



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level

PHYSICAL SCIENCE

8780/01

Paper 1 Multiple Choice

For Examination from 2011

SPECIMEN PAPER

40 minutes

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

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 working should be done in this booklet.

This document consists of **17** printed pages and **1** blank page.

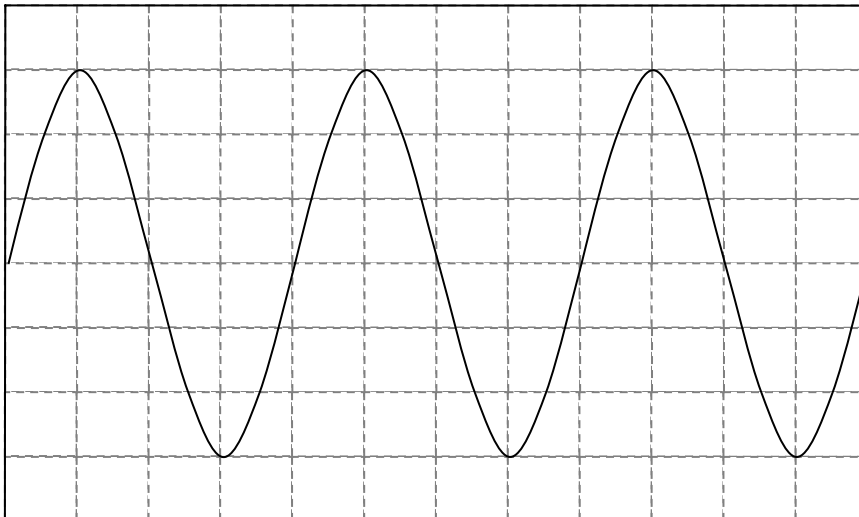


Relevant Data, Formulae and the Periodic Table are provided in the Data Booklet.

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 of the pairs includes a vector and a scalar quantity?
- A acceleration and displacement
 - B energy and work
 - C volume and density
 - D pressure and force
- 2 A microphone is connected to a cathode-ray oscilloscope (c.r.o). The (c.r.o.) display shows the waveform when a sound is detected. The c.r.o. time-base is set at 5 ms per division.

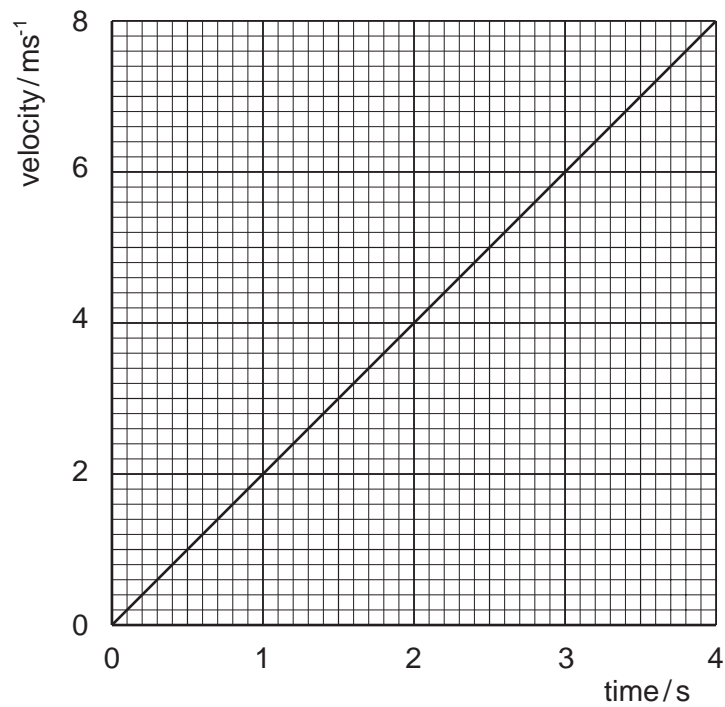


What is the period of the signal shown?

