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SECTION 1 Questions 1–13

*You should spend about 20 minutes on **Questions 1–13**, which are based on Reading Passage 1 on the following pages.*

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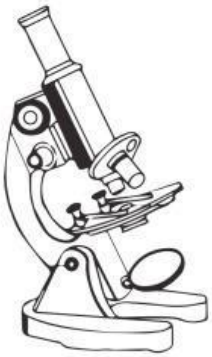

The Discovery of Penicillin

A The Scottish bacteriologist Dr Alexander Fleming (1881-1955) is credited with the discovery of penicillin in London in 1928. He had been working at St Mary's Hospital on the bacteriology of septic wounds. As a medic during World War I, he had witnessed the deaths of many wounded soldiers from infection and he had observed that the use of harsh antiseptics, rather than healing the body, actually harmed the blood corpuscles that destroy bacteria.

B In his search for effective antimicrobial agents, Fleming was cultivating staphylococcus bacteria in Petri dishes containing agar[1]. Before going on holiday in the summer of 1928, he piled up the agar plates to make room for someone else to use his workbench in his absence and left the windows open. When he returned to work two weeks later, Fleming noticed mould growing on those culture plates that had not been fully immersed in sterilising agent. This was not an unusual phenomenon, except in this case the particular mould seemed to have killed the *staphylococcus aureus* immediately surrounding it. He realised that this mould had potential.

C Fleming consulted a mycologist called C J La Touche, who occupied a laboratory downstairs containing many mould specimens (possibly the source of the original contamination), and they concluded it was the Penicillium genus of ascomycetous fungi. Fleming continued to experiment with the mould on other pathogenic bacteria, finding that it successfully killed a large number of them. Importantly, it was also non-toxic, so here was a bacteria-destroying agent that could be used as an antiseptic in wounds without damaging the human body. However, he was unsuccessful in his attempts to isolate the active antibacterial element, which he called penicillin. In 1929, he wrote a paper on his findings, published in the *British Journal of Experimental Pathology*, but it failed to kindle any interest at the time.

[1] agar is a culture medium based on a seaweed extract – used for growing microorganisms in laboratories

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D In 1938, Dr Howard Florey, a professor of pathology at Oxford University, came across Fleming's paper. In collaboration with his colleague Dr Ernst Chain, and other skilled chemists, he worked on producing a usable drug. They experimented on mice infected with streptococcus. Those untreated died, while those injected with penicillin survived. It was time to test the drug on humans but they could not produce enough - it took 2,000 litres of mould culture fluid to acquire enough penicillin to treat a single patient. Their first case in 1940, an Oxford police officer who was near death as a result of infection by both staphylococci and streptococci, rallied after five days of treatment but, when the supply of penicillin ran out, he eventually died.

E In 1941, Florey and biochemist Dr Norman Heatley went to the United States to team up with American scientists with a view to finding a way of making large quantities of the drug. It became obvious that *Penicillium notatum* would never generate enough penicillin for effective treatments so they began to look for a more productive species. One day a laboratory assistant turned up with a melon covered in mould. This fungus was *Penicillium chrysogeum*, which produced 200 times more penicillin than Fleming's original species but, with further enhancement and filtration, it was induced to yield 1,000 times as much as *Penicillium notatum*. Manufacture could begin in earnest.

F The standardisation and large-scale production of the penicillin drug during World War II and its availability for treating wounded soldiers undoubtedly saved many lives. Penicillin proved to be very effective in the treatment of pneumococcal pneumonia - the death rate in WWII was 1% compared to 18% in WWI. It has since proved its worth in the treatment of many life-threatening infections such as tuberculosis, meningitis, diphtheria and several sexually-transmitted diseases.

G Fleming has always been acknowledged as the discoverer of penicillin. However, the development of a commercial penicillin drug was due to the skill of chemical scientists Florey, Chain and others who overcame the difficulties of converting it into a usable form. Fleming and Florey received knighthoods in 1944 and they, together with Chain, were awarded the Nobel Prize in Physiology or Medicine in 1945. Heatley's contribution seems to have been overlooked until, in 1990, he was awarded an honorary doctorate of medicine by Oxford University - the first in its 800-year history.

