

Skill 9: Information Processing and Problem Solving

Sub skill (i) Scanning and skimming data

Example 1: Sorting evidence relating to animal experiments

A student researching animal experiments collected the following information contained within the box below.

1. According to UK government figures for 2005 43% of all animal experiments are conducted by universities.
2. According to UK government figures for 2005 31% of all animal experiments are conducted by commercial, profit making, companies.
3. According to UK government figures for 2005 nearly a third of experiments involving animals were for the purposes of pure research aiming at increasing our knowledge of biology.
4. According to UK government figures for 2005 only 14% of experiments involving animals were for the purposes of discovering whether drugs have harmful side effects.
5. According to Oxford University some of the major advances in the last century - anaesthetics, insulin, vaccines, penicillin or other antibiotics - would have been impossible without animal research.
6. In general, only about 10% of medical research in this country involves the use of animals.
7. Over 500 million animals are consumed as food in this country every year.
8. 133 MEPs have signed a petition calling for a total ban on the research on primates throughout EU.
9. According to government officials the UK has some of the tightest regulations in the world to ensure that animals used for research are well cared for and that those looking after them adhere to the highest standards.
10. According to the Universal Declaration of Animal Rights (adopted at UNESCO headquarters in 1978), wild animals have the right to live in their natural environment. In addition, experiments on animals involving physical or psychological suffering violate the rights of animals.

He was asked to decide whether the evidence he found did or did not support the claim that animal experiments within the UK are conducted mainly for medical research.

Complete the table below by inserting the number of the sentence in the correct column:

Information which supports the claim that animal experiments within the UK are conducted mainly for medical research	Information which conflicts with the claim that animal experiments within the UK are conducted mainly for medical research	Information which neither supports nor conflicts with the claim that animal experiments within the UK are conducted mainly for medical research

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Example 2 : Jigsawing – Crows, running and abortion

Below are three arguments, one about running, one about abortion and one about crows. However, they are all mixed up.

Plus it is much better for you to run in the fresh air than to be stuck inside all day. Therefore running is much better than going to the gym. If this choice is taken away, then women may seek illegal backstreet abortions which will put their health at risk. Therefore, crows deserve special protection. Running creates an opportunity for thought free from the distractions of the modern gym. So crows are very talented animals. If you go running outside you get to run to different places but if you go to the gym you just stare at the wall. Consequently women should have the option of abortion if they wish. For example a crow can bend a straight piece of wire into a hook to retrieve food from a tube. It is important that a woman has the right to choose what happens to her own body. Crows belong to that rare group of animals (including chimpanzees and a few other birds) that can actually make and use tools. Gyms can be very expensive.

1. Highlight the sentences from each argument using three different colours.
2. Write out the three arguments putting the sentences in order and adding any indicator words where necessary so they read clearly as an argument with explicit reasons and main conclusion.
3. Produce an argument map for each of your three arguments.

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Example 3: Jigsawing – Great apes; death penalty and raising the drinking age.

Below are three arguments, one about apes, one about the death penalty and one raising the limit from 18 to 21 for buying alcohol. However, they are all mixed up.

Great apes are very close to human beings in many important ways. The age limit for buying alcohol should not be raised from 18 to 21. It is wrong to kill human beings whether innocent or not. Apes share 99% of our DNA. Apes also have brains very similar to our own. At the age of 18 a person is rightly seen as a responsible adult. The social behaviour of apes in some respects resembles our own. It is therefore likely that experiments on great apes will reveal things about human brains and bodies which cannot be obtained in any other way. For example the law recognises that an 18 year old is able to vote, drive, and have a family. Furthermore in some cases this knowledge could greatly reduce human suffering. Therefore we should permit some medical experiments on great apes when the expected benefits to humans are very great. Furthermore capital punishment imposes a severe penalty on the innocent families and friends of the criminal. Moreover changing the age limit to 21 isn't fair on the vast majority of those between 18-21 years that can and do drink responsibly. Therefore the death penalty should not be restored. Furthermore this will also have a negative effect on the social life of many 18 year olds who will be prevented from socialising in pubs with other adults. Also the criminal justice system isn't always right and innocent people can be found guilty.

