
PHYSICAL SCIENCE

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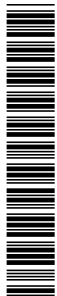
Paper 1 Multiple Choice

October/November 2014

40 minutes

Additional Materials: Multiple Choice Answer Sheet
 Soft clean eraser
 Soft pencil (type B or HB is recommended)
 Data Booklet

* 2 2 1 1 9 7 4 7 2 3 *



READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.

There are **thirty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

Electronic calculators may be used.

This document consists of **14** printed pages and **2** blank pages.

Relevant Data, Formulae and the Periodic Table are provided in the Data Booklet.

Section A

For each question there are four possible answers, **A**, **B**, **C**, and **D**. Choose the **one** you consider to be correct.

1 Which pair consists of two vector quantities?

- A force and potential energy
- B mass and work
- C power and acceleration
- D weight and displacement

2 A resistor of resistance R has potential difference (p.d.) V across it. The power P dissipated in the resistor is given by

$$P = \frac{V^2}{R}.$$

The p.d. is measured as $1.25 \pm 0.05\text{V}$.

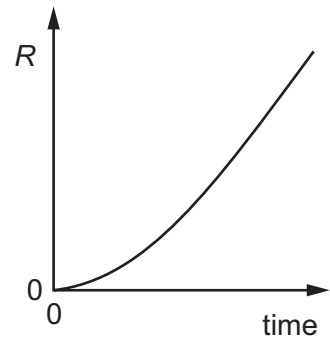
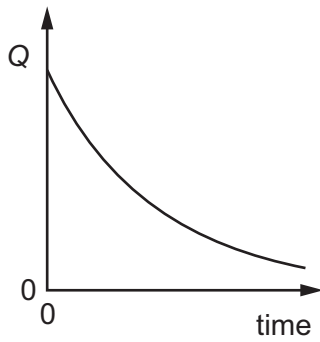
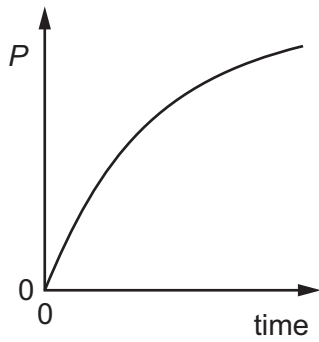
The resistor is marked as having a resistance of $330\Omega \pm 5\%$.

The above values are used to calculate the power dissipated in the resistor.

What is the percentage uncertainty in the calculated power?

- A** 3% **B** 11% **C** 13% **D** 21%

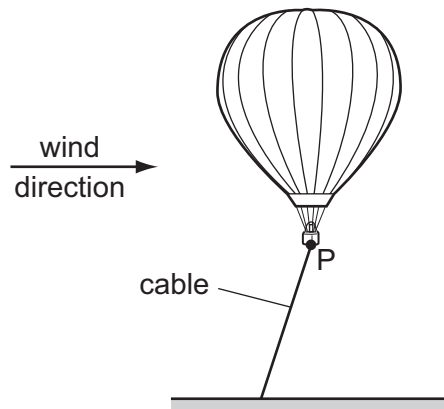
- 3 A ball is dropped from the top of a tall building. Air resistance acts on the ball. The graphs show how three quantities, P , Q and R , vary with time as the ball falls.



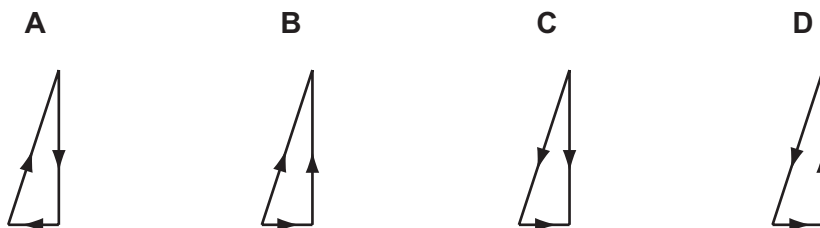
Which row shows the quantities represented by the graphs?

