

Year 9

Science Booklet 2



Use the knowledge organiser to help you answer these questions.

Use the mark scheme to check your work.

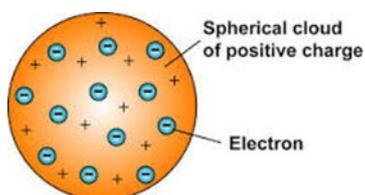
Topics are:

1. Chemistry- Atomic structure, Ions and Isotopes
2. Biology- Genetics, Natural selection and Genetic Modification.
3. Physics-Motion and forces

Chemistry topic questions- Atomic structure, Ions and Isotopes

A. Atomic structure: Model of the atom and structure of the atom

1. What was the earliest model of the atom?
2. Which subatomic particle did JJ. Thomson discover?
3. Which early atomic model does the following diagram show?



4. Name Rutherford's experiment.
5. State two ways in which Rutherford's experiment changed Thomson's model of the atom.
6. How did Bohr adapt the nuclear model?
7. Explain why Bohr revised Rutherford's model of the atom.
8. Name three subatomic particles and their charges.
9. Complete the sentence 'All atoms of one type of element have the same number of...'
10. What does the atomic number tell us about an atom?
11. What does the mass number tell us about an atom?
12. Why is the overall charge of an atom zero?
13. Calculate how many protons, electrons and neutrons there are in a silver atom with atomic number 47 and mass number 108.

B. Atomic structure: Isotopes and relative atomic mass

1. What is an isotope?

2. Why do some elements have relative atomic masses which are not whole numbers?
3. Calculate the number of neutrons in this isotope of chlorine.



4. (HT) Boron has two naturally occurring isotopes B-10 (20%) and B-11 (80%). Calculate the relative atomic mass of boron.
5. (HT) Magnesium has three naturally occurring isotopes Mg -24 (79%); Mg – 25 (10%) and Mg – 26 (11%). Calculate the relative atomic mass of magnesium.

C. Periodic table: Mendeleev, atomic number, metals and non-metals and electronic configuration

1. How are elements arranged in the periodic table?
2. What are the columns of the periodic table called?
3. What are the rows of a periodic table called?
4. What does the column an element is in tell you about the atoms?
5. What does the row an element is in tell you about the atoms?
6. Which side of the periodic table are the non-metals found?
7. How did Mendeleev arrange the elements in his periodic table?
8. How did Mendeleev use his periodic table to predict the existence of some elements not then discovered?
9. Why is the order based on atomic masses not always correct?
10. What do we call elements that tend to form positive ions?
11. What is the electron configuration for sodium?
12. Draw the electron configuration for a chlorine atom.
13. Write the electron configuration for potassium.

Biology topic questions- Genetics, Natural selection and

Genetic Modification.

A. Genetics – Part 1

1. What is a gamete?
2. Name the male and female gametes in a) a human b) a daisy plant
3. For each row, tick one box to show which method of cell division is correct.

	Meiosis	Mitosis
Genetic mixing happens		
Gamete production occurs		
New cells show variation		
New cells have same number of chromosomes as parent		
Happens in skin cells		
Two divisions occur		
Two new cells are formed as a result		
Identical cells are formed		

4. What occurs at the point of fertilisation in humans?
5. How many chromosomes are found in the nucleus of a human:
 - a) ovary cell ?
 - b) egg cell ?
 - c) embryo cell ?
 - d) a cell just after fertilisation has occurred?
 - e) a testes cell ?
6. What happens to the DNA just before the first meiotic division?
7. What does the term 'haploid' mean?

C. Genetics – Part 3

1. Complete the sentences below using one of the following words:
genotype phenotype homozygous gamete chromosome

The same alleles for a particular characteristic are described as

Mice fur can be described by its colour. This is known as the

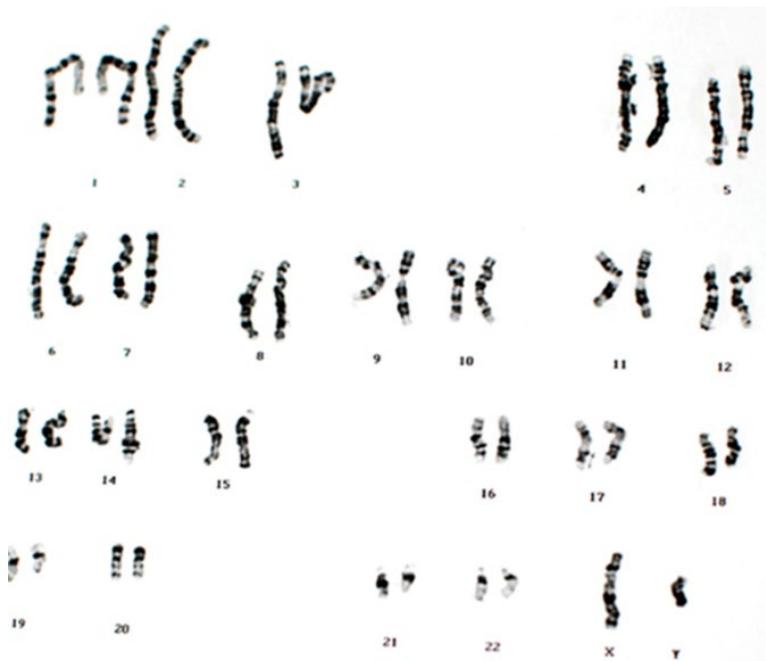
The alleles for a particular characteristic determine its