1. Highlight the sentences from each argument using three different colours.
2. Write out the three arguments putting the sentences in order and adding any indicator words where necessary so they read clearly as an argument with explicit reasons and main conclusion.
3. Produce an argument map for each of your three arguments.

Skill 9: Information Processing and Problem Solving

Sub skill (ii) Identifying relevant data

Example 1: Student class questionnaire

A teacher collects the following information about eight students in her class. This is presented in Table 1:

Table 1

	Personal details				
Name	Gender	Gained Grade A* in Maths GCSE in Yr10	Studied Thinking and Reasoning Skills in Year 11	Parent went to university	Likes designer clothes
Alan	Male	Yes	No	No	Yes
Brenda	Female	No	Yes	Yes	No
Charlotte	Female	No	Yes	No	No
Daniel	Male	Yes	No	Yes	Yes
Elizabeth	Female	No	Yes	Yes	No
Fiona	Female	No	Yes	No	No
Gordon	Male	Yes	No	Yes	Yes
Harry	Male	Yes	No	No	Yes

1. Using the information in Table 1, you can see that there are some patterns associating different personal details together.

Identify any three patterns in the data.

First Pattern

.....[1]

Second Pattern

.....[1]

Third Pattern

.....[1]

2. The same patterns are true of **all** students in the teacher's class.

The teacher has added 2 more students in the class to the table as shown below.

However the teacher has not finished the table and has not identified the gender of the students nor said whether they like designer clothes.

Using what you already know about patterns in the class and the information which the teacher has provided, correctly complete the table by:

- Circling either male or female in the column marked "Gender" for each student [2]
- Circling either yes or no in the column marked "Likes designer clothes" for each student [2]

Table 2

Name	Gender	Gained Grade A* in Maths GCSE in Yr10	Studied Thinking and Reasoning Skills in Year 11	Parent went to university	Likes designer clothes
Student I	Male / female	Yes	No	No	Yes / No
Student J	Male / female	No	Yes	No	Yes / No

Skill 9: Information Processing and Problem Solving

Sub skill (ii) Identifying relevant data

Example 2: Medals at the Olympics

A student collects the following information about the number of medals won at the Olympics. This is presented in Table 1:

Table 1

Country	Gold Medals	Silver Medals	Bronze Medals	Population (millions)
China	30	20	40	1,400
USA	45	25	25	300
Russia	30	20	20	200
Japan	25	20	15	150
Germany	15	15	15	80
Britain	12	10	15	60
France	10	15	10	60
Australia	35	40	25	20

1. Which country won the greatest number of Gold Medals?
.....[1]
2. Which country won the greatest number of Silver Medals?
.....[1]
3. Which country won the greatest number of Bronze Medals?
.....[1]
4. Which country won the greatest number of Medals relative to the size of its population?
.....[1]
5. Which country won the fewest number of Medals relative to the size of its population?
.....[1]

Skill 9: Information Processing and Problem Solving

Sub skill (ii) Identifying relevant data

Example 3: Bus Timetable

A student consults a bus timetable. This is presented in Table 1:

1. At what time does the last bus from Longton to Stone arrive at Meir Heath?

.....

2. How many buses make the journey from Stoke to Stone?

.....

Table 1

Hanley	07.00	08.00	09.00	10.00	12.00	13.00	15.00	16.00	20.00
Fenton		08.10		10.10	12.10		15.10		20.10
Longton		08.20		10.20	12.20		15.20		20.20
Burslem		08.30		10.30	12.30		15.30		20.30
Stoke	07.40	08.40	09.40	10.40	12.40	13.40	15.40	16.40	20.40
Meir Heath					12.50		15.50		
Barlston					13.00		16.00		
Stone	08.10		10.10		13.10	14.10	16.10	17.10	

Skill 9: Information Processing and Problem Solving

Sub skill (iii) Recognising and identifying patterns

Example 1: Finding the PIN number

4 digit personal identification numbers (PINs) are used for withdrawing cash from cash machines.

It is often difficult to remember these numbers.

