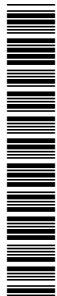**PHYSICAL SCIENCE** **8780/01**

Paper 1 Multiple Choice **October/November 2015**

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, 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.

DO **NOT** WRITE IN ANY BARCODES.

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 **12** printed pages.

International Examinations **[Turn over**

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   Z is the product of two lengths, X and Y.
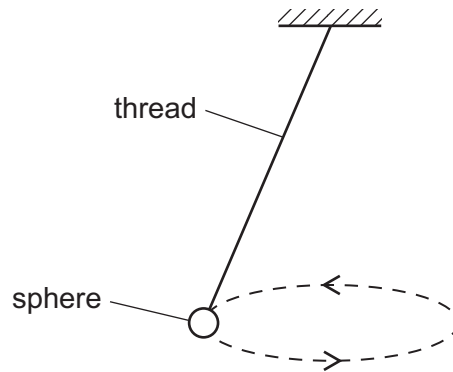
Which values of X and Y will give the highest value for Z?

	X	Y
A	100 µm	1.0 Gm
B	10 mm	0.01 Gm
C	0.1 km	1.0 Mm
D	0.1 µm	1.0 Tm

2   A voltmeter with a zero error is used to take a series of readings.
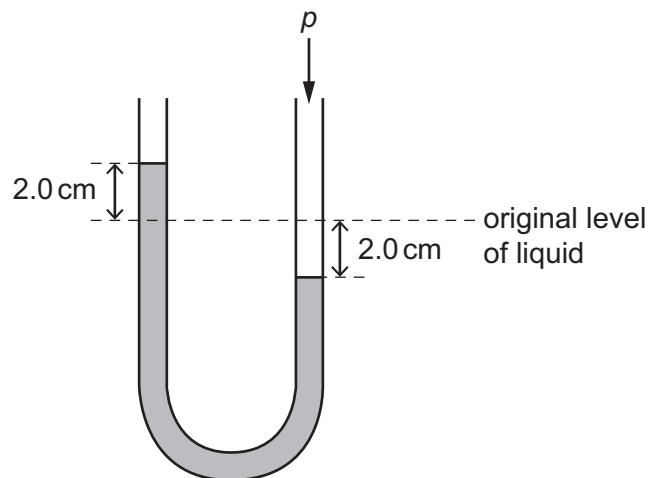
What is affected by the zero error?

A   both the precision and accuracy of the readings

B   neither the precision nor the accuracy of the readings

C   only the accuracy of the readings

D   only the precision of the readings

3   What is the definition of force?

A   power divided by velocity

B   pressure multiplied by area

C   rate of change of momentum

D   work done divided by displacement

4   What is meant by the term *centre of gravity* of a body?

A   the geometrical centre of a body

B   the point at which the weight of a body may be taken to act

C   the point on a body about which there is no resultant moment

D   the point on a body where gravity acts

5 The diagram shows a sphere supported by a thread. The sphere moves at constant speed in a circular, horizontal path.

thread

sphere

Which separate forces are acting on the sphere?

A   the gravitational force and the centripetal force only

B   the gravitational force and the tension in the thread only

C   the gravitational force, the tension in the thread and the centripetal force

D   the tension in the thread and the centripetal force only

6 The diagram shows a U-tube filled with a liquid of density $800 \, kg \, m^{-3}$.

p

2.0 cm

2.0 cm

original level
of liquid

The left-hand side of the U-tube is open to the atmosphere. A pressure p is applied to the right-hand side causing a vertical movement of 2.0 cm in the liquid on each side of the U-tube.

By which amount does the value of p exceed atmospheric pressure?

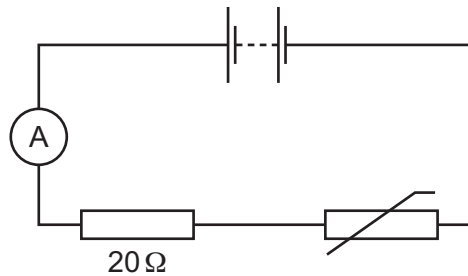A   31.4 kPa   B   15.7 kPa   C   314 Pa   D   157 Pa

7 In an experiment to demonstrate diffraction, water waves move through a gap in a barrier. Very little diffraction is observed.

