



PHYSICAL SCIENCE

0652/22

Paper 2 Multiple Choice (Extended)

October/November 2019

45 minutes

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

* 3 6 8 1 7 8 5 9 2 6 *

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 **forty** 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.

A copy of the Periodic Table is printed on page 16.

Electronic calculators may be used.

This document consists of **15** printed pages and **1** blank page.

- 1 Carbon dioxide is a solid at temperatures below $-78\text{ }^{\circ}\text{C}$.

What is **not** a property of solid carbon dioxide?

- A It has a fixed shape.
- B It is incompressible.
- C Its particles are very close together.
- D Its particles slide past each other.

- 2 Which process is used to separate the components of petroleum?

- A chromatography
- B crystallisation
- C filtration
- D fractional distillation

- 3 Magnesium oxide is a compound formed from a metal and a non-metal.

Which statement describes the bonding in magnesium oxide?

- A Magnesium and oxygen atoms share their outer shell electrons.
- B Magnesium atoms gain electrons and oxygen atoms lose electrons.
- C Magnesium atoms lose electrons and oxygen atoms gain electrons.
- D The magnesium atoms and oxygen atoms both gain electrons.

- 4 Diamond and graphite are both forms of the element carbon.

They have macromolecular structures.

Some properties are listed.

- 1 high melting point
- 2 each carbon forms four covalent bonds
- 3 conducts electricity
- 4 hard

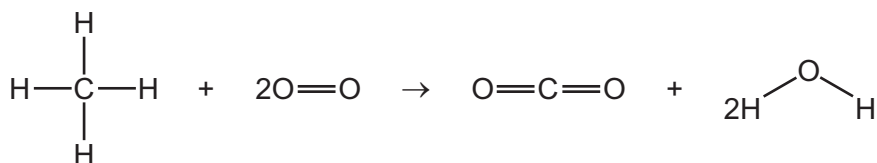
Which of these are the properties of diamond?

- A 1, 2 and 4 only B 1 and 4 only C 2 and 3 only D 3 and 4 only

- 5 Chromium(III) sulfate is made of chromium(III) ions, Cr^{3+} , and sulfate ions, SO_4^{2-} .

What is the formula of chromium(III) sulfate?

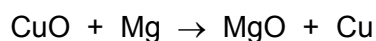
- A CrSO_4 B $\text{Cr}_2(\text{SO}_4)_3$ C Cr_3SO_4 D $\text{Cr}_3(\text{SO}_4)_2$
- 6 What is the relative formula mass, M_r , of aluminium oxide Al_2O_3 ?
- A 43 B 50 C 102 D 113
- 7 Methane reacts with oxygen to form carbon dioxide and water. Heat is given out during the reaction.



Which row identifies the number of bonds that are broken and the type of process when the bonds are broken?

	bonds broken	type of process when the bonds are broken
A	2C=O and 4O-H	endothermic
B	2C=O and 4O-H	exothermic
C	4C-H and 2O=O	endothermic
D	4C-H and 2O=O	exothermic

- 8 The equation for the reaction of magnesium with copper(II) oxide is shown.



Which statement is correct?

- A Copper(II) oxide is oxidised.
- B Copper(II) oxide is reduced.
- C Magnesium oxide is oxidised.
- D Magnesium oxide is reduced.

9 Which row describes metallic and non-metallic oxides?

	metallic oxides	non-metallic oxides
A	acidic	basic
B	amphoteric or basic	acidic or neutral
C	amphoteric only	acidic only
D	basic only	acidic only

10 How are elements with one electron in their outer shell described?

- A** Group I metals
- B** Group I non-metals
- C** Group VII metals
- D** Group VII non-metals

11 Lithium has a lower density than sodium. Sodium is more reactive than lithium.

Which sentence predicts the properties of the Group I element, rubidium?

- A** It is less dense and less reactive than sodium.
- B** It is less dense and more reactive than sodium.
- C** It is more dense and less reactive than sodium.
- D** It is more dense and more reactive than sodium.

12 Which element is mixed with copper to make brass?

- A** argon
- B** carbon
- C** iodine
- D** zinc

13 An element, Y, reacts with aqueous copper sulfate and copper is produced.

The same element does not react with aqueous zinc sulfate.

