It says what happens in each process if the body is too hot and if it is too cold. This sort of comparison is a useful one to make. There is a good explanation of how sweating helps to maintain the body's temperature. The description of blood flow is also good – but the answer could be improved by explaining how this helps either keep heat in the body or helps to cool the body down. Further improvements could come from explaining the role of the hairs in the skin. Lastly, it would be good to use some more scientific words – here, the best one to use would be 'thermoregulation'.

### Now try this

- Compare the ways in which nerves and hormones carry messages around the body. (6 marks)

When answering this question there are lots of different ways to organise your answer. You could draw up a table. Or you could just write a few sentences on the way that nerves carry messages and the way that hormones carry messages. But you need to make sure that you compare the two systems and you must use full sentences and include all the relevant information.

## Vertebrates and invertebrates

The phylum **Chordata** contains animals that have a supporting rod running the length of their body. Many animals in the Chordata are **vertebrates** (animals with backbones).

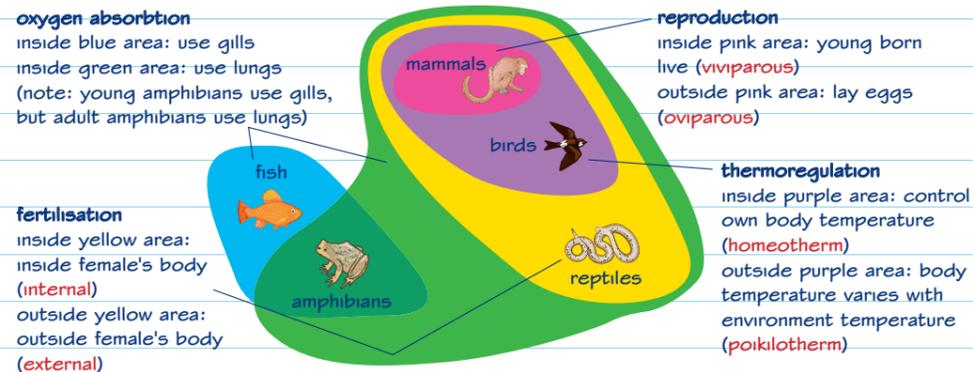
### EXAM ALERT!

Vertebrates are animals with backbones. Make sure that you say 'backbone' rather than 'spinal cord', which is the nervous tissue inside the backbone.

Students have struggled with this topic in recent exams – **be prepared!** **ResultsPlus**

### Vertebrate groups

Scientists sort vertebrates into five main groups.



### Worked example

Bats and birds are vertebrates with wings, but they are classified in different vertebrate groups. Use these examples to help explain why it is sometimes difficult to classify vertebrates.

Bats and birds both have wings and can fly. Other characteristics are very different so they should be classified in different groups. Bats are mammals because they give birth to live young. Birds lay hard-shelled eggs.

Organisms that live in similar ways often have similar characteristics as a result of adaptation to their environment. It can be easy to confuse these characteristics with those shared as a result of evolution.

### Now try this

1. Name the five main groups of vertebrates. (5 marks)
2. Match each word to its correct definition. (4 marks)

	Definitions
oviparous	controlled body temperature
viviparous	lays eggs
poikilotherm	live births
homeotherm	varying body temperature

## Species

### Defining 'species'

Scientists define a **species** as a group of organisms that can breed with each other and produce **fertile** offspring. Fertile means that the offspring can produce their own offspring when they are adults. A few species can interbreed and produce **hybrid** offspring, but usually these hybrids are sterile, which means they cannot produce offspring of their own.

This definition of a species can cause problems.

Some organisms from closely related species can interbreed and produce hybrid offspring that are fertile.

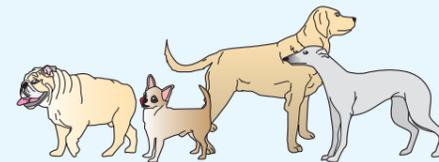
For example, tigers have been bred with lions in zoos to produce fertile hybrids called tignons or ligers.

Some organisms produce offspring from parts of their body (plants and fungi) or by dividing in two (bacteria and protocists).