One very simple strategy is to use the date of your birth to generate your PIN. This can be done by using the day to give the first two numbers and the month to give the last two numbers. So someone born on the nineteenth of October would take as their PIN 1910. If the date is a single number then it can be made into two digits by placing a 0 before the first number. So someone born on the fifth of June would take as their PIN 0506.

However this strategy is too simple and can easily be guessed by thieves. So one strategy for making the PIN more difficult to guess, but still memorable, is to reverse the two digits. So someone born on the nineteenth of October would take as their PIN 9101 and someone born on the fifth of June would take as their PIN 5060.

- (a) If my birthday is the last day in December which of the following is my PIN assuming I use the first simple strategy explained above:

- 1231
- 1312
- 1321
- 3121
- 3112

Circle the right answer

- (b) If my birthday is the last day in December which of the following is my PIN assuming I use the second more advanced strategy explained above:

- 1231
- 1312
- 1321
- 3121
- 3112

Circle the right answer

- (c) If you know that I am using the second more advanced strategy to generate my PIN but you do not know the date of my birthday which of the following could not be my PIN:

- 1290
- 3080
- 5011
- 6460
- 8090

Circle the right answer

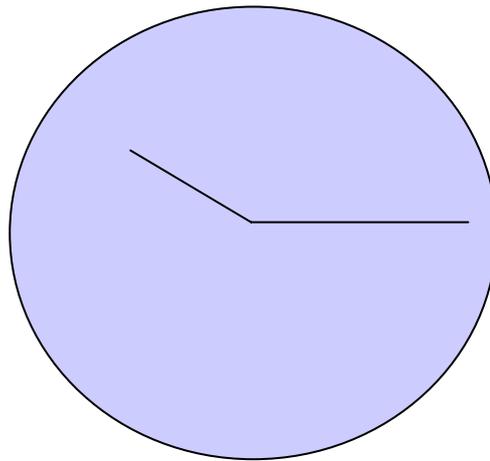
Skill 9: Information Processing and Problem Solving

Sub skill (iii) Recognising and identifying patterns

Example 2: Identifying the correct time

A student has an unusual watch on which the minute hand behaves normally but the hour hand goes round backwards. It reads the same time as a conventional watch at 12 noon and 12 midnight.

What time is it when the hands are positioned as shown in the picture below?



- A) 8.50
- B) 9.15
- C) 9.45
- D) 2.15
- E) 2.45

Circle the right answer

Skill 9: Information Processing and Problem Solving

Sub skill (iii) Recognising and identifying patterns

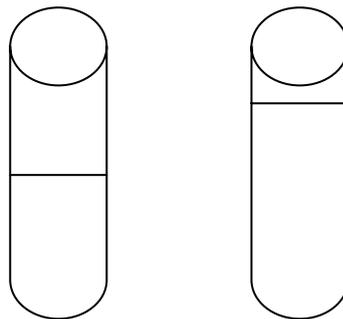
Example 3: The novelty clock

A novelty clock consists of two separate tubes which slowly fill with coloured liquid.

The left hand tube takes 12 hours to fill. It then empties and starts again.

The right hand tube takes 60 minutes to fill. It then empties and starts again.

(a) What time is it when the novelty clock is as shown as in the picture below?



A) 2.15

B) 2.45

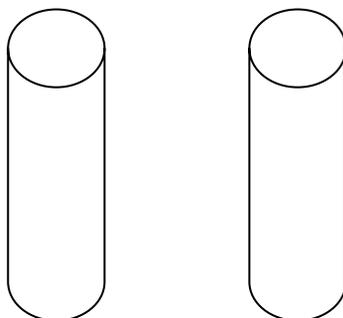
C) 6.10

D) 6.50

E) 10.30

Circle the right answer

(b) Draw what the clock will look like at 6.30



(c) Identify one problem with the novelty clock

.....
.....

Skill 9: Information Processing and Problem Solving

Sub skill (iv) Using matrices

Example 1: Students and their favourite music

Anita, Ben, Carol and David all have a different taste in music: one listens to classical music, one listens to pop music, one listens to folk music and one listens to rock music, but not necessarily in that order.

Use the information provided below to complete the matrix and identify which student listens to which music.