The pollen of a rose plant can also be described as a male

2. What are the different forms of a gene called?
3. Why is it easy to describe an organisms phenotype for a particular characteristic but very difficult to state the genotype?
4. List the alternative ways of describing the following outcome of a genetic cross:

3 in every 4 crosses will have black fur.

5. If two heterozygous tall plants were crossed 75 times, what proportion of the offspring would you expect to be short?
6. What is polydactyly and is it caused by inheriting a recessive or dominant allele?
7. Look at the following picture of a person's chromosomes.



a. How many chromosomes does this person have in a normal body cell?

b. What sex is the person and how do you know?

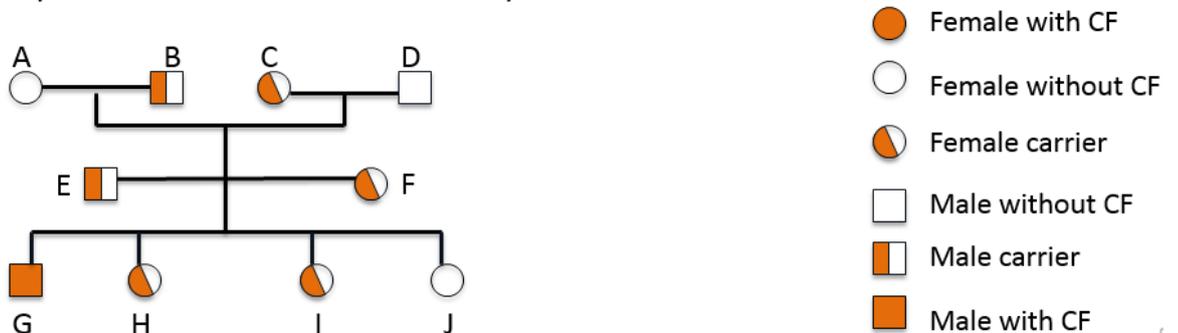
8. Black fur is dominant to brown fur in mice. Use B to represent black fur and b to represent brown fur.

- a) Complete the Punnett square diagram to show the outcome of a genetic cross between two heterozygous mice.

Gametes		

- b) What is the phenotype of the parent mice?
 c) What are the chances of a homozygous recessive mouse being born to two heterozygous mice?

9. What is meant by the term zygote?
 10. The family tree shows the inheritance of cystic fibrosis (CF). Cystic fibrosis is a condition caused by a recessive allele. Let F = healthy allele and f = CF allele



- a. What is the genotype of a female carrier?
 b. Explain why person G inherited cystic fibrosis.
 c. Explain why person J did not inherit cystic fibrosis.
 d. What is the probability of a fifth child having cystic fibrosis?
 e. Many people feel opposed to the screening of embryos to identify the CF allele. Suggest two reasons why they may feel this way.

D. Genetics – Part 4

1. Write down the definition of the genome of a horse.

2. List two reasons why it is important to understand more about the human genome.
3. What can bring about genetic variation in a species?
4. What is meant by 'an acquired characteristic'?
5. What is the chance of most genetic mutations having an effect on the phenotype?
High, Medium or Low
6. What is meant by discontinuous variation?

A. Development and understanding of evolution

1. What theory did Charles Darwin propose?
2. What was Charles Darwin's book called?
3. Write a definition for evolution.
4. What does the theory of evolution by natural selection state?
5. What is the definition of the term species?
6. List three observations Darwin made which led him to propose his theory.
7. Name two pieces of evidence for Darwin's theory of evolution through natural selection which mean it is now largely accepted.
8. What are fossils and how are they formed?
9. List two reasons why there are not many traces of early life on Earth.
10. What can be learned from studying fossils?
11. Which species lived on Earth most recently: Ardi, Lucy or Turkana boy?
12. What feature indicates that Ardi used to climb trees, as well as walk upright?
13. Which fossil species had the smallest brain: Ardi, Lucy or Turkana boy?
14. Who was Leakey?
15. What type of tool did Homo habilis use?
16. What three methods do scientists use to age stone tools?
17. Why do bacteria evolve rapidly?