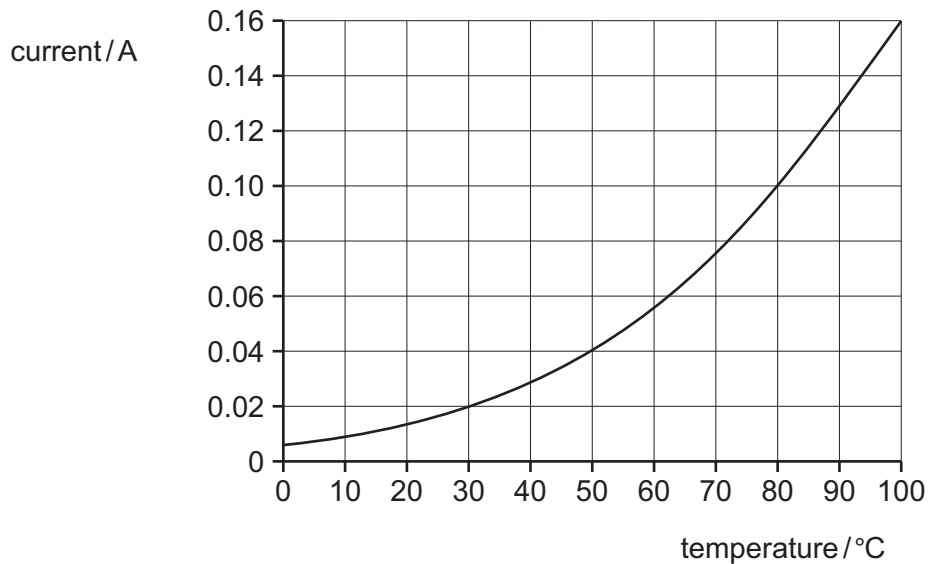To increase the amount of diffraction, the gap width and the wavelength can be changed.

Which row will definitely increase the diffraction?

	gap width	wavelength
A	larger	longer
B	larger	shorter
C	smaller	longer
D	smaller	shorter

8 A thermistor is connected in series with a resistor of resistance $20\,\Omega$, an ammeter and a 6.0 V battery of negligible internal resistance.
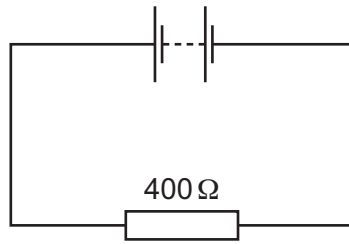

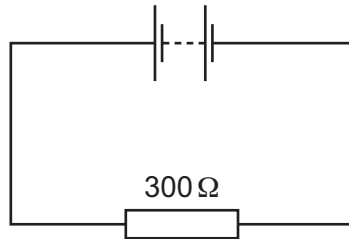The graph shows the variation of current in the circuit with the temperature of the thermistor.

What is the resistance of the thermistor at $80\,°C$?

A $80\,\Omega$ **B** $60\,\Omega$ **C** $40\,\Omega$ **D** $20\,\Omega$

9 The circuit diagram shows a battery of negligible internal resistance connected to a 400 Ω resistor. Power *P* is dissipated in the resistor.
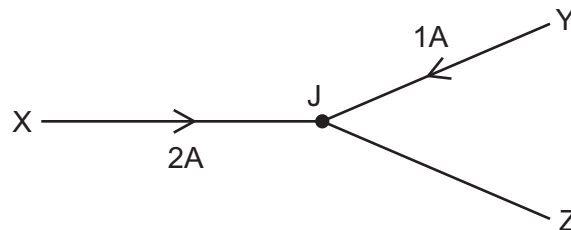
400 Ω

The same battery is connected to a 300 Ω resistor.

300 Ω

What is the power dissipated in the 300 Ω resistor?