	displacement	velocity	acceleration
A	P	R	Q
B	Q	P	R
C	R	Q	P
D	R	P	Q

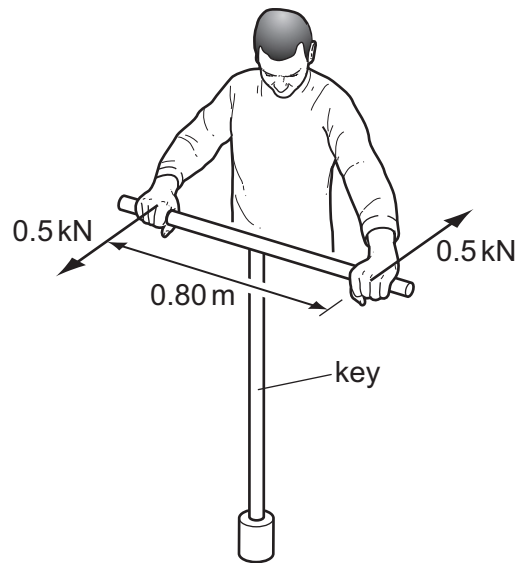
- 4 The diagram shows a stationary helium-filled balloon fixed to the ground by a cable.



Which diagram shows the correct vector triangle for the forces acting at point P ?



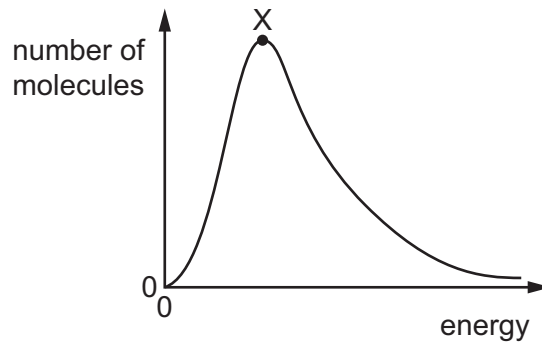
5 The diagram shows a man using a key to open a valve to release water at a dam.



What is the torque produced by the couple on the key?

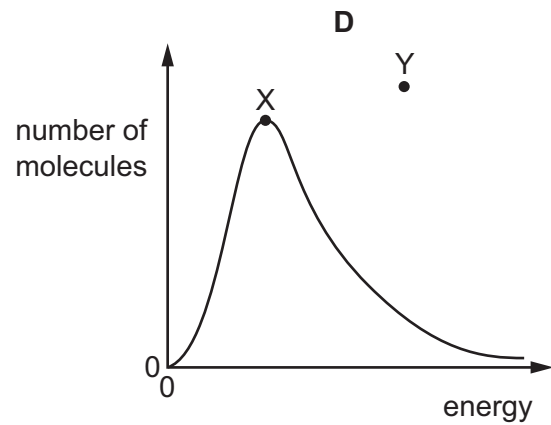
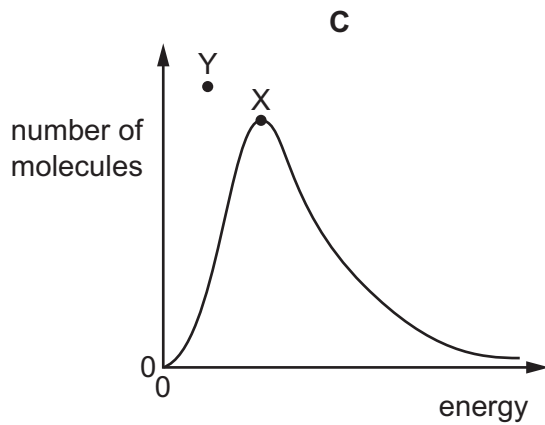
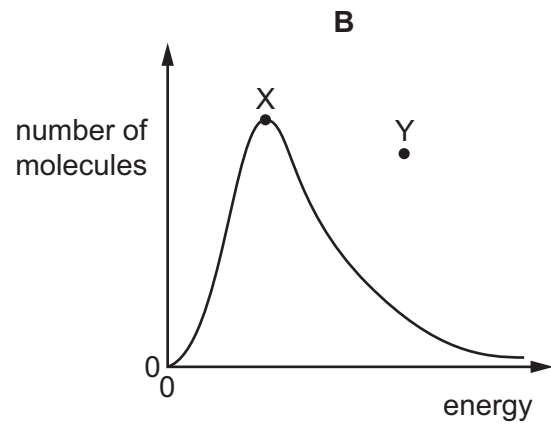
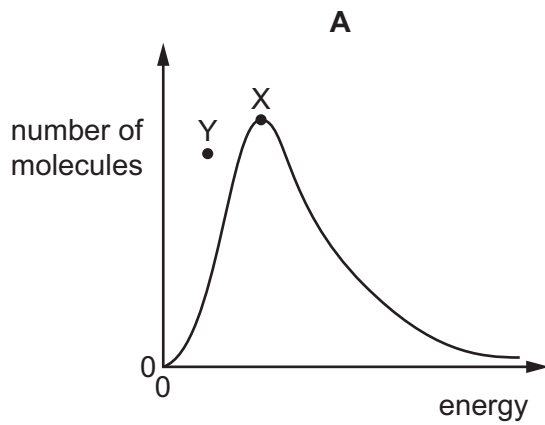
- A** 0.4 Nm **B** 0.8 Nm **C** 400 Nm **D** 800 Nm

