

SEVENOAKS SCHOOL



YEAR 9 (13+) SCHOLARSHIP

March 2026
for entry in September 2026

SCIENCE

Your Name: _____

Your School: _____

Time allowed: 1 hour

Equipment needed: Pen, pencil and ruler.

You may use an eraser and a calculator if needed.

Information for candidates:

1. Write your name and school on this page.
2. Write all of your answers on the question paper in the space provided.
If you need additional paper, please ask the invigilator. Please put your name on any sheets of paper you use.
3. The marks for each question or part question are shown in square brackets [] after the question.
4. Answer **ALL QUESTIONS**
5. The total mark for this paper is 60.

Physics

1. A helicopter is stationary above the ground when a bag of sand is dropped from it.

- (a) (i) The bag falls 6.30 m.

The mass of the bag is 19 kg and the gravitational field strength is 10 N/kg.
Calculate the gravitational potential energy (GPE) change for the bag.

[GPE change = mass $\times$ gravitational field strength $\times$ height change]

GPE change = J

[2 marks]

- (ii) State the kinetic energy (KE) gained by the bag after falling 6.3 m.
You can ignore the effects of air resistance.

KE gained = J

[1 mark]

- (b) Closer to the ground, the effects of air resistance cannot be ignored.

The bag travels at a constant speed when the air resistance equals the weight of the bag.

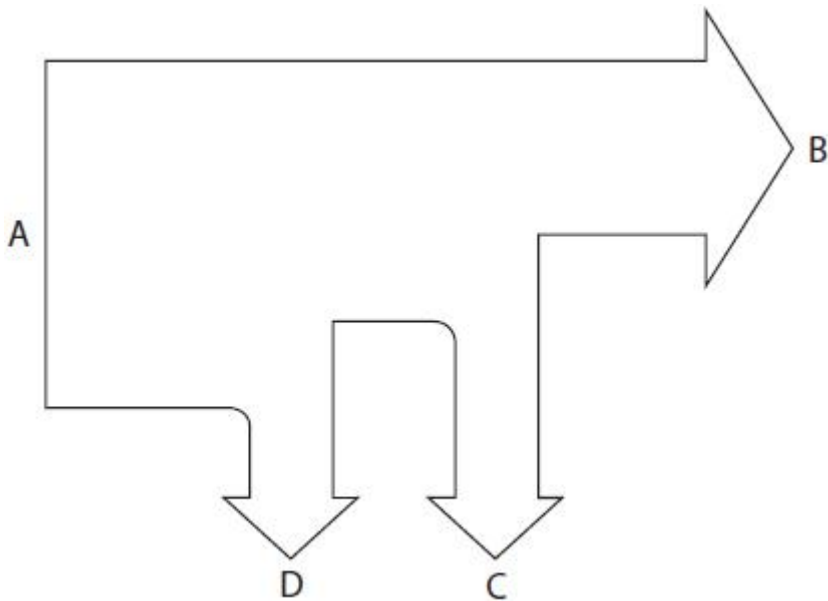
Calculate the value of the air resistance when the bag travels at constant speed.

air resistance = N

[2 marks]

(c) The bag hits the ground and stops without bouncing.

The Sankey diagram shows energy transfers for the bag from just before the bag hits the ground to when the bag stops.



Use words from the box to complete the labels A, B and D. Label C has been done for you. Each word may be used once, more than once or not at all.

thermal	magnetic	mechanically	electrically
kinetic	nuclear	by heating	by radiation

A: energy is transferred from the bag's store

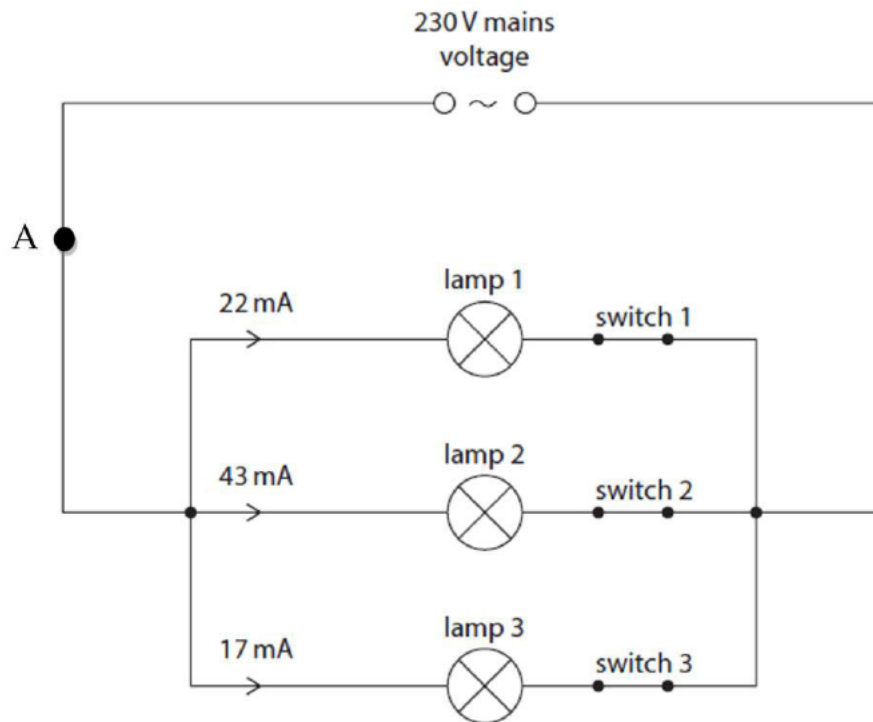
B: energy is transferred to the bag's store