H Fleming was mindful of the dangers of resistance to penicillin early on and he expressly warned on many occasions against overuse of the drug, because this would lead to bacterial resistance. Ironically, the occurrence of resistance is pushing the drive today to find new, more powerful antibiotics.

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Questions 1–6

Reading Passage 1 has eight paragraphs, **A–H**.

Which paragraph contains the following information?

Write the correct letter, ***A–H****, in boxes 1–6 on your answer sheet.*

1 results of animal experiments

2 recognition of the scientists' valuable work

3 a statement about the beginning of mass production

4 Fleming's cautionary advice

5 examples of uses for penicillin

6 the starting point for Fleming's original research

Questions 7–10

Complete the summary below.

Choose ***NO MORE THAN TWO WORDS*** *from the passage for each answer.*

Write your answers in boxes 7–10 on your answer sheet.

Dr Fleming's Accidental Discovery

In a bid to find a safe and effective antiseptic, Dr Fleming was growing *staphylococcus aureus* bacteria in his lab. On his return from **7** ……., he found mould on an unsterilised plate and saw that it had destroyed the bacteria around it. A **8** …….. helped him identify the mould. Fleming found that it was active against several different **9** …….. and, because it was **10** ……., it was safe to use in humans.

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Questions 11–13

Complete the table below.

Choose ***NO MORE THAN TWO WORDS*** *from the passage for each answer.*

Write your answers in boxes 11–13 on your answer sheet.

Timeline

1928	Fleming's discovery of penicillin
1929	Fleming's research published
1938	Florey begins work on penicillin
1940	The first human subject **11** …….
1941	Collaboration with **12** …….
1944	Two of the scientists are knighted
1945	Three of them share a **13** …….
1990	Heatley's work is acknowledged

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SECTION 2 Questions 14–26

*You should spend about 20 minutes on **Questions 14–26**, which are based on Reading Passage 2 below.*

Daylight Saving Time

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Each year in many countries around the world, clocks are set forward in spring and then back again in autumn in an effort to 'save' daylight hours. Like many modern practices, Daylight Savings Time (DST) dates back to ancient civilisations. The Romans would adjust their routines to the sun's schedule by using different scales in their water clocks for different months of the year.

This practice fell out of favour, however, and the concept was renewed only when, in 1784, the American inventor Benjamin Franklin wrote a jocular article for *The Journal of Paris* exhorting the city's residents to make more use of daylight hours in order to reduce candle use. In 1895, in a more serious effort, New Zealand entomologist George Vernon Hudson proposed a biannual two-hour shift closely resembling current forms of DST. His cause was not taken up, however, until Germany first pushed their clocks forward in April 1916 as part of a drive to save fuel in World War I.

Over the next several decades, global use of DST was sporadic and inconsistent. Countries such as the UK and USA adopted DST in World Wars I and II, but reverted to standard time after the wars ended. In the USA, the decision to use DST was determined by states and municipalities between 1945 and 1966, causing widespread confusion for transport and broadcasting schedules until Congress implemented the Uniform Time Act in 1966.

Today, DST is used in some form by over 70 countries worldwide, affecting around one sixth of the world's population. There is still no uniform standard, however. Countries such as Egypt and Russia have adjusted their policies on multiple occasions in recent years, in some instances leading to considerable turmoil. Muslim countries often suspend DST for the month of Ramadan. The European Union finally standardised DST in 2000, while the USA's most recent adjustments were introduced with the Energy Policy Act of 2005.

In general, the benefits of DST are considerable and well documented. Perhaps the most significant factor in terms of popular support is the chance to make better use of daylight in the evening. With extended daylight hours, office workers coming off a 9 to 5 shift can often take part in outdoor recreational activities for an hour or two. This has other positive effects, such as reducing domestic electricity consumption as more opportunities become available to use sunlight instead of artificial lighting. A further

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benefit is a reduction in the overall rate of automobile accidents, as DST ensures that streets are well lit at peak hours.

Many industries are supportive of DST due to the opportunities it provides for increased revenue. Extended daylight hours mean people are more likely to stay out later in the evening and spend more money in bars and restaurants, for example, so tourism and hospitality are two sectors that stand to gain a lot from more daylight. In Queensland, Australia, which elected not to implement DST due to complaints from dairy farmers over disruption to milking schedules, the annual drain on the state's economy is estimated to be as high as $4 billion.