B. Classification of living organisms

1. What does an evolutionary tree show?
2. Name the seven groups that Linnaeus used to classify living organisms.
3. What is the binomial naming system?
4. List the five kingdoms.
5. How are organisms classified in the five kingdoms?

6. Carl Woese used information from chemical analysis to suggest a new method of classification. What is it called?
7. List the groups that organisms are divided into using Carl Woese's method.

C. Genetic engineering

1. Humans choose animals or plants to breed from based on usefulness or appearance. List four characteristics which would be selected (two in plants and two in animals).
2. What is a major disadvantage caused by selective breeding?
3. What is the impact of selective breeding on food plants and domesticated animals?
4. What is genetic engineering?
5. What is a GMO?
6. What human product is made by genetically engineered bacteria to treat diabetes?
7. What are plants called which have had their genome modified?

Higher tier only

8. In genetic engineering, how are the required genes isolated from the host?
9. What is the biological definition of a vector?
10. Name a common vector for inserting genes into the required cells.
11. What does a restriction enzyme do?
12. What does a ligase enzyme do?

Physics topic questions- Motion and forces

Part 1

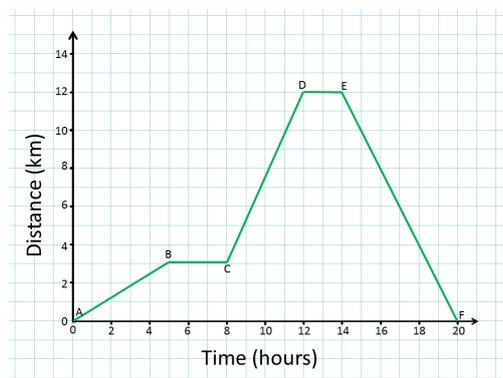
1. What is a scalar quantity?
2. Explain how a car can be moving at a constant speed but have changing velocity.
3. State whether the following quantities are scalars or vectors:

speed direction energy displacement mass weight

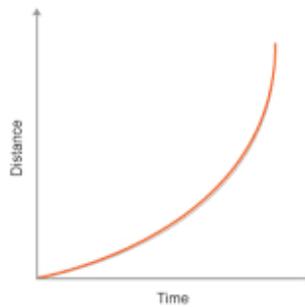
velocity acceleration momentum

Part 2

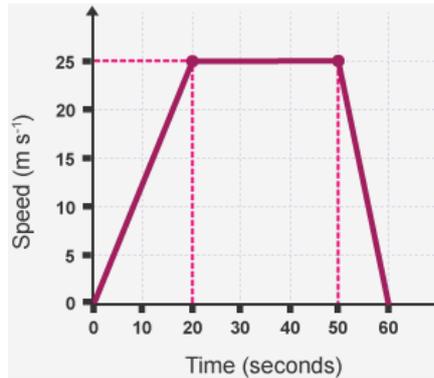
1. Recall the equations that link speed, distance and time, including units.
2. Describe the difference between speed and velocity.
3. A car moves round a circular track at 120 mph. Give the average velocity of the car. Explain your answer.
4. A motorcycle travels a distance of 420 miles in 8.5 hours. Give the average speed of the motorcycle.
5. Describe the difference between instantaneous speed and average speed.
6. Describe fully the motion shown in the distance-time graph shown below.



7. Describe how you would find the instantaneous speed of an object from a distance-time graph where the line is a curve. (Higher Tier Only).



8. State the equation that links acceleration, change in velocity and time taken, including units.
9. Describe what is meant by a negative acceleration.
10. Give the units of acceleration.
11. A stone is dropped off a cliff. The stone hits the floor at 30 m/s. Calculate the height of the cliff. Take $g = 9.8 \text{ m/s}^2$
12. Describe how the distance travelled by an object can be found from a velocity-time graph.
13. Describe fully the motion shown in the velocity-time graph shown below.