- A 10 ms B 15 ms C 20 ms D 30 ms

Space for working

- 3 The velocity of an object during the first four seconds of its motion is shown on the graph.



What is the distance travelled by the object in this time?

- A** 2 m **B** 8 m **C** 16 m **D** 32 m
- 4 In which of the processes is there a decrease in the internal energy of the substance?
- A** boiling at a constant temperature
B condensing at a constant temperature
C evaporating at a constant temperature
D melting at a constant temperature

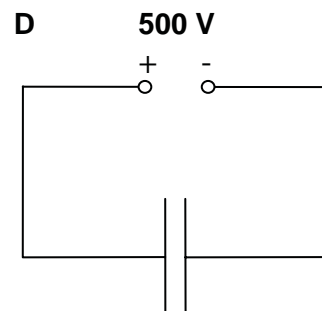
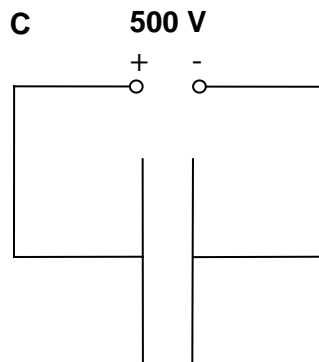
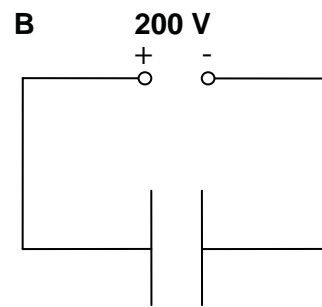
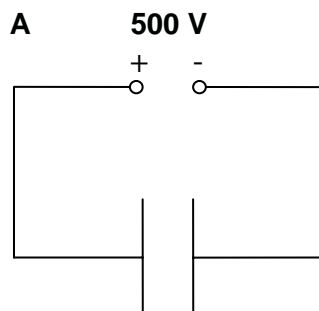
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- 5 A sound wave has a speed of 320 m s^{-1} and a frequency of 250 Hz . Two points have a phase difference of $\pi/2 \text{ rad}$.

What is the distance between the two points?

- A 0.20 m
- B 0.32 m
- C 0.64 m
- D 1.28 m

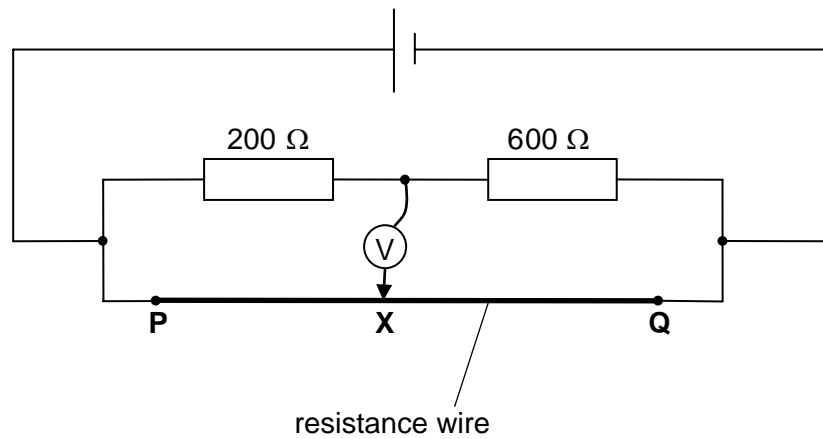
- 6 The diagrams show parallel metal plates connected to a high tension voltage supply.



In which diagram is the electric field between the plates the greatest?

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7 The diagram shows a potential divider.