- 6 The graph shows the Boltzmann distribution of molecular energies of a fixed mass of gas at a given temperature. At this temperature the peak of the distribution graph is labelled X.

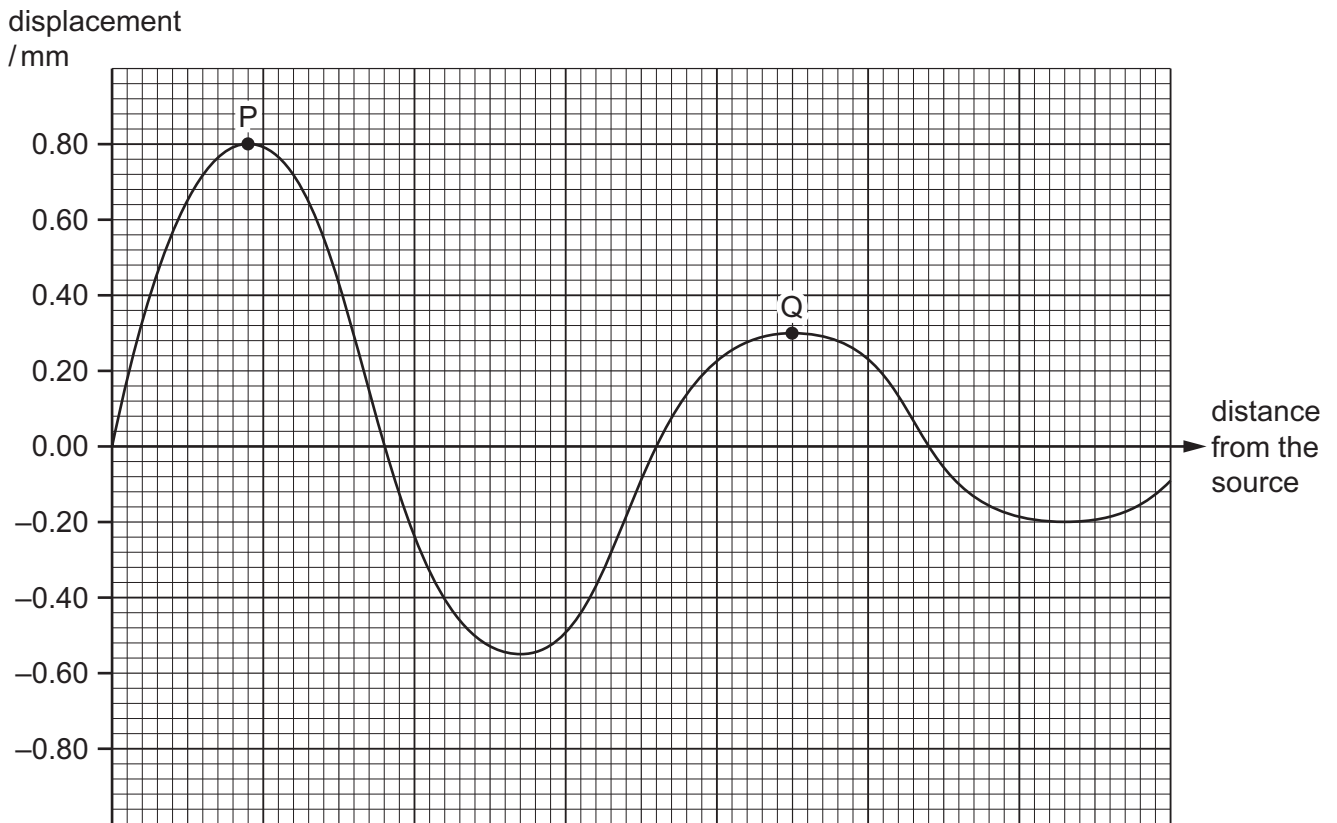


The temperature of the gas is increased.