If we never see two organisms breeding together, we cannot be sure if they are of the same species or not.

### Worked example

All these animals belong to the same species, *Canis lupus* (domesticated dog). Use the pictures to help you explain why it can be difficult to classify organisms into species.



Individuals in a species can show a lot of variation. This makes it difficult to classify them because we rely on what organisms look like to help us classify them.

### How scientists work

When scientists make a new discovery, such as finding a new species, they tell other scientists by:

- writing a paper and sending it to a **scientific journal** – before the paper is accepted by the journal it is checked by other scientists to make sure it is good enough to be published, and this check is called **peer review**
- presenting their discovery to other scientists at **scientific conferences**.

Sharing new discoveries makes it possible for other scientists to check that the findings are **reliable**.

**Variation** is the difference in characteristics between organisms.

### Now try this

1. State one way that scientists tell everyone about a new discovery. (1 mark)
2. State two problems with classifying a group of organisms as a species. (2 marks)
3. Describe what we mean by variation in a species. (1 mark)



### Assessing children's understanding

The following statements are indicators of basic understanding:

- You can make a food chain from: apple tree, deer, wolf.
- There is usually more than one food chain in an ecosystem.

More advanced understanding:

- Animals and plants in an ecosystem are linked in all kinds of ways so if something changes, e.g. one animal gets a disease, then all the animals in the ecosystem can be affected. The knock-on effects of one small change can be huge and hard to predict.

## EXTERMINATE THEM



### Story link

*Kester and Polly encounter Captain Skuldiss and the cullers.*



### THE SCIENCE: Microbes

We are covered in microbes both inside and out: bacteria, viruses and fungi (which includes yeasts and moulds). Most of them cause us no harm and our bodies are accustomed and adapted to their presence. Indeed, many of them are essential for our bodies to function properly. We have bacteria in our gut that are essential for efficient digestion.

However, some microbes cause diseases. They can be spread from one person to another by coughing, sneezing. One person sneezes on their hands and then touches someone else and the microbes are passed on by the touch. These microbes (or germs) cannot live long outside the body of their host (us). They rely on the warmth, the moisture and the food provided by our bodies to survive so most will not last long on our skin or on dry household objects. Washing our hands before we touch our food and eat is a good precaution to stop most of these microbes from entering our bodies and making us sick.

Some microbes are important in food production, e.g. making bread, cheese, beer and wine. Yeast produces bubbles of carbon dioxide as it ferments, which gives the bubbles to bread and sparkling wines and beers. It also produces alcohol which remains in the beer

but is evaporated out of bread by the heat in the cooking process. Mould gives the cheese its flavour. These microbes are harmless.

Another essential function of microbes is to recycle. Microbes are essential in the rotting process. They convert organic materials such as dead leaves and dead animals into useful nutrients that can be absorbed by plants and thus be part of living organisms again.

All microbes are living organisms. They need food, water, oxygen and warmth. Many are adapted to live in extreme environments but will still need these basic requirements in some form.

Scientists argue that viruses are not alive, based on this definition, as all they need to replicate is a host cell.



### DEMO AND INVESTIGATIONS: Microbes – nasty or nice?

You will need:

- glitter dust (very fine glitter powder – available from party shops)
- yeast (dried yeast for baking)
- balloons
- small pots – film canisters work well
- sugar
- warm water and cold water
- bread
- transparent plastic food bags
- UV torch
- gel or dust that will glow in the dark and is safe to use in the classroom (search online for glo germ powder).



### Storify the science

Before you begin, rub a little glitter dust onto the palm of your hand. Keep the palms of your hands out of sight of the children.

Read up to page 150 where Captain Skuldiss explains that he wants to exterminate all the diseased animals. Ask the children why they think he is trying to kill all the animals. Elicit that killing all the animals would get rid of the red-eye too.

Ask the children what the red-eye is and discuss the diseases they know of. Elicit that disease can be caused by microbes that are too small to see.