Some research casts doubt on the advantages of DST, however. Although the overall incidence of traffic accidents is lower, for pedestrians the risk of being hit by a car in the evening increases by as much as 186 per cent in the weeks after clocks are set back in autumn, possibly because drivers have not yet adjusted to earlier sunsets. Although this shift does in turn make streets safer in early mornings, the risk to pedestrians is not offset simply because fewer pedestrians use the streets at that time.

A further health concern involves the disruption of our body clock. Setting clocks one hour forward at night can cause many people to lose sleep, resulting in tiredness and all its well-documented effects, such as mood swings, reduced productivity and problems with overall physical well-being. In 2008, a Swedish study found that heart attack rates spike in the few days following the switch to DST for summer. Tiredness may also be a factor behind the increase in road accidents in the week after DST begins.

Finally, safety issues have arisen in parts of Latin America relating to a suspected relationship between DST and higher incidences of street crime. In 2008, Guatemala chose not to use DST because it forced office workers to leave their homes while it was still dark outside in the morning. This natural cover for criminals was thought to increase incidents of crime at this hour.

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Questions 14–19

Do the following statements agree with the information given in Reading Passage 2?

In boxes 14–19 on your answer sheet, write

TRUE	*if the statement agrees with the information*
FALSE	*if the statement contradicts the information*
NOT GIVEN	*if there is no information on this*

14 Daylight savings time has been in continual use since ancient times.

15 Today, DST is very similar to how George Vernon Hudson suggested it.

16 DST was not considered successful during World Wars I and II.

17 The USA finalised its DST policy in 1966.

18 Around the world, there is now general agreement on how DST should be used.

19 Frequent changes to DST over a short time span have caused problems in some countries.

Questions 20–26

Complete the table below.

Choose ***NO MORE THAN THREE WORDS*** *from the passage for each answer.*

Write your answers in boxes 20 –26 on your answer sheet.

Advantages and disadvantages of Daylight Saving Time

Advantages	**Disadvantages**
More opportunities for **20** …….. after work.	Dairy farmers find that DST upsets their **23** …….
People use less power in their homes because they don't need as much lighting.	More dangerous for **24** …….. following re-setting of clocks in autumn.
Better lighting during **21** …….. leads to fewer car crashes following the spring change to DST.	Loss of sleep can lead to **25**…….. , inferior performance at work and poorer general health because of fatigue.
Some industries, such as **22** …….. , earn more money with DST.	Darker mornings may lead to more **26** …….

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SECTION 3 Questions 27–40

*You should spend about 20 minutes on **Questions 27–40**, which are based on Reading Passage 3 below.*

WILLPOWER

A Although willpower does not shape our decisions, it determines whether and how long we can follow through on them. It almost single-handedly determines life outcomes. Interestingly, research suggests the general population is indeed aware of how essential willpower is to their wellbeing; survey participants routinely identify a 'lack of willpower' as the major impediment to making beneficial life changes. There are, however, misunderstandings surrounding the nature of willpower and how we can acquire more of it. There is a widespread misperception, for example, that increased leisure time would lead to subsequent increases in willpower.

B Although the concept of willpower is often explained through single-word terms, such as 'resolve' or 'drive', it refers in fact to a variety of behaviours and situations. There is a common perception that willpower entails resisting some kind of a 'treat', such as a sugary drink or a lazy morning in bed, in favour of decisions that we know are better for us, such as drinking water or going to the gym. Of course this is a familiar phenomenon for all. Yet willpower also involves elements such as overriding negative thought processes, biting your tongue in social situations, or persevering through a difficult activity. At the heart of any exercise of willpower, however, is the notion of 'delayed gratification', which involves resisting immediate satisfaction for a course that will yield greater or more permanent satisfaction in the long run.