What is the position of Y in the reactivity series?

- A above zinc and above copper
- B above zinc and below copper
- C below zinc and above copper
- D below zinc and below copper

14 Which reaction in the extraction of iron from hematite is **not** a redox reaction?

- A $C + O_2 \rightarrow CO_2$
- B $C + CO_2 \rightarrow 2CO$
- C $CaCO_3 \rightarrow CaO + CO_2$
- D $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

15 Which substance is used as a chemical test for water?

- A anhydrous copper(II) sulfate
- B hydrated cobalt(II) chloride
- C hydrated copper(II) sulfate
- D pink cobalt(II) chloride

16 Which fuel does **not** produce carbon dioxide during complete combustion?

- A coal
- B hydrogen
- C natural gas
- D petroleum

17 Which statements about members of the same homologous series are correct?

- 1 They have the same ending to their name.
- 2 They have the same functional group.
- 3 They have the same molecular formula.
- 4 They have the same relative molecular mass.

- A 1 and 2
- B 1 and 4
- C 2 and 3
- D 3 and 4

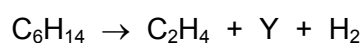
18 Which statements about the alkanes are correct?

- 1 They are generally unreactive except in terms of burning.
- 2 They burn in air to produce carbon dioxide and water.
- 3 They contain carbon to carbon double bonds.
- 4 They decolourise bromine water.

A 1, 2 and 3 only **B** 1 and 2 only **C** 1, 3 and 4 only **D** 2 and 4 only

19 When hexane is heated in the presence of a catalyst, it decomposes to give ethane, hydrogen and another hydrocarbon Y.

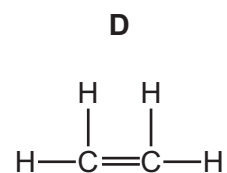
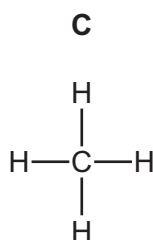
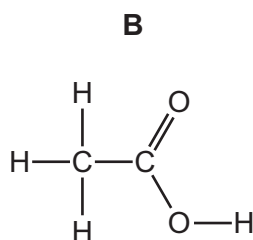
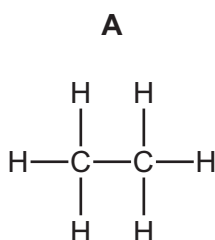
The equation for the reaction is shown.



Which type of hydrocarbon is Y and what is its formula?

	type of hydrocarbon	formula
A	alkane	C_4H_8
B	alkane	C_4H_{10}
C	alkene	C_4H_8
D	alkene	C_4H_{10}

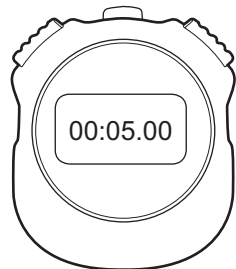
20 Which structure represents an unsaturated hydrocarbon?



- 21 A student carries out an experiment to determine the period of a simple pendulum.

The student starts counting oscillations when the stopwatch reads 5.00 s and stops the stopwatch at the end of the 20th oscillation.

The diagram shows the stopwatch when the student starts counting oscillations and at the end of 20 oscillations.



stopwatch when counting starts



stopwatch at the end of 20 oscillations

What is the period of the pendulum?

- A** 0.25 s **B** 0.82 s **C** 1.07 s **D** 1.32 s

- 22 A light ball is dropped from rest from a high cliff.

Which row shows what happens after the ball is dropped and before it reaches terminal velocity?

	speed of ball	acceleration of ball
A	decreases	decreases
B	decreases	remains constant
C	increases	decreases
D	increases	remains constant

- 23 Three properties of a body are its mass, its shape and its size.