C: energy is transferred to the ground's thermal store

D: energy is transferred to the surroundings

[3 marks]

Total for question = 8 marks



2. The diagram shows a household lighting circuit.

(a) Explain an advantage of using this type of circuit for domestic lighting.

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[2 marks]

(b) When switch 1 is closed, the current in lamp 1 is 22 mA.

(i) Give the name of the charged particle that moves in an electric current.

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[1 mark]

(ii) How would the currents through lamps 2 & 3 change if switch 1 was opened. Explain your reasoning.

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[2 marks]

- (c) "mA" (milliamps) is a measurement of current. What is the current at point A in the circuit?

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[1 mark]

- (d) Switches 1 and 3 are closed, which turn on lamps 1 and 3. Switch 2 is open.

What is the current at point A now?

current = mA

[2 marks]

- (e) Edit the circuit diagram at the beginning of this question to add another lamp that is also controlled by switch 2. (It should turn on and off at the same time as lamp 2 turns on and off.)

[1 mark]

- (f) In the space below, draw an alternative circuit which has two switches and three lamps and obeys the following conditions.

- Switches 1 and 2 must **both** be closed in order for the three lamps to be on.
- If one lamp breaks, then the other two must continue to shine.

[3 marks]

Total for question = 12 marks

[Total marks for Physics = 20]

Biology

1. The following headline appeared in the BBC news in October 2021:

“Does feeding garden birds in the UK do more harm than good?”

The numbers of some birds such as blue tits are increasing due to being fed by humans, whereas numbers are decreasing of some other birds such as willow tits. Both tits live in the same habitat, but blue tits tend to nest a little earlier in the spring than willow tits.

- (a) Suggest why blue tit populations have increased due to feeding yet willow tit populations have not increased.

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[2 marks]

- (b) Suggest why an increase in blue tit numbers might directly cause a decrease in the number of willow tits.

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[2 marks]

- (c) Recent research shows that great tits living in the UK have slightly longer beaks than those living in the rest of Europe, where feeding garden birds is less common. Suggest a reason for the difference in beak length between the UK and the rest of Europe.

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[2 marks]

2. Newly hatched birds (hatchlings) can either be **precocial** or **altricial**. Look at the table below and answer the following questions.

Feature	Precocial birds	Altricial birds
Average Clutch size	4-5 eggs	2-3 eggs
Incubation Period	21-35 days	11-14 days
Hatchling State	Eyes open, downy, self-feeding	Blind, naked, helpless

- (a) Draw a circle around the picture of a precocial hatchling.



[1 mark]

- (b) Which hatchling state (precocial or altricial) would allow for more clutches to be raised each breeding season?

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[1 mark]

- (c) Which hatchling state would allow the brains to grow and develop more in response to the environment?

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[1 mark]

- (d) Which hatchling state would require more energy and effort from the parents after hatching?

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[1 mark]

- (e) Mammals who have precocial offspring tend to have longer pregnancies than similar sized animals who have altricial offspring. Humans are an exception to this rule, with long pregnancies and very altricial offspring. Suggest a reason for this difference in humans compared to similar sized mammals, such as sheep, which have shorter pregnancies but precocial offspring.