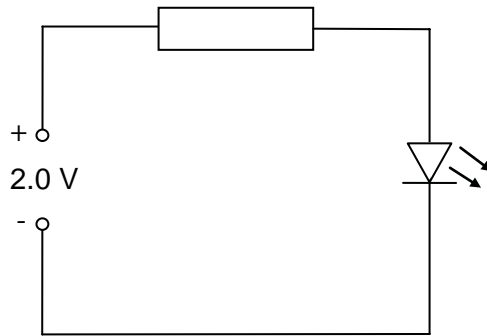
PQ is a uniform resistance wire of length 100 cm. The position of the contact **X** is adjusted so that the reading on the voltmeter is zero.

What is the distance **PX**?

- A 25.0 cm
- B 33.3 cm
- C 66.7 cm
- D 75.0 cm

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- 8 The diagram shows a circuit which contains a light-emitting diode (LED).



The LED has a working resistance of 900Ω .

There is a safety resistor of resistance 100Ω in the circuit.

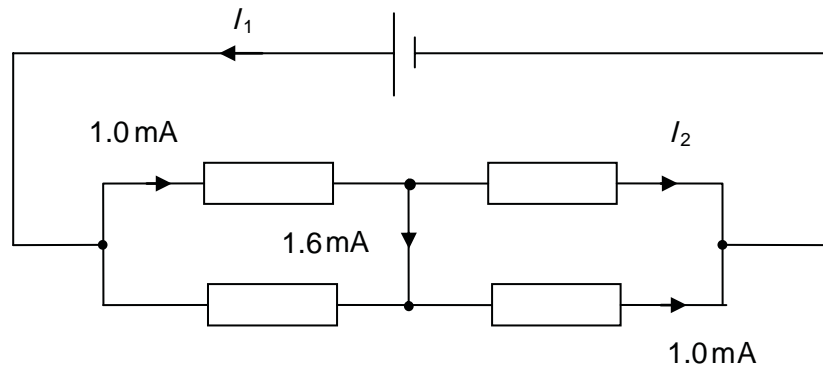
The power supply has an e.m.f. of 2.0V and negligible internal resistance.

At what rate does the LED dissipate energy?

- A 0.2mW
- B 3.6mW
- C 4.0mW
- D 4.4mW

Space for working

9 The diagram represents a circuit.



Some currents are shown on the diagram.

What are the currents I_1 and I_2 ?

	I_1	I_2
A	1.8mA	0.6mA
B	1.8mA	-0.6mA
C	3.0mA	0.6mA
D	3.0mA	-0.6mA

Space for working

- 10 A nucleus of lead, ${}_{82}^{212}\text{Pb}$, decays multiple times, emitting two β -particles and one α -particle.

How many protons and neutrons are present in the stable nucleus produced at the end of this decay chain?

	protons	neutrons
A	76	132
B	76	208
C	82	125
D	82	126

- 11 A mixture of 10cm^3 of methane and 10cm^3 of ethane was sparked with an excess of oxygen. After cooling to room temperature, the residual gas was passed through aqueous potassium hydroxide.

What volume of gas was absorbed by the alkali?

- A** 15cm^3
- B** 20cm^3
- C** 30cm^3
- D** 40cm^3

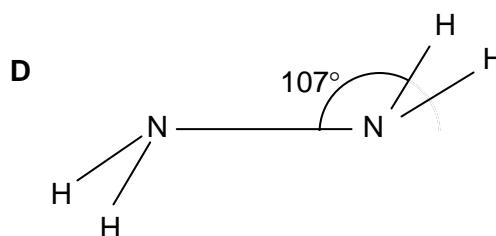
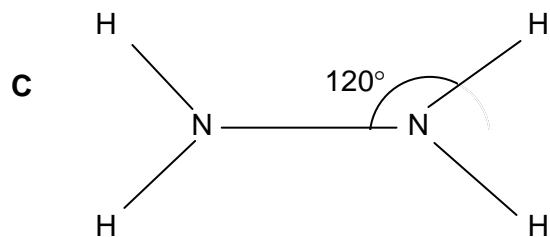
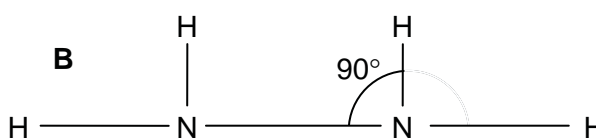
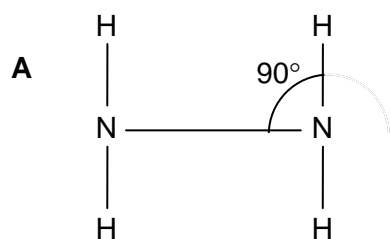
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- 12 The African weaver ant defends its territory by spraying an intruder with a mixture of compounds. The ease by which these compounds are detected by other ants depends upon the volatility. Volatility increases as the strength of the intermolecular forces in the compound decreases.