Now make a show of congratulating a child (Child A) who gave you a correct answer in your discussion. Shake their hand firmly and get them glittery without drawing attention to it. Then insist that they shake hands with some other children in the room who gave good answers – make a show of it and make sure they shake hands firmly. Then tell them they all did well and let them all shake hands with everyone around them. Let them carry on for a moment, even if they start moving around. You want the glitter spread as far as possible.



## DOES EVERYTHING FREEZE?



*Story link*

*The sea was frozen.*



### THE SCIENCE: Freezing other liquids

Water is not the only liquid that can be frozen.

Salt water, like seawater can be frozen but it must be cooled to a lower temperature as the salt molecules 'get in the way' of the formation of ice crystals.

Fruit cordials and juices are mostly water so they freeze in much the same way as water. Juices containing pulp may not freeze so well as the pulp will not behave in the same way as the water.

Oils will also freeze to a solid. However, oils are made from many different molecules and each type can have a different freezing temperature so they can look quite interesting as they freeze and it is hard to specify an exact freezing point for an oil. Olive oil will begin to solidify in the fridge.

Milk is full of water so it will freeze but the exact temperature will be affected by the amount of sugar and salt and fat in the milk.

#### **What do the children need to know?**

- Other liquids can be frozen to make solids.



### INVESTIGATION: Solidifying liquids

You will need:

- |  |  |
|--|--|
| • transparent pots or plastic cups           | • salt   |
| • oil  | • tray of water  |
| • milk                                       | • block of ice   |
| • juice                                      | • ice pops/fruit juice ice pops (not yet frozen) – enough for one each to eat and some to test |
| • squash (cordial)                           | • freezer.   |
| • water                                      |  |
| • other liquids as suggested by the children |  |



**Being able to explore in a variety of environment enables children to experience texture, shapes, smell and changes over the seasons**

outdoors. Create barefoot trails where children walk through or on dry natural objects like bark, pebbles or log circles to then move onto textures like grass, dry soil or compost, and then finish with textures where water has been added, sand or compost which is great for that squelching feeling through the toes and finishing with a warming foot bath full of bubbles. It is interesting to watch the reaction of the children and observe which section is enjoyed the most – the bubble foot bath at the end can be a firm favourite on a warm summer's day.

often to a great height, and so the physical clues that the children once saw are no longer there.

Young toddlers need this 'wild' exposure to help them develop and build up their balance and muscle strength. Research has shown that in today's society, children are rarely going barefoot in the outdoors. There could be a variety of reasons, cheapness of shoes, lack of understanding, even health and safety. Podiatrist, Simon J. Wilker explained how walking barefoot is vital in physical development of children, as it supports agility in their feet, ankles, legs, knees and hips. It will support their balance, posture and movement (Wilker 1961). Although his book *Take your Shoes Off and Walk* is out of print, many in the chiropody and occupational therapy field still refer to his research (Hanscom 2014).

With barefoot experiences in mind, there are many activities that you can do

#### CASE STUDY: BAREFOOT – NATURAL MUD PIT

*A young family was developing part of their long garden into a wild sensory area for the children to use. They had several large log circles and an assortment of smaller cut pieces of wood to make a small circular area. Then, using some lining for the inner circle, they added some compost.*

*The two children (Lucas, aged 4 years 7 months, and Henry, 18 months) were both helping with the project. Henry was more eager to help and collect the small sticks and materials, while Lucas, who did help with the big logs, was at times more focused on his remote-control toys. With the compost now in place, they were asked if they wanted to see what it felt*

**Children exploring but the older child prefers to keep his shoes on**



**Sheer delight for the younger child as he experiences the change to the soil**

*like in bare feet. Henry had no hesitation in taking his crocks and socks off and got straight into the dry compost pit, wiggling his toes around the mixture. Lucas was very hesitant, saying there were worms and it was dirty. He did eventually go in with his brother, but with his shoes on.*

*Their mother asked what it might be like if they added some water. Both were eager to help with this job and got their own small watering cans to fill. Henry, still barefoot, was at ease in moving around the whole area of the garden and in the new mud pit. They both poured the water into the pit, Henry pouring from inside, while Lucas chose to sit on a log and pour. Henry was clearly excited by the effect the water was having on the compost, and would squeal with delight, babbling different sounds to express his happiness (no identifiable*

### Provision of resources

Children at Peter Pan had been listening to the story Mother Earth (see appendix Chapter 4).