Which row correctly shows whether these properties can be changed by a force?

	mass	shape	size
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✓	✓

key

✓ = can be changed

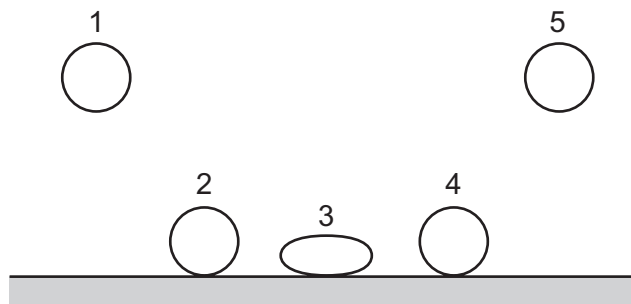
✗ = cannot be changed

- 24 A force F acts on an object that moves in a straight line through a distance d .

The change in energy of the object is equal to $F \times d$.

Which statement **must** be correct?

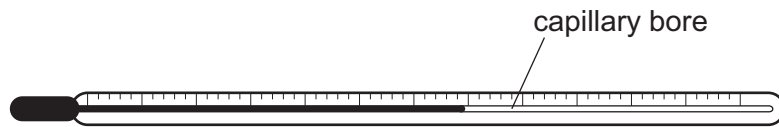
- A F is in the same direction as d .
 - B F is perpendicular to d .
 - C The object gains gravitational potential energy.
 - D The object is moving at constant speed.
- 25 The diagram shows a number of stages of a soft ball bouncing.



Between which two stages does the kinetic energy transfer to elastic (strain) energy?

- A 1 to 2
 - B 2 to 3
 - C 3 to 4
 - D 4 to 5
- 26 A ball is thrown vertically upwards with a speed of 5.00 m/s.
- All of the ball's initial kinetic energy is transferred into gravitational potential energy.
- What is the maximum height reached by the ball?
- The acceleration of free fall is 10.0 m/s^2 .
- A 0.250 m
 - B 1.25 m
 - C 2.50 m
 - D 12.5 m

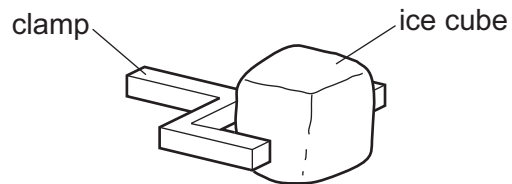
- 27 The internal diameter of the capillary bore of a thermometer is increased.



How does this affect the range and the sensitivity of the thermometer?

	range	sensitivity
A	increased	decreased
B	increased	increased
C	no change	decreased
D	no change	increased

- 28 An ice cube is held in a clamp. The air next to the ice cube becomes very cold.



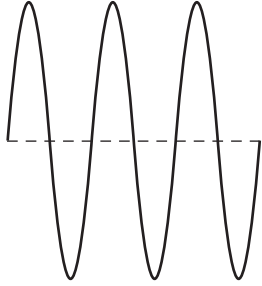
What happens to the density of the air as the air becomes colder and in which direction does the cold air move?

	density change of the air	direction the air moves
A	decreases	downwards
B	decreases	upwards
C	increases	downwards
D	increases	upwards

- 29 The diagrams represent water waves in a deep pond. The diagrams are all drawn to the same scale and the waves are all moving with the same speed.

Which diagram shows the wave with the highest frequency?

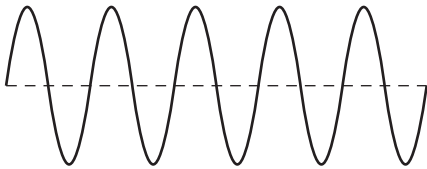
A



B



C



D



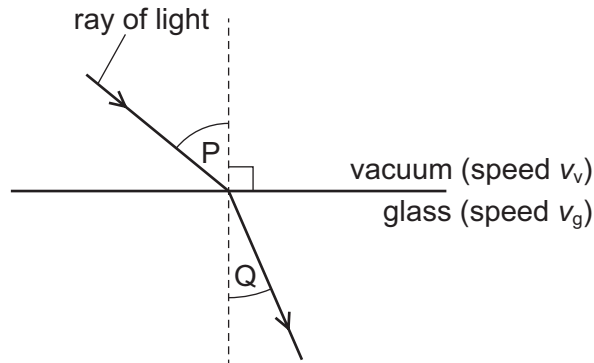
30 The speed of light in a vacuum is v_v .