Which compound would be the most volatile?

- A $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$
 B $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CHO}$
 C $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$
 D $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$

- 13 Which is the most likely shape of a molecule of hydrazine, N_2H_4 ?



Space for working

14 Which of the following exists in the solid state as a giant covalent lattice?

- A ice
- B iodine
- C silicon(IV) oxide
- D aluminium oxide

15 The successive ionisation energies, in kJ mol^{-1} , of an element **X** are given below.

1012 1903 2912 4957 6274 21269 25398

What is the electron configuration of an atom of **X**?

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

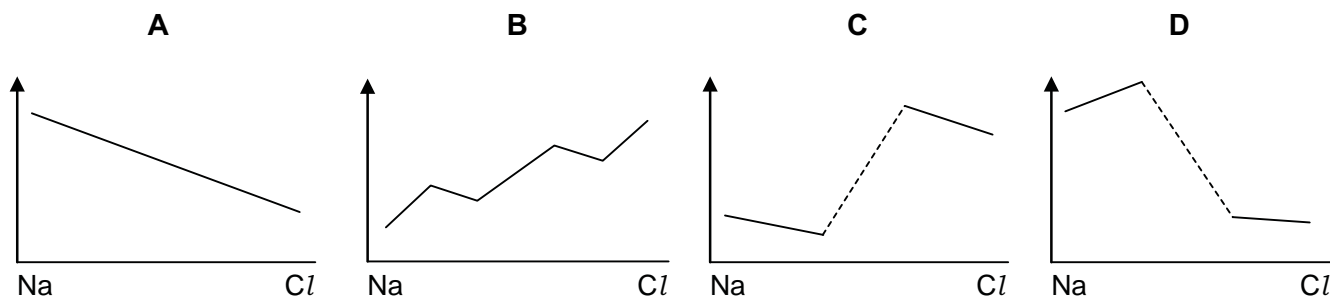
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- 16 A piece of zinc foil dissolved completely in 20cm^3 of a dilute sulfuric acid solution, and the volume of hydrogen evolved was noted at equal, short time intervals. Another piece of zinc foil of the same surface area and mass was added to 40cm^3 of the same solution of dilute sulphuric acid.

How will the initial rate of reaction and the total volume of hydrogen evolved in this second experiment compare to the first experiment?

	<i>initial rate of reaction</i>	<i>total volume of hydrogen evolved</i>
A	no change	decrease
B	no change	no change
C	increase	no change
D	increase	increase

- 17 Which diagram represents the change in ionic radius of the elements across the third period (Na to Cl)?



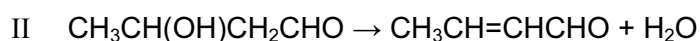
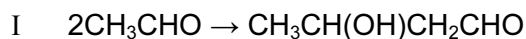
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- 18 The propellant used in the solid rocket booster of a space shuttle is a mixture of aluminium and compound **X**. Compound **X** contains chlorine in an oxidation state of +7.

Which of the following could be compound **X**?