14. State the typical speed of a person

Walking

Cycling

15. Explain how the motion of a skydiver changes from the moment they jump out of the plane until they land.

Part 3

1. What does Newton's first law state about objects that are stationary?
2. What does Newton's first law state about objects that are moving?
3. Describe why a cannon ball, when fired from a cannon does not continue to move with constant velocity.
4. Recall the equation used for Newton's second law.
5. A car has an acceleration of 1.7 m/s^2 and a mass of 700 kg. Calculate the driving force of the car.
6. A skydiver has a weight of 686 N and a mass of 70 kg. Calculate the acceleration of the skydiver the moment he jumps out of the plane.
7. A motorcycle has a driving force of 1400 N and an acceleration of 6 m/s^2 . Calculate the mass of the motorcycle.
8. A boy has a mass of 40 kg. Calculate the boy's weight. Take $g = 10 \text{ N/kg}$.
9. Name a piece of scientific equipment that you would use to find the weight of a block in a science laboratory.
10. On The Moon an astronaut has a weight of 130 N. The gravitational field strength on The Moon is 1.7 N/kg . The gravitational field strength on the Earth is 10 N/kg . Calculate the weight of the astronaut on the Earth.

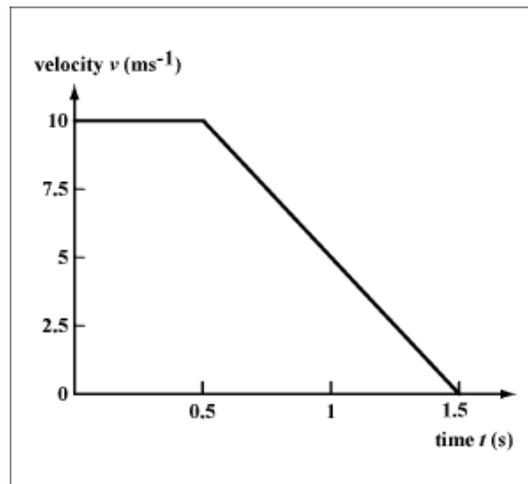
Part 4

1. State the units of momentum.
2. State the equation that links mass, momentum and velocity.
3. Momentum is a conserved quantity. Explain what is meant by a conserved quantity.
4. A football has a mass of 0.75 kg and is kicked with a speed of 12 m/s. Calculate the momentum of the kicked football.
5. Two ice skaters push themselves apart on the ice. Explain how the conservation of momentum applies in this case.
6. A trolley has a mass of 1.2 kg and a speed of 4.5 m/s. The trolley crashes into a stationary trolley of mass 0.8 kg. On impact the two trolley's stick together and move off with speed, v .
 - a. Calculate the momentum of the trolleys before impact.
 - b. Calculate the speed of the trolleys after impact.
7. A gymnast falls onto a crash mat. The crash mat reduces the risk of injury to the gymnast. Explain how the crash mat reduces injury.
8. A car of mass 850 kg hits a crash barrier at a speed of 30 m/s. The car stops in 0.4 s. Calculate the force on the car.

Part 5

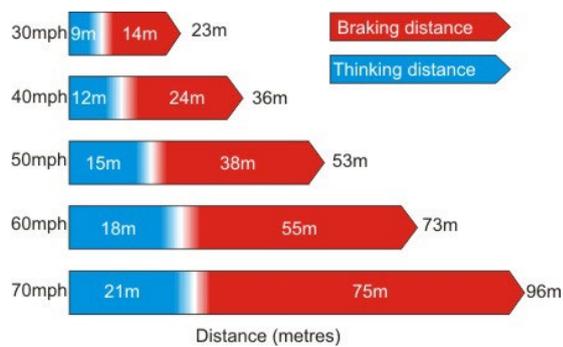
1. Define thinking distance.
2. Complete the equation:
Stopping distance = +
3. Describe how the speed of a vehicle affects the thinking distance.
4. A driver sees a car braking sharply in front of him. The driver takes 0.5 s to react to the stimulus and then brakes. Figure 1 shows the velocity-time graph for the motion of the vehicle from seeing the stimulus to stopping. Calculate the stopping distance of the vehicle.

Figure 1



5. The highway code shows the stopping distances for vehicles up to 70 mph. In 2011 the government proposed a new 80 mph speed limit for UK motorways.

Use the information in the diagram, and your own knowledge, to determine the overall stopping distance of a vehicle at 80 mph.



6. Describe how you could measure the reaction time of a person.
7. Explain the dangers caused by large decelerations of a vehicle.
8. Put the following factors under the correct headings to show whether the factor affects thinking distance, braking distance or both thinking and braking distance.

speed **mass** **icy roads** **tiredness**
poor brakes **mobile phone use** **alcohol** **bald tyres**

Thinking Distance	Braking Distance	Both

Well done on completing the booklet. Thank you for your hard work.

Now use your knowledge organiser to make some revision resources.

You could make:

- A poster
- A mind map
- A model of a diagram
- A quiz
- A written story e.g. of sound travelling into someone's ear
- A storyboard e.g. of plant reproduction
- A crossword with clues
- Flashcards of definitions