C Scientists are making general investigations into why some individuals are better able than others to delay gratification and thus employ their willpower, but the genetic or environmental origins of this ability remain a mystery for now. Some groups who are particularly vulnerable to reduced willpower capacity, such as those with addictive personalities, may claim a biological origin for their problems. What is clear is that levels of willpower typically remain consistent over time (studies tracking individuals from early childhood to their adult years demonstrate a remarkable consistency in willpower abilities). In the short term, however, our ability to draw on willpower can fluctuate dramatically due to factors such as fatigue, diet and stress. Indeed, research by Matthew Gailliot suggests that willpower, even in the absence of physical activity, both requires and drains blood glucose levels, suggesting that willpower operates more or less like a 'muscle', and, like a muscle, requires fuel for optimum functioning.

D These observations lead to an important question: if the strength of our willpower at the age of thirty-five is somehow pegged to our ability at the age of four, are all efforts to improve our willpower certain to prove futile? According to newer research, this is not necessarily the case. Gregory M. Walton, for example, found that a single verbal cue - telling research participants how strenuous mental tasks could 'energise' them for further challenging activities - made a profound difference in terms of how much willpower participants could draw upon to complete the activity. Just as our willpower is easily drained

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by negative influences, it appears that willpower can also be boosted by other prompts, such as encouragement or optimistic self-talk.

E Strengthening willpower thus relies on a two-pronged approach: reducing negative influences and improving positive ones. One of the most popular and effective methods simply involves avoiding willpower depletion triggers, and is based on the old adage, 'out of sight, out of mind'. In one study, workers who kept a bowl of enticing candy on their desks were far more likely to indulge than those who placed it in a desk drawer. It also appears that finding sources of motivation from within us may be important. In another study, Mark Muraven found that those who felt compelled by an external authority to exert self-control experienced far greater rates of willpower depletion than those who identified their own reasons for taking a particular course of action. This idea that our mental convictions can influence willpower was borne out by Veronika Job. Her research indicates that those who think that willpower is a finite resource exhaust their supplies of this commodity long before those who do not hold this opinion.

F Willpower is clearly fundamental to our ability to follow through on our decisions but, as psychologist Roy Baumeister has discovered, a lack of willpower may not be the sole impediment every time our good intentions fail to manifest themselves. A critical precursor, he suggests, is motivation - if we are only mildly invested in the change we are trying to make, our efforts are bound to fall short. This may be why so many of us abandon our New Year's Resolutions - if these were actions we really wanted to take, rather than things we felt we ought to be doing, we would probably be doing them already. In addition, Muraven emphasises the value of monitoring progress towards a desired result, such as by using a fitness journal, or keeping a record of savings toward a new purchase. The importance of motivation and monitoring cannot be overstated. Indeed, it appears that, even when our willpower reserves are entirely depleted, motivation alone may be sufficient to keep us on the course we originally chose.

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Questions 27–33

Do the following statements agree with the information given in Reading Passage 3?

In boxes 27–32 on your answer sheet, write

TRUE	*if the statement agrees with the information*
FALSE	*if the statement contradicts the information*
NOT GIVEN	*if there is no information on this*

27 Willpower is the most significant factor in determining success in life.

28 People with more free time typically have better willpower.

29 Willpower mostly applies to matters of diet and exercise.

30 The strongest indicator of willpower is the ability to choose long-term rather than short-term rewards.

31 Researchers have studied the genetic basis of willpower.

32 Levels of willpower usually stay the same throughout our lives.

33 Regular physical exercise improves our willpower ability.

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Questions 34 –39

Look at the following statements (Questions 37–40) and the list of researchers below.

Match each statement with the correct person, ***A–D****.*

Write the correct letter, ***A–D****, in boxes 37–40 on your answer sheet. You may use some letters more than once.*

This researcher …

34 identified a key factor that is necessary for willpower to function.

35 suggested that willpower is affected by our beliefs.

36 examined how our body responds to the use of willpower.

37 discovered how important it is to make and track goals.

38 found that taking actions to please others decreases our willpower.

39 found that willpower can increase through simple positive thoughts.

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List of People

A Matthew Gailliot

B Gregory M. Walton

C Mark Muraven

D Veronika Job

E Roy Baumeister

Question 40

Which of the following is **NOT** mentioned as a factor in willpower?

Willpower is affected by:

A. physical factors such as tiredness

B. our fundamental ability to delay pleasure

C. the levels of certain chemicals in our brains

D. environmental cues such as the availability of a trigger

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