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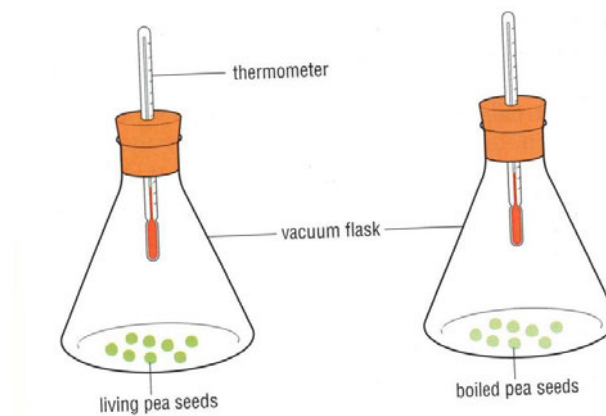
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[1 mark]

3. The following experiment was set up to investigate temperature changes in germinating pea seeds.



- (a) Describe and explain any temperature changes you would expect to see in the flasks.

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[3 marks]

- (b) Both sets of seeds were washed in a disinfectant solution immediately before putting them in the flask. Explain why this was an important step to prove that the living pea seeds were affecting the temperature.

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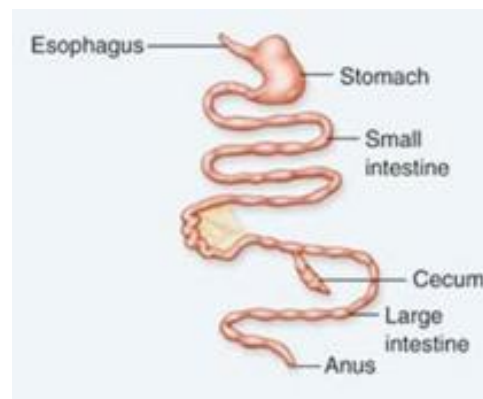
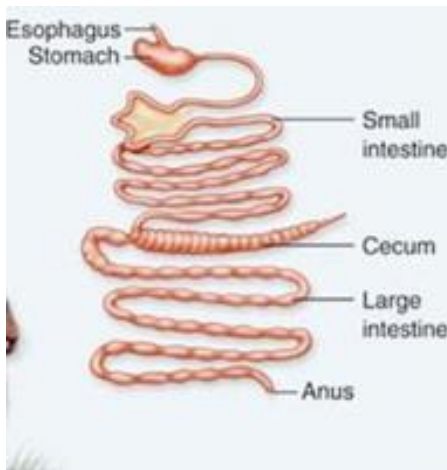
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[2 marks]

4. Different mammals have different digestive systems depending on whether they are carnivores or herbivores. Meat and fat are nutrient-dense and easy to digest and absorb. Diets that contain plant material take longer to break down and digest.

- (a) **Name** one animal that could have a digestive system similar to each of the two pictures.

[2 marks]



1. Possible animal:

2. Possible animal:

- (b) Suggest with a reason how the human digestive system might compare to the digestive systems shown in pictures 1 and 2.

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[2 marks]

[Total marks for Biology = 20]

Chemistry

Question

This question is about Group 2 elements, the alkaline earth metals. They are the second most reactive family of elements. Beryllium, magnesium, calcium, strontium, barium and radium are all shiny, and have silvery-white appearance. A copy of the periodic table is below.

The Periodic Table of the Elements

1		2										3		4		5		6		7		0													
				1 H hydrogen 1																		4 He helium 2													
				Key relative atomic mass atomic symbol name atomic (proton) number																															
7 Li lithium 3		9 Be beryllium 4										11 B boron 5		12 C carbon 6		14 N nitrogen 7		16 O oxygen 8		19 F fluorine 9		20 Ne neon 10													
23 Na sodium 11		24 Mg magnesium 12										27 Al aluminium 13		28 Si silicon 14		31 P phosphorus 15		32 S sulfur 16		35.5 Cl chlorine 17		40 Ar argon 18													
39 K potassium 19		40 Ca calcium 20		45 Sc scandium 21		48 Ti titanium 22		51 V vanadium 23		52 Cr chromium 24		55 Mn manganese 25		56 Fe iron 26		59 Co cobalt 27		59 Ni nickel 28		63.5 Cu copper 29		65 Zn zinc 30		70 Ga gallium 31		73 Ge germanium 32		75 As arsenic 33		79 Se selenium 34		80 Br bromine 35		84 Kr krypton 36	
85 Rb rubidium 37		88 Sr strontium 38		89 Y yttrium 39		91 Zr zirconium 40		93 Nb niobium 41		96 Mo molybdenum 42		[98] Tc technetium 43		101 Ru ruthenium 44		103 Rh rhodium 45		106 Pd palladium 46		108 Ag silver 47		112 Cd cadmium 48		115 In indium 49		119 Sn tin 50		122 Sb antimony 51		128 Te tellurium 52		127 I iodine 53		131 Xe xenon 54	
133 Cs caesium 55		137 Ba barium 56		139 La[*] lanthanum 57		178 Hf hafnium 72		181 Ta tantalum 73		184 W tungsten 74		186 Re rhenium 75		190 Os osmium 76		192 Ir iridium 77		195 Pt platinum 78		197 Au gold 79		201 Hg mercury 80		204 Tl thallium 81		207 Pb lead 82		209 Bi bismuth 83		[209] Po polonium 84		[210] At astatine 85		[222] Rn radon 86	
[223] Fr francium 87		[226] Ra radium 88		[227] Ac[*] actinium 89		[261] Rf rutherfordium 104		[262] Db dubnium 105		[266] Sg seaborgium 106		[264] Bh bohrium 107		[277] Hs hassium 108		[268] Mt meitnerium 109		[271] Ds darmstadtium 110		[272] Rg roentgenium 111		Elements with atomic numbers 112-116 have been reported but not fully authenticated													