Which diagram shows the new position, Y, of the peak?



- 7 The graph shows a wave at a particular instant as it travels away from its source. P and Q are points on the wave.

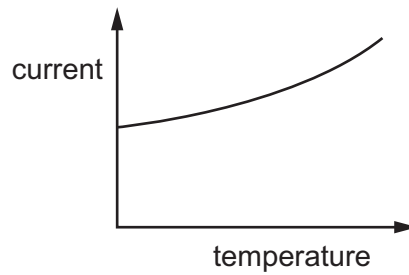
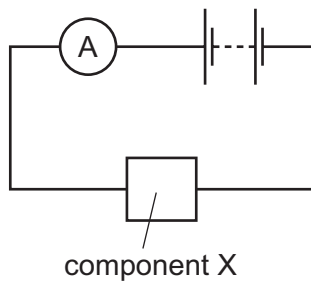


What is the value of the ratio $\frac{\text{intensity at point Q}}{\text{intensity at point P}}$?

- A** 0.14 **B** 0.38 **C** 2.7 **D** 7.1

- 8 The circuit diagram shows a battery connected in series with an ammeter and a component, X.

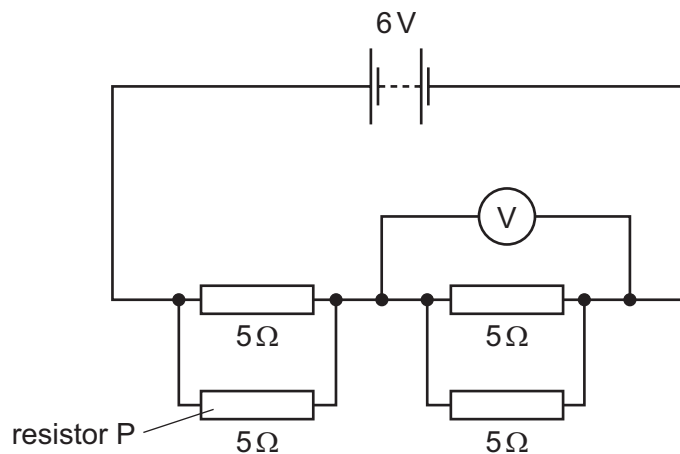
The graph shows the variation of the current in the circuit as the temperature of component X increases.



Which row is correct?

	identity of component X	properties of component X
A	metal wire	the resistance decreases as the temperature increases
B	metal wire	the resistance increases as the temperature increases
C	thermistor	the resistance decreases as the temperature increases
D	thermistor	the resistance increases as the temperature increases

- 9 Four resistors, each of resistance 5Ω , are connected into a circuit as shown. The battery has an electromotive force of 6V and negligible internal resistance.



Resistor P is disconnected from the circuit.

What happens to the voltmeter reading?

- A** It decreases by 1V .
- B** It decreases by 2V .
- C** It increases by 1V .
- D** It increases by 2V .

- 10 In an experiment to investigate the nature of the atom, a very thin gold foil was bombarded with α -particles.

One of the observations of this experiment was that a tiny minority of the α -particles was deflected through angles greater than 90° .

What can be concluded from this observation **alone**?

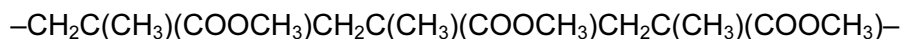
- A Electrons orbit around the nucleus in well-defined paths.
 B The atom contains a very small positively charged nucleus.
 C The nucleus is at the centre of the atom.
 D The nucleus is made of protons and neutrons.
- 11 What is the electron arrangement of an atom of the element that is most easily oxidised?

- A $1s^2 2s^2 2p^5$
 B $1s^2 2s^2 2p^6 3s^2$
 C $1s^2 2s^2 2p^6 3s^2 3p^5$
 D $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$

- 12 Lime is used in agriculture and in building construction.

Which statement about the use of lime is correct?

- A Blocks of lime are used to build walls.
 B Concrete is made using lime.
 C Lime is added to soils that are naturally too alkaline.
 D When lime is added to soil, the pH of the soil decreases.
- 13 A fragment of an addition polymer used to make contact lenses is shown.



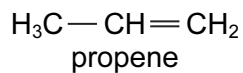
What is the molecular formula of the monomer?