- A** NH_4Cl **B** NH_4ClO_3 **C** NH_4ClO_4 **D** $\text{N}_2\text{H}_5\text{Cl}$

- 19 The Russian composer Borodin was also a research chemist who discovered a reaction in which two ethanal molecules combine to form a compound commonly known as aldol (reaction I). Aldol forms another compound on heating (reaction II).



Which of the following best describes reactions I and II?

- | | I | II |
|----------|--------------|-------------|
| A | addition | elimination |
| B | addition | reduction |
| C | elimination | reduction |
| D | substitution | elimination |

- 20 Chloroethane is used as a starting material for the production of 'time-release capsules' in pharmaceutical products. One way of preparing chloroethane is to react chlorine and ethane in the presence of ultraviolet light.

Which statement is correct about the **first** stage of the mechanism of this reaction?

- A** The $\text{Cl}-\text{Cl}$ bond is split homolytically.
B The $\text{Cl}-\text{Cl}$ bond is split heterolytically.
C The $\text{C}-\text{H}$ bond is split homolytically.
D The $\text{C}-\text{H}$ bond is split heterolytically.

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Section B

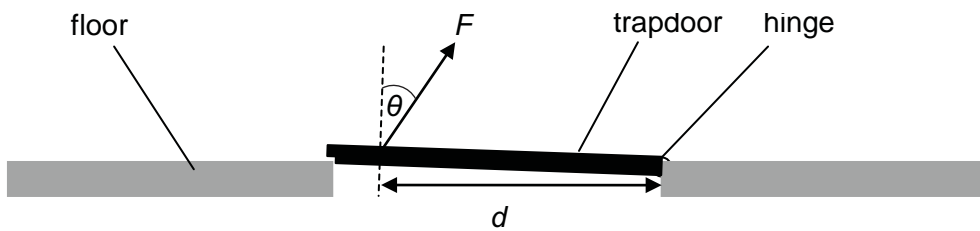
For each of the questions in this section, one or more of the numbered statements 1 to 4 may be correct.

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

- 21 A force F is applied to a trapdoor of mass M at a distance d from the hinge. The force acts at an angle θ to the perpendicular to the door.



Which changes will decrease the magnitude of the resultant moment at the hinge?

- 1 Increase the force F .
- 2 Increase the angle θ .
- 3 Increase the distance d .
- 4 Increase the mass of the trapdoor M .

Space for working

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

22 A student is demonstrating the interference of light.

Which of the following conditions **must** be satisfied for interference fringes to be to be observed?

- 1 The sources must be coherent.
- 2 The sources must be in phase.
- 3 The sources must have the same frequency.
- 4 The sources must have the same amplitude.

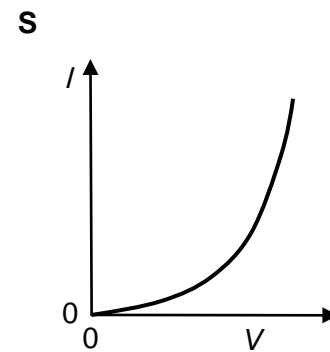
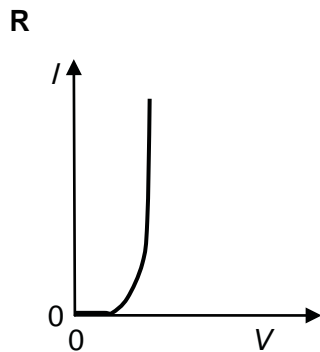
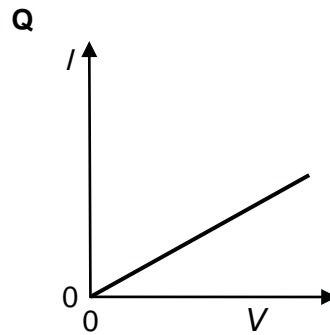
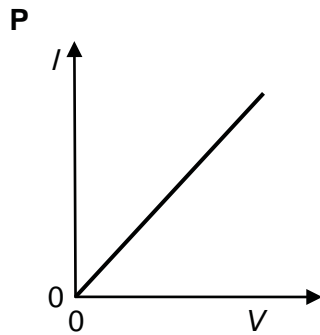
23 A student uses his understanding of molecules to explain the properties of solids, liquids and gases.