A $\left(\dfrac{9}{16}\right)P$ B $\left(\dfrac{3}{4}\right)P$ C $\left(\dfrac{4}{3}\right)P$ D $\left(\dfrac{16}{9}\right)P$

10 The diagram shows a junction J in an electric circuit where three conductors X, Y and Z meet. The diagram also shows the magnitudes and directions of the currents in X and Y.

What is the magnitude and direction of the current in Z?

	magnitude	direction
A	1A	away from J
B	1A	towards J
C	3A	away from J
D	3A	towards J

11 Which solution will form a white precipitate when mixed with aqueous sodium hydroxide?

A $MgCl_2(aq)$

B $H_2SO_4(aq)$

C $HCl(aq)$

D $BaCl_2(aq)$

12 A student has a pure sample of a calcium compound. It is a white solid. He knows it is **either** calcium carbonate **or** calcium nitrate, but he doesn't know which. He heats the white solid in a test-tube, and he sees that a brown gas is produced.

Which other observation could be made during this experiment?

A If he bubbles the gas into limewater it will go milky.

B If he puts a glowing splint in the test-tube it will relight.

C If he puts a lighted splint in the test-tube it will immediately go out.

D There is no solid remaining in the test-tube when he stops the heating.
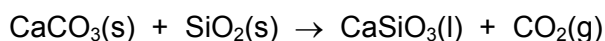
13 Aqueous silver nitrate, followed by dilute ammonia, is added to solutions of sodium chloride and sodium iodide.

Which row is correct?

	sodium salt	colour of precipitate	solubility in $NH_3(aq)$
A	$NaCl(aq)$	white	soluble
B	$NaCl(aq)$	yellow	insoluble
C	$NaI(aq)$	white	insoluble
D	$NaI(aq)$	yellow	soluble

14 The ideal gas equation, $pV = nRT$, is relevant to this question.

Limestone is used to remove silicon dioxide in a blast furnace. The reaction involved is represented by the equation shown.

$$CaCO_3(s) + SiO_2(s) \rightarrow CaSiO_3(l) + CO_2(g)$$

Which volume of CO_2, measured at 298 K and 101 kPa, is formed in this reaction when 24.0 kg of SiO_2 is removed?

A $9.79\,m^3$ **B** $19.6\,m^3$ **C** $588\,m^3$ **D** $9791\,m^3$

15 Which statement about the Group VII elements and ions is correct?

A The elements become more volatile down Group VII.

B The oxidising power of the halide ions increases down Group VII.

C When chlorine reacts with cold aqueous sodium hydroxide, the oxidation number of all chlorine atoms changes from 0 to +1.

D When chlorine reacts with cold water, the oxidation number of chlorine changes from 0 to +1 and from 0 to –1.

16 Which equation represents the reaction whose enthalpy change is equal to the second ionisation energy of aluminium?

A $Al(g) \rightarrow Al^{2+}(g) + 2e^-$

B $Al(s) \rightarrow Al^{2+}(s) + 2e^-$

C $Al^+(g) \rightarrow Al^{2+}(g) + e^-$

D $Al^+(s) \rightarrow Al^{2+}(s) + e^-$

17 The exhaust gases of a petrol-fuelled internal combustion engine contain nitrogen monoxide, NO. Nitrogen monoxide is an atmospheric pollutant.

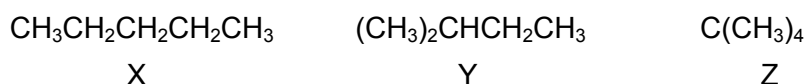How can the percentage of nitrogen monoxide in the exhaust gases from the engine be **lowered**?

A Cool the exhaust gases before releasing them into the air.

B Increase the amount of air taken in by the engine.

C Increase the operating temperature of the engine.

D Pass the exhaust gases through a catalytic convertor before releasing them into the air.

18 Solid sulfur consists of S_8 molecules.

Which equation represents the reaction whose enthalpy change is equal to the standard enthalpy change of formation of sulfur trioxide?