At the end of the story each child was given a small piece of clay and encouraged to find natural resources around in the forest which they could use to build a creature as in the story. Children were able to combine their physical skills of dexterity, observational skills and their imagination to produce their creature. The creatures were named and placed on the trunks of nearby trees so everyone could see them.



**Children enjoyed making creatures with clay and natural materials following the Mama Earth story (see appendix to Chapter 4)**

Similarly the provision of natural resources to enhance play with sand and water can extend and deepen children's involvement. Sand cakes, pies and tarts can be decorated with petals, moss, acorns, etc. It may be possible to take photographs and create a 'recipe book' to share with parents and friends.

A supply of well-maintained resources that children can access themselves needs to be provided. It should include a wide range of natural materials and also a range of materials for mark making. Children may want to use paper or a special place on the ground to work with their ideas. They need to be able to share these ideas with the adults if they wish, or they may prefer to work quietly on their own. Sometimes a child will begin a creation as in the leaf work case study and other children become interested and then may join in. Peer recognition is as important as adult recognition.

### Conclusion

The natural world is the greatest resource we have for inspiration. It is the source of colour and shapes. Intricate patterns are seen in the plants and the creatures around the world. Markings help us to distinguish species. Artists are inspired by the patterns on a bird's wing or the moving colours as sunlight passes over fields and hills. Children too will be inspired if we share our excitement and interest in the things around us. By observing closely, we too will become more involved with the beauty that surrounds us. We need to talk to children about our discoveries and make time to observe and listen to the children as they too make discoveries.

One of the best ways to encourage children is to talk about what they have done but instead of asking 'What's that?' try to ask them to talk about what they are doing and share some of their thoughts. If they sense that you value what they are doing they will become more confident and more creative. Children need to feel that there is time for them to work on something; a special place where they can leave things they create over a period of time is also helpful. This may not always be possible, but there may be ways of preserving children's work and ideas maybe through photographs, or making them into hanging decorations which take up less floor space.

Valuing children's creations will enhance their creativity and you can offer inspiration too as you maybe work alongside them, or share the work of artists. Some of the more expensive art books can be borrowed from libraries and children may enjoy looking with you at some of the websites suggested. Open your eyes and mind to what is around and you will be able to share your experiences and encourage children's natural inborn creativity.



**Hanging decorations are a good way to display children's creations if there is not much floor space**



## Baseball Card Collection

### MATERIALS

Pretend money (\$100 bills) or Base Ten Blocks (100 flats) or Digi-Blocks (100 blocks)

Baseball cards (or index cards to represent the collection)

Baseball Card Collection number lines (see page 86), laminated full page of number lines for each player

Dry-erase markers and erasers

### HELPFUL HINTS

Keeping track of how much money Marvin and Leon spend and earn helps participants accurately solve this problem. Additionally, it is important for participants to clarify how much money with which Leon and Marvin began.

### ANSWERS

Marvin made \$200.00, Leon lost \$200.00

### CHALLENGE ANSWERS

Marvin made \$500.00, Leon lost \$500.00

### COMMON CORE STATE STANDARDS IN ACTION

#### Math Content: The Number System

- Apply and extend previous understandings of numbers to the system of rational numbers.
- Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.

#### Math Practices

- MP1 Make sense of problems and persevere in solving them.
- MP4 Model with mathematics.



## Baseball Card Collection

*Math Question: How much money, if any, do Marvin or Leon make or lose?*

### DIRECTIONS

1. To role-play this math situation, decide who will be Marvin and who will be Leon.
2. Gather supplies to represent money and the baseball card collection. Role-play the math situation.