1. The classical music fan has been asked by Anita to go with her to a birthday party for Carol.
2. Carol and Ben went on a camping holiday with the pop music fan.
3. Both David and the fan of classical music are in the same class as the student who listens to folk music.
4. Carol and Ben are not in the same class.

Complete the matrix by putting ticks in the box to match the music with the right student.

	Pop Music	Classical Music	Folk Music	Rock Music
Anita				
Ben				
Carol				
David				

Skill 9: Information Processing and Problem Solving

Sub skill (iv): Using simple matrices in order to organise data to solve a problem

Example 2: Students and their pets

Bernadette, Maxime and Ness each have one pet.

One of them has a snake and one of them has a horse and the third one has newts.

Use the clues below to complete the matrix grid and reveal who has which colour pet.

- 1. Bernadette is a snake and newt lover.
- 2. Ness is frightened of horses.
- 3. Maxime only likes the colour black.
- 4. Ness prefers darker colours to lighter colours.
- 5. Bernadette is allergic to snakes even though she loves them.

	Horse	Newt	Snake		Black	Brown	Yellow
Bernadette							
Maxime							
Ness							

Skill 9: Information Processing and Problem Solving

Sub skill (iv): Using simple matrices in order to organise data to solve a problem

Example 3: Students and their choice of food

Anne, her sister Alex and their friend Tim go out together for a meal. Find out what everyone ordered.

1. The person who ordered the kebab was not very thirsty.
2. Both Anne and the girl who ordered the milkshake were very thirsty.
3. The person who ate the vegetarian curry drank the coke.

	Burger	Kebab	Vegetarian curry		Coke	Milkshake	Fresh orange
Anne							
Alex							
Tim							

Skill 9: Information Processing and Problem Solving

Sub skill (v) Drawing conclusions from data

Example 1: Getting to school on time

Jordan gets the bus to school each morning. Her bus journey takes 25 minutes and it takes her another 5 minutes to walk from the bus stop to her school. The bus runs at half hour intervals.

- (a) She arrives at the bus stop at 7.30am and does not get to school until 8.15am. Assuming there were no traffic delays and she walked directly to school how long did she wait for a bus?

- 5 minutes
- 10 minutes
- 15 minutes
- 20 minutes

Circle the correct answer. (1 mark)

- (b) If she had wanted to catch the earlier bus, at what time would she have needed to get to the bus stop?

- 7.15 am
- 7.20 am
- 7.25 am
- 7.30 am

Circle the correct answer. (1 mark)

- (c) She arrives at the bus stop at 7.20am. There are no traffic delays and she walks directly to school. How long will it take her to get to school?

- 25 minutes
- 30 minutes
- 45 minutes
- 55 minutes

Circle the correct answer. (1 mark)

(d) She arrives at the bus stop at 7.20am. The bus is running 10 minutes late. But there are no traffic delays and she walks directly to school. How long will it take her to get to school?

- 35 minutes
- 40 minutes
- 45 minutes
- 50 minutes

Circle the correct answer. (1 mark)

Skill 9: Information Processing and Problem Solving

Sub skill (v) Drawing conclusions from data

Example 2: Andrew and Bella intend to climb Everest

Two young climbers, Andrew and Bella, intend to climb Everest.

- It is 15 miles from the base camp to the summit of Everest.
- They each need one canister of oxygen for every mile they walk.
- They can each carry up to 10 canisters of oxygen.

Their plan is for Andrew to go only part of the way up Everest and to hand over to Bella some spare canisters of oxygen while keeping enough for himself to enable him to walk safely back to base camp alone. They think this will enable Bella to carry on to the summit alone. Bella will not need to walk back to camp as she will be collected from the summit by helicopter.

However, they are not sure at what point Andrew should turn back and hand over some of his canisters of oxygen to Bella so that Bella can get as close to the summit as possible while allowing Andrew to return safely.

They ask their friends for advice.

- (a) A first friend recommends both Andrew and Bella walk **4 miles** together towards the summit of Everest. Andrew then keeps enough oxygen to get back to base camp and hands what is left over to Bella.

How many miles short of the summit will Bella be when she runs out of oxygen if they follow this advice?