- A $\text{C}_5\text{H}_8\text{O}_2$ B $\text{C}_6\text{H}_{10}\text{O}_2$ C $\text{C}_9\text{H}_{14}\text{O}_4$ D $\text{C}_{15}\text{H}_{24}\text{O}_6$
- 14 Which is a propagation step in the reaction between ethane and bromine?

- A $\text{Br}_2 \rightarrow 2\text{Br}^\bullet$
 B $\text{C}_2\text{H}_5^\bullet + \text{Br}^\bullet \rightarrow \text{C}_2\text{H}_5\text{Br}$
 C $\text{C}_2\text{H}_6 + \text{Br}^\bullet \rightarrow \text{C}_2\text{H}_5^\bullet + \text{HBr}$
 D $\text{C}_2\text{H}_6 \rightarrow \text{C}_2\text{H}_5^\bullet + \text{H}^\bullet$

- 15 Which factor influences the boiling points of the halogens, X_2 ?
- A The electronegativities of X.
 - B The number of electrons in X_2 .
 - C The number of neutrons in X_2 .
 - D The strength of the X–X bond.
- 16 Which reaction does **not** proceed by a nucleophilic substitution mechanism?
- A bromoethane + alcoholic potassium hydroxide
 - B bromoethane + ammonia
 - C bromoethane + aqueous sodium hydroxide
 - D bromoethane + potassium cyanide
- 17 Which statement is correct?
- A The increase in reaction rate resulting from an increase in temperature, is mainly due to the molecules colliding more frequently.
 - B An increase in concentration causes an increase in the energy of the reactants, so that a higher proportion of them have activation energy.
 - C Increasing the temperature causes the activation energy of a reaction to decrease.
 - D When the pressure of a gaseous mixture of reactants is increased, the reaction rate increases because molecules collide more frequently.
- 18 Iron is extracted from its ore, hematite, by reducing the hot ore in a blast furnace.
- Which two substances are responsible for the reduction of the iron(III) oxide to iron?
- A C and CO
 - B CaO and C
 - C CO and CO_2
 - D CO_2 and CaO

- 19 Propene is produced by cracking hydrocarbon fractions.



What are the numbers of σ and π bonds present in one molecule of propene?

	σ	π
A	6	2
B	7	1
C	7	2
D	8	1

- 20 Which statement is correct?

- A** An O–H bond is more polar than an S–H bond.
- B** SiO₂ has a higher melting point than P₄O₁₀ because of stronger van der Waals' forces.
- C** The atomic radii of Period 3 elements increase from sodium to chlorine.
- D** The first ionisation energy of Group II elements increases from magnesium to barium.

Section B

For each of the questions in this section, one or more of the four numbered statements **1** to **4** may be correct.

Decide whether each of the statements is or is not correct (you may find it helpful to put a tick against the statements that you consider to be correct).

The responses **A** to **D** should be selected on the basis of

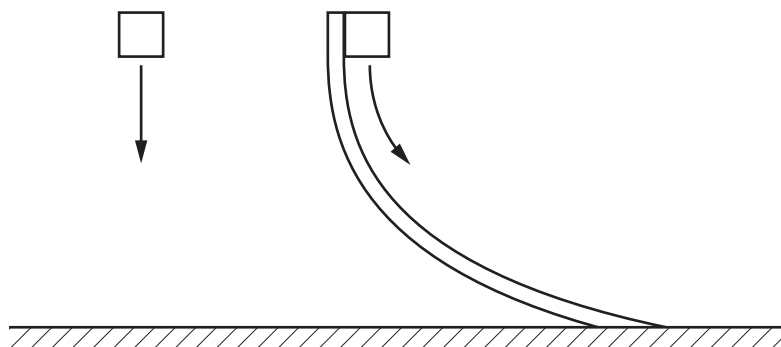
A	B	C	D
1, 2 and 3 only are correct	1 and 3 only are correct	2 and 4 only are correct	4 only is correct

No other combination of statements is used as a correct response.

21 Which statements regarding interactions between two bodies in an isolated system are correct?

- 1** In elastic interactions both kinetic energy and linear momentum are conserved.
- 2** In elastic interactions kinetic energy is conserved but linear momentum is not conserved.
- 3** In inelastic interactions kinetic energy is not conserved but linear momentum is conserved.
- 4** In inelastic interactions neither kinetic energy nor linear momentum is conserved.