A $\frac{1}{8}S_8(s) + 1\frac{1}{2}O_2(g) \rightarrow SO_3(l)$

B $\frac{1}{4}S_8(s) + 3O_2(g) \rightarrow 2SO_3(l)$

C $S(s) + 3O(g) \rightarrow SO_3(l)$
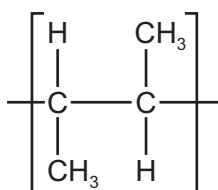
D $SO_2(g) + \frac{1}{2}O_2(g) \rightarrow SO_3(l)$

19 Each of the following three alkanes, X, Y and Z, can be converted into bromoalkanes of molecular formula $C_5H_{11}Br$.

$$CH_3CH_2CH_2CH_2CH_3 \qquad (CH_3)_2CHCH_2CH_3 \qquad C(CH_3)_4$$
$$\text{X} \qquad\qquad\qquad \text{Y} \qquad\qquad\qquad \text{Z}$$

In which row are these alkanes shown in increasing order of the number of $C_5H_{11}Br$ isomers they could form?

	least $C_5H_{11}Br$ isomers	$\longrightarrow$	most $C_5H_{11}Br$ isomers
A	X	Y	Z
B	X	Z	Y
C	Z	X	Y
D	Z	Y	X

20 Polymerisation is an extremely important reaction of alkenes. The structure shown is the repeat unit for a common addition polymer.

What is the name of the monomer from which this polymer is formed?

A butane

B but-1-ene

C but-2-ene

D 2-methylpropene

Section B

For each of the questions in this section, one or more of the four numbered statements **1** to **4** may be correct.
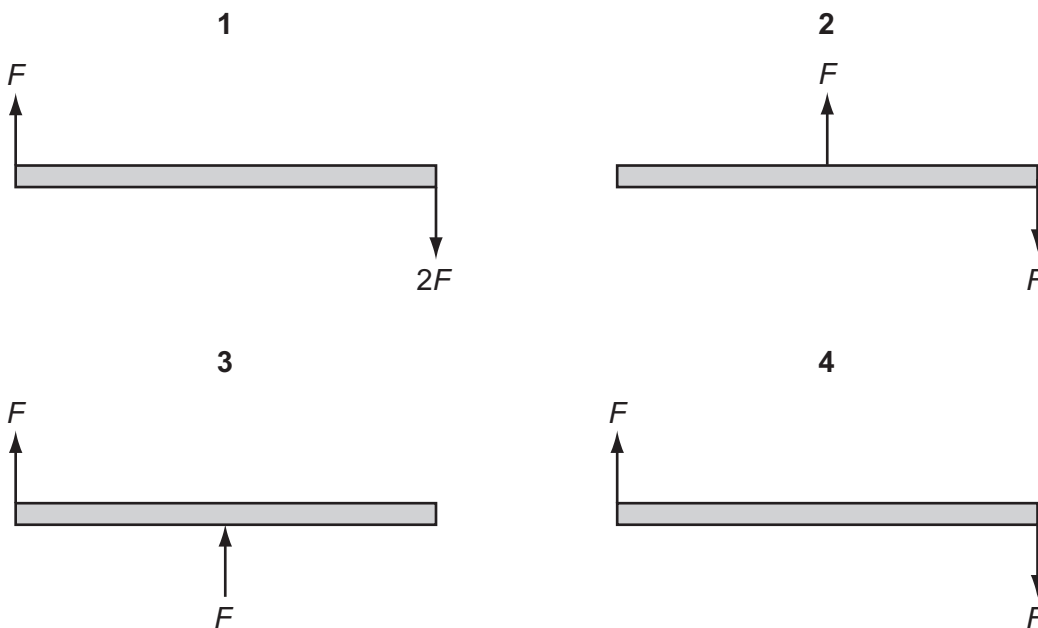
Decide whether each of the statements is or is not correct (you may find it helpful to put a tick against the statements that you consider to be correct).

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 diagrams show only a couple is acting on an object?

22 A fixed mass of gas in a container of fixed volume is heated. The pressure in the container increases.

Which statements help to explain the increase in pressure of the gas on the walls of the container?