Circle the right answer:

1 mile

2 miles

3 miles

4 miles

[1]

- (b) i) A second friend recommends both Andrew and Bella walk **1 mile** together towards the summit. Andrew then keeps enough oxygen to get back to base camp and hands what is left over to Bella.

How many miles short of the summit will Bella be when she runs out of oxygen if they follow this advice?

Circle the right answer:

1 mile

2 miles

3 miles

4 miles

[1]

ii) Explain the problem with this advice.

.....
.....

[1]

(c) One friend recommends both Andrew and Bella walk **5 miles** from base camp together and that Andrew then hands over 5 canisters of oxygen to Bella enabling Bella to climb for another 10 miles to the summit of Everest.

Explain one problem with this advice.

.....
.....

[1]

(d) What is the closest that Bella can get to the summit while allowing Andrew to walk back to base safely?

Circle the right answer:

1 mile

2 miles

3 miles

4 miles

[1]

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Sub skill (v) Drawing conclusions from data

Example 3: Students watching more than one soap

A teacher conducted a survey of 15 students to identify their favourite TV programmes.

- 2 students responded by claiming that they never watch TV
- 5 students responded by claiming that they only watch sports programmes
- 5 students responded by claiming that they only watch East Enders
- 8 students responded by claiming that they only watch TV soaps

How many students claim to watch more than one TV soap?

Circle the right answer:

1 student; 2 students; 3 students; 4 students; 5 students

Skill 9: Information Processing and Problem Solving

Sub skill (v) Drawing conclusions from data

Example 4: Friends their likes and dislikes

There are 4 close friends: Alan, Bob, Cat and Deborah.

They all like the same things and dislike all the same things.

They will only become friends with anyone if they share all their likes and dislikes.

(a) If Alan likes football what can you work out about the other three friends?

.....
.....

(b) If you are told that Deborah dislikes Spanish which of the following cannot be true:

- Alan studies Spanish GCSE
- Bob went to Spain for his summer holidays
- Cat likes Spanish
- Deborah likes the Spanish teacher

Circle the right answer

(c) If Deborah leaves the group of friends and is replaced by Eddie whose favourite author is J.K. Rowling which one of the following must be true

- Alan now likes Spanish
- Bob likes Spanish and reading J.K. Rowling
- Cat likes reading J.K. Rowling
- Deborah dislikes reading J.K. Rowling

Circle the right answer

Skill 9: Information Processing and Problem Solving

Sub skill (v) Drawing conclusions from data

Example 5: Choosing enrichment courses

Pupils at a school have to decide what enrichment courses they are going to take during the year.

The table shows how the choices can be made. They must choose one course from each column together with a fourth course which can come from any column.

1	2	3
Army Cadets	First Aid Course	Debating
Ready steady cook	Car maintenance course	Film Club
Art appreciation		Dance
Music appreciation		Martial Arts

Which of the following combinations would not be allowable?

- A. First Aid Course, Army Cadets, Dance, Art appreciation
- B. First Aid Course, Car maintenance course, Martial Arts, Music appreciation
- C. Ready steady cook, Car maintenance course, Art appreciation, Debating
- D. First Aid Course, Car maintenance course, Army Cadets, Music appreciation
- E. Army Cadets, Music appreciation, First Aid Course, Film Club

Circle the right answer

Skill 9: Information Processing and Problem Solving

Sub skill (v) Drawing conclusions from data

Example 6: Jogging in the heat

Priya goes fell running. She will run 12 kilometres up to the top of the fell and then 12 kilometres back. She runs at 3 kilometres an hour uphill and 4 kilometres an hour downhill. It is very hot so she will need to drink $\frac{1}{2}$ litre of water every hour. There is a spring at the top of the fell where she can refill her water bottle.

(a) What size water bottle will Priya need to take on her run?

- 1.5 litre bottle
- 1.75 litre bottle
- 2 litre bottle
- 2.5 litre bottle
- 2.75 litre bottle

Circle the right answer

(b) Suppose the spring where Priya can refill her bottle is located not at the top of the fell but exactly half way up to the top. What size water bottle will Priya now need to take on her run?

- 1.5 litre bottle
- 1.75 litre bottle
- 2 litre bottle
- 2.5 litre bottle
- 2.75 litre bottle

Circle the right answer