- a) Which one of the properties below does **not** belong to Group 2 elements? Circle the correct letter.
- A. They are solid at room temperature
 - B. They are good electrical conductors
 - C. They react with oxygen to form acidic oxides
 - D. They are malleable

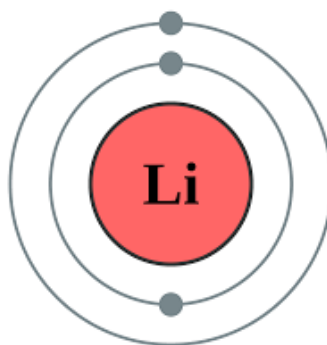
[1 mark]

b) Atoms consist of a central nucleus which is made up of the neutrons (neutral) and protons (positively charged). Electrons (negatively charged) orbit around the nucleus. Scientists use *electron configuration* to describe the arrangement of electrons in an atom. Read the information below carefully to answer the next part of the question.

Electron configuration rules:

- The number of electrons in an atom is equal to the number of protons, which is shown on the periodic table by the atomic number of that element.
- Electrons are assigned in *shells* around the nucleus – a shell is a region in space.
- Shells are categorised by their distance from the central nucleus – first shell is the one that is closest to the nucleus and outer shell is the furthest.
- Electrons are assigned to the first shell first, up to 2 electrons per shell. If there are more electrons remaining, they are then assigned to the second shell, up to 8 electrons per shell. If there are more electrons remaining, they are placed into the third shell, also up to 8 electrons, and so on.
- Electrons are normally represented using crosses or dots, and shells are normally drawn using circles.

An example of the electron configuration diagram of a lithium atom is shown below.



Using the key on the Periodic Table and the information above, **draw an electron configuration diagram of a magnesium atom (Mg)**. You can represent electrons using either dots or crosses. You need to include all the electrons on your diagram.

[2 marks]

- c) Magnesium has three stable isotopes. Isotopes are atoms of the same element that have the same number of protons but different numbers of neutrons. The number of protons in an atom equals its atomic number. The atomic mass is the total of protons and neutrons, and, in a neutral atom, the number of electrons equals the number of protons.

Use the Periodic Table and the information above to **determine the number of subatomic particles** (protons, neutrons and electrons) in each magnesium isotope.

	$^{24}_{12}\text{Mg}$	$^{25}_{12}\text{Mg}$	$^{26}_{12}\text{Mg}$
Number of protons			
Number of neutrons			
Number of electrons			

[3 marks]

- d) i) Compounds made from the elements from the same group have *gradated* physical properties. The table below shows the melting point of some of the Group 2 metal chlorides. **Complete the missing melting point** for calcium chloride, CaCl_2 and **suggest the meaning** of the word '*gradated*'.