1 The mean speed of the molecules increases.

2 There are more collisions between molecules and the container walls per unit time.

3 On average, there is a greater change of momentum when molecules collide with the walls.

4 The mean intermolecular spacing increases.

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

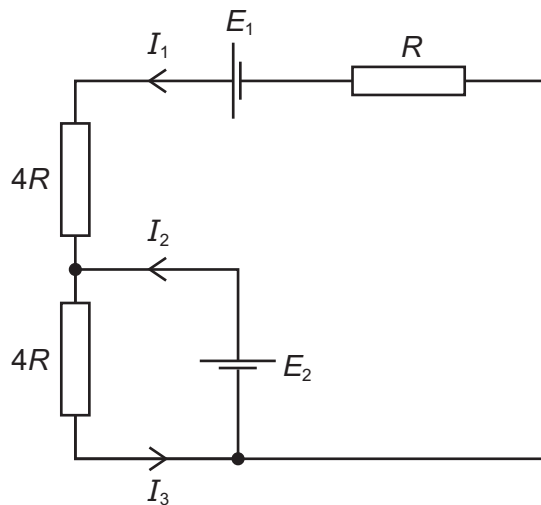| A	B	C	D
1, 2 and **3** only are correct	**1** and **3** only are correct	**2** and **4** only are correct	**4** only is correct

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

23 Which properties of two overlapping light waves are necessary for interference fringes to be observed?

1 equal frequency

2 in phase

3 coherent

4 equal amplitude

24 The circuit diagram shows two cells of electromotive force (e.m.f.) E_1 and E_2 that give rise to current I_1, I_2 and I_3 in a network of resistors.

The resistors have resistances $4R$ and R.

Which equations are correct?

1 $4I_3R + 5I_1R = 0$

2 $E_1 = 5I_1R + E_2$

3 $E_1 = 9I_1R$

4 $E_2 = 4I_3R$

25 A sample of radon gas undergoes radioactive decay.

Which statements give evidence for the random nature of the decay?

1 The count rate decreases with time.

2 The count rate is not affected by a change in pressure of the sample.

3 The count rate is not affected by a change in temperature of the sample.
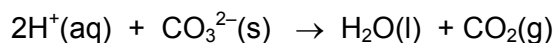
4 The count rate fluctuates.

26 Aluminium is extracted from aluminium oxide by electrolysis. Impure copper is purified by electrolysis.

Which statements apply to **both** these industrial processes?

1 The anode is made of a non-metal.

2 The electrolyte is an aqueous solution.

3 The anode remains unchanged throughout the process.

4 Metal ions are reduced at the cathode.

27 A beaker is half-filled with $0.50\,mol\,dm^{-3}$ hydrochloric acid. Four large marble chips are added to the beaker and they react with the acid at a steady rate. Marble contains calcium carbonate.

The reaction involved is represented by the equation shown.

$$2H^+(aq) + CO_3^{2-}(s) \rightarrow H_2O(l) + CO_2(g)$$

The experiment is repeated under identical conditions, except that water is added to the acid at the same time as the four marble chips. The water is at the same temperature as the acid. The rate of reaction is slower than it was in the first experiment.

Why is the rate of the reaction slower in the second experiment?

1 The H^+ ions in the acid are further apart.

2 Collisions between reacting species are less frequent.

3 There are fewer H^+ ions per cm^3 of solution.

4 Fewer H^+ ions possess the activation energy.

28 Which reactions would give propanoic acid as one of the products?

1 adding Tollens' reagent to propanone and warming

2 heating propan-2-ol under reflux with acidified potassium dichromate solution

3 adding aqueous $NaBH_4$ to propanal

4 boiling propanenitrile with dilute sulfuric acid

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 2-bromopropane reacts with sodium hydroxide dissolved in ethanol.

Which statements about this reaction are correct?

1 An elimination reaction takes place.

2 Nucleophilic substitution is the only reaction that takes place.

3 The main organic product of the reaction is propene.

4 The main organic product of the reaction is propan-2-ol.

30 Methyl lithium, $LiCH_3$, is a reagent used in organic synthesis. It is thought to react by generating CH_3^- ions, which can act as nucleophiles.

Which compounds will be attacked by CH_3^- ions?

1 ethane

2 bromoethane

3 ethene

4 1-bromo-2-chloroethane