*Marvin bought a baseball card collection from Leon for \$300. Later, Marvin sold the baseball card collection back to Leon for \$400. Marvin bought back the baseball card collection from Leon for \$500. Again, Marvin sold the baseball card collection to Leon for \$600. Overall, how much money, if any, did Marvin make or lose, and how much money, if any, did Leon make or lose?*

3. Represent each transaction on a number line diagram.

### GET STUDENTS TALKING ABOUT MATH

- Does the answer make sense?
- How does the number line diagram help model the math?
- Does it matter how much money Marvin or Leon has in the beginning? Why or why not?

### ★ CHALLENGE

**If the pattern continues, how much money, if any, will Marvin make or lose after he buys back *and* sells for the fifth time? What about Leon?**



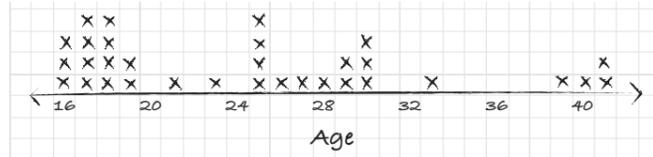
# The Plot Thickens

## MATERIALS

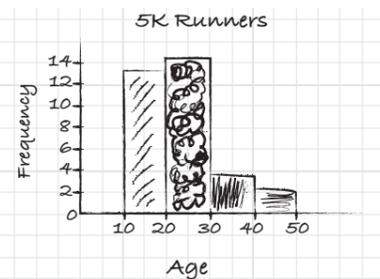
- Chart-size graph paper
- Markers
- Calculators
- The Plot Thickens reference sheet (see page 120)

## ANSWERS

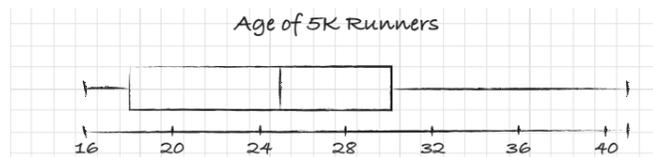
### Line Plot:



### Histogram:



### Box Plot:



## COMMON CORE STATE STANDARDS IN ACTION

### Math Content: Statistics and Probability

- Summarize and describe distributions.

### Math Practices

- MP4 Model with mathematics.
- MP6 Attend to precision.

# The Plot Thickens

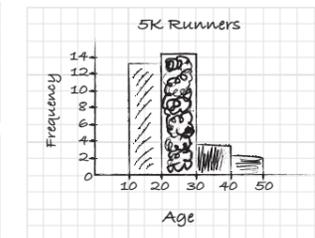
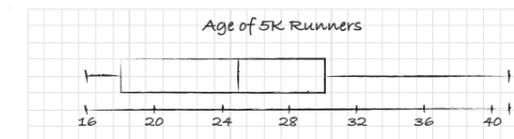
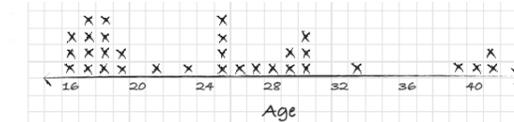
*Math Question: What do various plot displays reveal about a data set?*



The softball team at Broadway High School recently hosted a 5K run to benefit the local children's hospital. The school would like to analyze the data to identify the target audience for future planning and advertising.

## DIRECTIONS

- Review the data set showing the age of the participants who ran in the 5K race (also provided on the reference sheet).



- Create a poster to display the data set on a line plot, a histogram, and a box plot. Use the reference sheet as a model.
- Label the target audience on the poster, and list some implications for future planning.

## GET STUDENTS TALKING ABOUT MATH

- What can you see on the line plot that is not as visible on the histogram?
- What might a box plot show more readily than a histogram or line plot?
- Without the data set, would you be able to find the median age from each display? Why or why not?

## ★ CHALLENGE

Consider and discuss whether all displays illustrate the variability in the age distribution. Explain your thinking.



# How have I done?

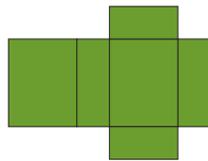


Here is a chance to see how much you've learnt about Shapes and Measures. Questions about this subject are sure to come up in your end of Year 6 SATs tests. Good luck!