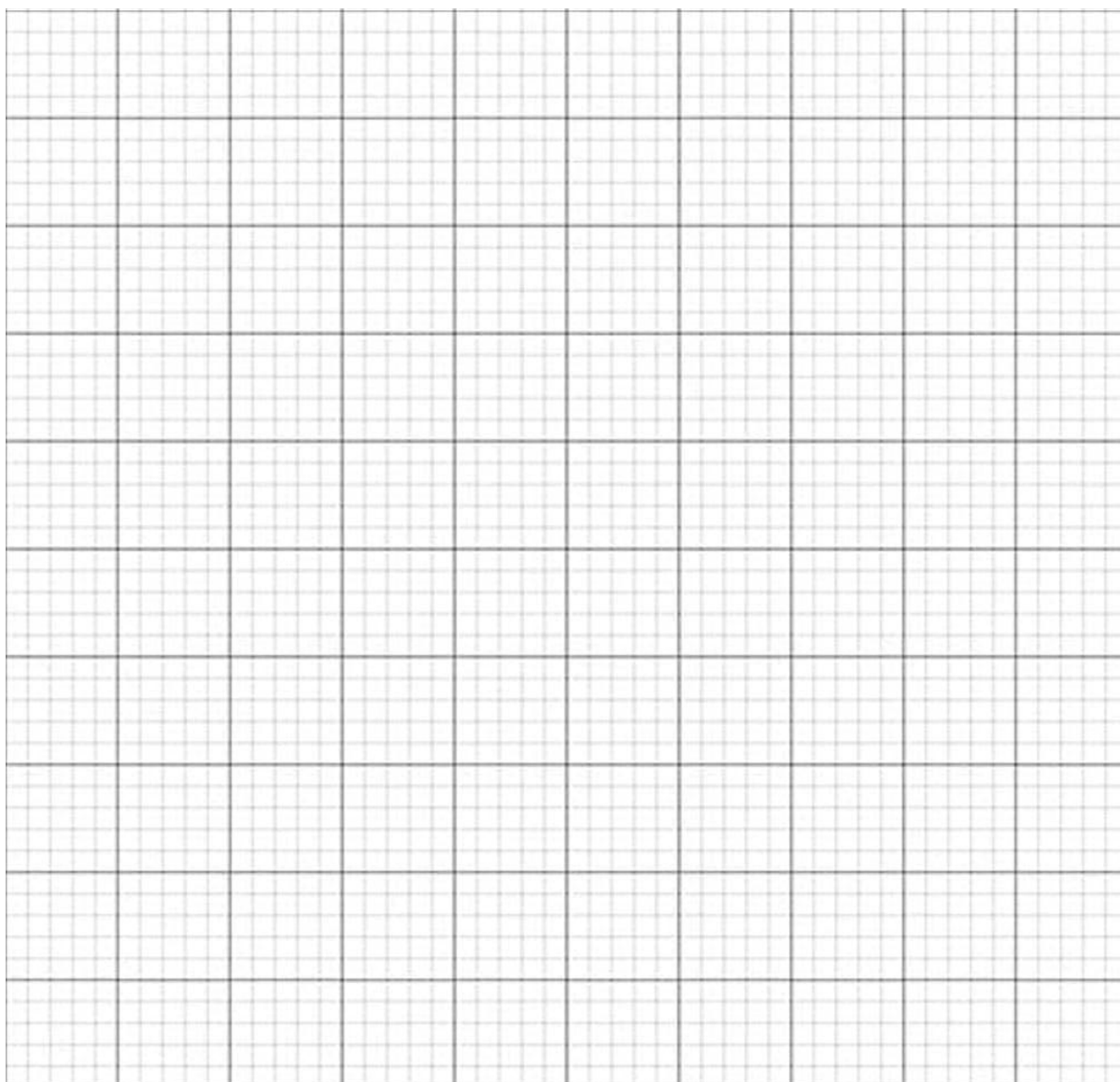
Compounds	Melting point ($^{\circ}\text{C}$)
Beryllium chloride	405
Magnesium chloride	714
Calcium chloride	
Strontium chloride	1050

Gradated means

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[2 marks]

ii) Using your answer from d) i), **plot a graph** of the melting point of the four chloride salts on the grid below. Your graph will need to show both axes with appropriate labels and units where appropriate.



[3 marks]

e) Group 2 elements undergo similar reactions compared to other metallic elements. Use this information to **predict the product(s) of each reaction** below in words.

i) magnesium + oxygen $\rightarrow$

ii) barium + chlorine $\rightarrow$

[2 marks]

f) i) A student dropped a piece of strontium into a trough of water. They noted the following observations:

- effervesces
- metal disappears to form solution
- heat is released

They then added universal indicator to the solution and blue colour appeared. They also managed to collect the gas produced and found the gas was flammable. Use the information to **circle the most suitable products** of this reaction. **Give a reason** for each selection.

strontium + water →	A strontium oxide	+	A oxygen
	B strontium chloride		B hydrogen
	C strontium hydroxide		C argon
	D strontium		D helium

What is your reason for selecting these chemicals:

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[4 marks]

ii) When metals react, they typically lose the electron(s) in their outer shell, donating them to another reactant. Using the atomic diagrams of the Group 2 elements below and the information from part (b), **predict the order of reactivity** of these metals from *least to most* reactive. **Support your prediction** by explaining how their atomic structure influences their reactivity.



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[3 marks]

[Total marks for Chemistry = 20]

END OF PAPER