Which of his explanations are correct?

- 1 Solids are rigid because the molecules in a solid vibrate.
- 2 Liquids flow because the molecules in a liquid are closer than in a gas.
- 3 Gases are less dense than liquids because the molecules in a gas move randomly.
- 4 Solids, liquids and gases become less dense when heated because the average separation of the molecules increases.

Space for working

- 24 The graphs show the $I - V$ characteristics of four components.
All the graphs are drawn to the same scale.



Which statements are correct?

- 1 Graph **P** is the characteristic of a metallic resistor at a constant temperature.
- 2 Graph **Q** is the characteristic of a similar component to **P** but of lower resistance.
- 3 Graph **R** is the characteristic of a diode.
- 4 Graph **S** is the characteristic of a filament of a lamp.

Space for working

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

25 Which statements about β -particles are correct?

- 1 A β -particle has a charge of -1.60×10^{-19} C.
- 2 A β -particle is a fast moving electron.
- 3 When β -particles travel through air they cause ionisation.
- 4 A β -particle travels at the speed of light.

26 Which of the following are features of the structure of metallic copper?

- 1 delocalised electrons
- 2 ionic bonds
- 3 lattice of ions
- 4 dipole-dipole attractions

27 Which statements about the commercial extraction of aluminium are correct?

- 1 The anode reaction is $Al^{3+} + 3e^{-} \rightarrow Al$.
- 2 The lining of the electrolytic cell acts as the cathode.
- 3 The electrolyte is pure molten Al_2O_3 .
- 4 The high cost of the process is due to the massive amount of electricity it uses.

28 Which compounds show *cis-trans* isomerism?

- 1 2-methylpropene
- 2 2-methylbut-2-ene
- 3 but-1-ene
- 4 but-2-ene

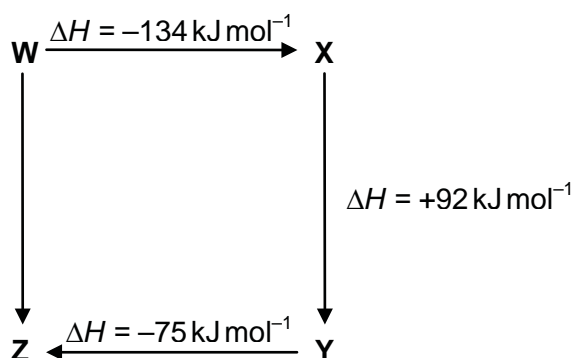
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29 There is a trend in the electronegativity values of the period 3 elements Na to Cl.

Electronegativity increases across period 3 because

- 1 there is a decrease in the size of the atoms from Na to Cl,
- 2 there is an increase in shielding from Na to Cl,
- 3 there is an increase in the proton number from Na to Cl,
- 4 there is an increase in the attraction between the nucleus and the outer electrons from Na to Cl.

30 The diagram illustrates the enthalpy changes of a set of reactions.



Which of the following statements are correct?

- 1 The enthalpy change for the transformation $\mathbf{Z} \rightarrow \mathbf{X}$ is endothermic.
- 2 The enthalpy change for the transformation $\mathbf{W} \rightarrow \mathbf{Z}$ is -33 kJ mol^{-1} .
- 3 The enthalpy change for the transformation $\mathbf{X} \rightarrow \mathbf{Z}$ is -17 kJ mol^{-1} .
- 4 The enthalpy change for the transformation $\mathbf{Y} \rightarrow \mathbf{W}$ is $+42 \text{ kJ mol}^{-1}$.

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