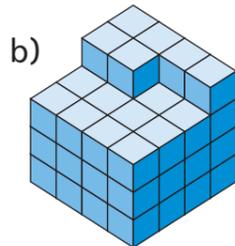
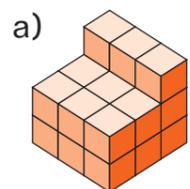
1 I have seven equal sides and seven equal angles. What is my name? (1 mark) \_\_\_\_\_

2 I have four faces, four vertices and six edges. What am I? (1 mark) \_\_\_\_\_

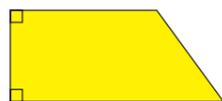
3 This is the net of which 3D shape? (1 mark) \_\_\_\_\_



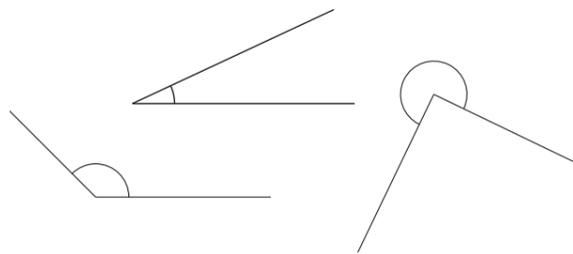
4 How many blocks are needed to complete these cubes? a) \_\_\_\_\_ b) \_\_\_\_\_ (2 marks)



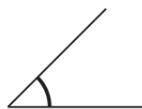
5 Mark the parallel lines on this shape. (1 mark)



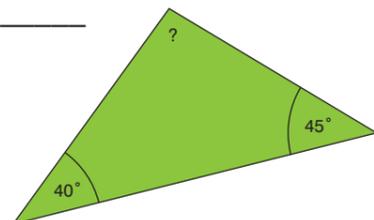
6 Write next to these angles whether they are acute, obtuse or reflex. (2 marks: 1 mark for 1 or 2 correct; 2 marks for all 3)



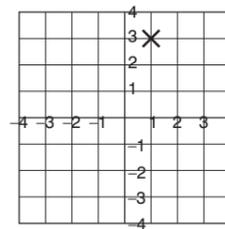
7 Measure the size of this angle. (1 mark) \_\_\_\_\_



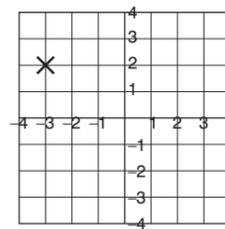
8 What is the missing angle in this triangle? (1 mark) \_\_\_\_\_



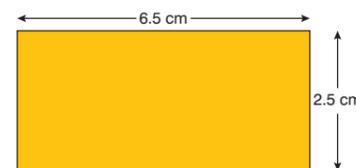
9 What are the coordinates for 'X marks the spot'? (1 mark) \_\_\_\_\_



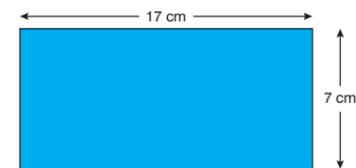
10 What are the coordinates for 'X marks the spot' on this grid? (1 mark) \_\_\_\_\_



11 What is the perimeter of this rectangle? (1 mark) \_\_\_\_\_



12 What is the area of this rectangle? (1 mark) \_\_\_\_\_



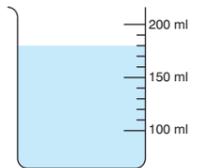
13 Draw the reflection of this shape. (1 mark)



14 Which unit of measurement would you use to measure the weight of a DVD? (1 mark) \_\_\_\_\_

15 What is 2750ml in litres? (1 mark) \_\_\_\_\_

16 How much liquid is in this measuring jug? (1 mark) \_\_\_\_\_

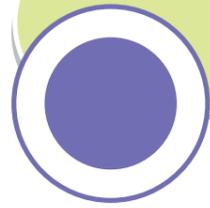


17 Look at a TV listing in a newspaper or magazine. What is being shown on BBC2 at 15:15 tomorrow? (1 mark) \_\_\_\_\_

18 New York is five hours behind GMT. If it is 14:23 in London, what time is it in New York? (1 mark) \_\_\_\_\_

Total marks       
20

Thanks for this visit to Kids Club. We hope you enjoyed your stay – come and see us all again soon!