22 Two identical boxes, at the same height, are released from rest at the same time. One box falls directly to the ground and the other box slides down a slope to the ground, as shown.



Friction between the box and the slope and air resistance are negligible.

Which statements are correct?

- 1** Both boxes arrive at the ground with the same momentum.
- 2** Both boxes arrive at the ground with the same speed.
- 3** Both boxes arrive at the ground with the same velocity.
- 4** Both boxes arrive at the ground with the same kinetic energy.

The responses **A** to **D** should be selected on the basis of

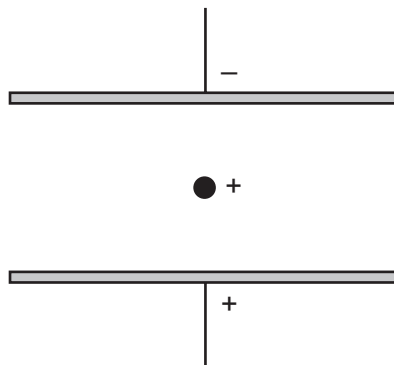
A	B	C	D
1, 2 and 3 only are correct	1 and 3 only are correct	2 and 4 only are correct	4 only is correct

No other combination of statements is used as a correct response.

23 Which statements about γ -rays are correct?

- 1 They have a higher frequency than ultraviolet waves.
- 2 They can have a wavelength of 1×10^{-9} m.
- 3 They are transverse waves.
- 4 They can be deflected by a uniform electric field.

24 The diagram shows a positively-charged oil drop in an electric field between two charged, horizontal conducting plates.



Which changes would **increase** the electric force acting on the oil drop?

- 1 moving the plates further apart
- 2 increasing the charge on the oil drop
- 3 decreasing the mass of the oil drop
- 4 increasing the potential difference between the plates

25 Radioactive decay is both random and spontaneous.

The following statements about radioactive decay of any single isotope are all correct.

Which statements describe only the **spontaneous** nature of radioactive decay?

- 1 It is impossible to predict when a given nucleus will decay.
- 2 The count rate of a sample of this isotope decreases as time increases.
- 3 The fluctuations in the count rate are detected from a sample of the isotope.
- 4 The decay of a nucleus is not affected by changes in temperature or pressure.

26 Which polymers can be made from the polymerisation of the named small molecule?

	polymer	small molecule
1	$\text{-(CH}_2\text{-CH}_2\text{)}_n\text{-}$	ethene
2	$\text{-(CHBr-CHBr)}_n\text{-}$	bromoethene
3	$\text{-(CH}_2\text{-CHCl)}_n\text{-}$	chloroethene
4	$\text{-(CH}_2\text{-CH}_2\text{)}_n\text{-}$	ethane

27 Which particles have a half-filled 3p subshell?

- 1 an isolated P atom
- 2 an isolated K^{4+} ion
- 3 an isolated Si^- ion
- 4 an isolated Se^+ ion

28 Which substances form acidic solutions when added to water?

- 1 CaO 2 Cl_2 3 Na_2O 4 SO_3

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, 2 and 3 only are correct	1 and 3 only are correct	2 and 4 only are correct	4 only is correct

No other combination of statements is used as a correct response.

- 29** Elements X and Y are in Period 3. The atomic number of Y is one more than the atomic number of X.

The first ionisation energy of X is higher than the first ionisation energy of Y.

What is a possible explanation for this difference in first ionisation energy?

- 1 An atom of Y has paired electrons in a 3p orbital, but an atom of X does not.
- 2 An atom of X and an atom of Y have different nuclear charges.
- 3 The outer electron in an X atom is in an s subshell, but the outer electron in a Y atom is in a p subshell.
- 4 An atom of X and an atom of Y have their outer electrons in different shells.

- 30** Consider the two chemical reactions.

Reaction one: solid ammonium chloride is added to aqueous sodium hydroxide in a test-tube. When the test-tube is heated a gas, **X**, is given off.

Reaction two: gas **X** is allowed to mix with hydrogen chloride gas, HCl . As the two gases mix they form a finely powdered white solid, **Y**.

Which statements about reaction one and reaction two are correct?

- 1 Gas **X** is ammonia.
- 2 Water is also produced in reaction one.
- 3 Solid **Y** is the only product of reaction two.
- 4 Solid **Y** is sodium chloride.

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