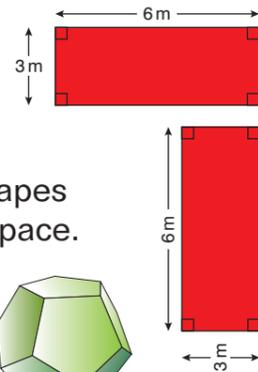
# Glossary

This glossary contains the definitions of twenty mathematical terms to do with shapes and measures which you are introduced to in Years 5 and 6. There are many others to learn but these make a good starting point. Try learning the correct spellings as well as what the words mean.

**Acute angle** – An angle between 0 and 90 degrees.

**Centilitre** – Symbol = cl. A unit of volume which is one hundredth of a litre.

**Congruent** – An adjective which describes two or more shapes which are the same in every way except their position in space. The two rectangles shown are congruent.



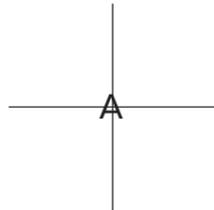
**Dodecahedron** – A 3D shape with twelve faces. The faces of a regular dodecahedron are regular pentagons. A dodecahedron has 30 edges and 20 vertices.



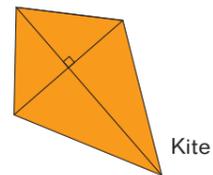
Dodecahedron

**Greenwich Mean Time** – Abbreviated to GMT. Time around the world is measured from the 0 degree meridian line which passes through Greenwich in London. All time zones west of the meridian line are behind GMT; all time zones east of the meridian line are ahead of GMT.

**Intersect** – To have a common point or points. The two lines shown intersect at point A.



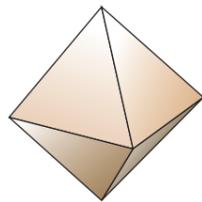
**Kite** – A quadrilateral with two pairs of equal, adjacent sides whose diagonals intersect at right angles.



Kite

**Obtuse angle** – An angle greater than 90 degrees but less than 180 degrees.

**Octahedron** – A 3D shape with eight faces. A regular octahedron has faces that are equilateral triangles.

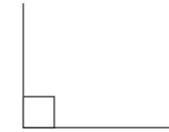


**Parallel** – Parallel lines are always the same distance apart and never meet. The lines shown are parallel.



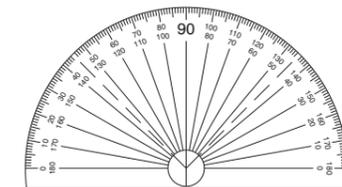
**Parallelogram** – A quadrilateral whose opposite sides are parallel and therefore equal in length.

**Perpendicular** – A line or plane that is at right angles to another line or plane. The two lines shown are perpendicular to each other.

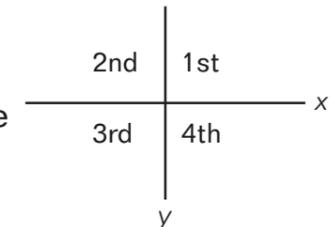


**Plane** – A flat surface.

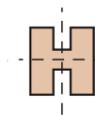
**Protractor** – An instrument used to draw or measure angles.



**Quadrant** – One of the four regions into which a plane is divided by the x and y axis in the coordinate system. Always read the x axis (along) first and then the y axis (up or down).



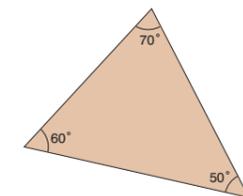
**Reflective symmetry** – A 2D shape has reflective symmetry about a line if an identical looking object in the same position is produced by reflection in that line. The letter H has two lines of symmetry.



**Reflex angle** – An angle that is greater than 180 degrees but less than 360 degrees.

**Rhombus** – A parallelogram with four equal sides.

**Scalene triangle** – A triangle with three sides of different lengths and therefore three angles of different sizes.



**Trapezium** – A quadrilateral with just one pair of parallel sides.