The speed of light in glass is v_g .

Light passes from a vacuum into glass.

The diagram shows the change in direction of the light.

Angles P and Q are labelled.



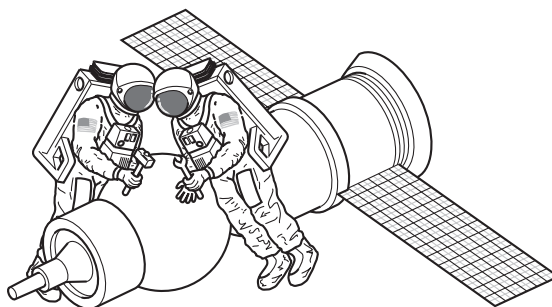
Which row compares v_v with v_g and gives an expression for the refractive index of the glass?

	speeds	refractive index
A	$v_v < v_g$	$\frac{\sin P}{\sin Q}$
B	$v_v < v_g$	$\frac{\sin Q}{\sin P}$
C	$v_v > v_g$	$\frac{\sin P}{\sin Q}$
D	$v_v > v_g$	$\frac{\sin Q}{\sin P}$

31 What is the approximate speed of electromagnetic waves in air?

- A** 3×10^2 m/s **B** 3×10^4 m/s **C** 3×10^6 m/s **D** 3×10^8 m/s

- 32 Two astronauts without radios can only communicate in space if their helmets are touching. There is no air in space.



What does this show about sound?

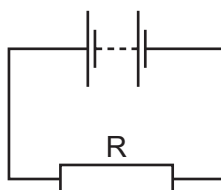
- A It can travel through a solid and a vacuum.
 B It can travel through a solid but cannot travel through a vacuum.
 C It cannot travel through a solid but can travel through a vacuum.
 D It cannot travel through either a solid or a vacuum.
- 33 In 2.0 hours, a charge of 5000 C flows at a constant rate past a point in a circuit.

What is the current in the circuit?

- A 0.69 A B 42 A C 2500 A D 10 000 A
- 34 The current in a battery is 5.00 A. The battery supplies 2.70 kJ of energy in 1.0 minute.

What is the e.m.f. of the battery?

- A 0.540 V B 9.00 V C 13.5 V D 32.4 V
- 35 A circuit contains a battery and a resistor R.

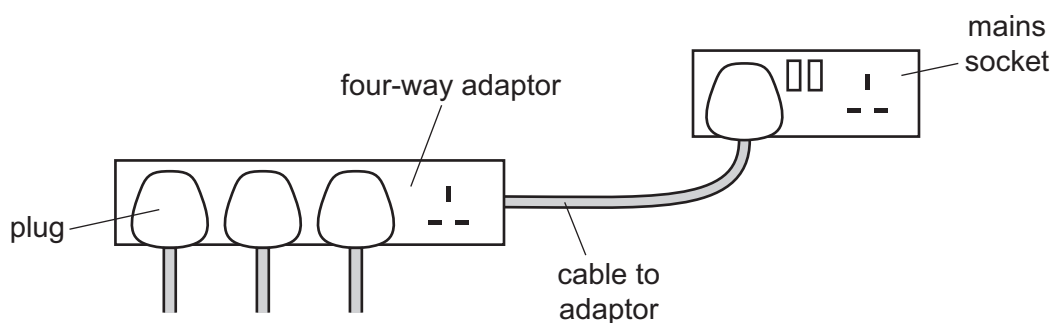


Another resistor is now added in series with R.

Which statement is correct?

- A The e.m.f. of the battery decreases.
 B The e.m.f. of the battery increases.
 C The p.d. across R decreases.
 D The p.d. across R increases.

- 36 A four-way adaptor is connected by a cable to the mains supply. The cable is protected by a 13A fuse.



Which use of the adaptor causes the fuse protecting the cable to 'blow'?

	number of plugs used	current in plugs
A	1	12 A
B	2	10 A and 10 A
C	3	3 A, 4 A and 5 A
D	4	2 A, 2 A, 3 A and 3 A

- 37 In a transformer, how is an e.m.f. induced across the secondary coil?
- A** The primary coil and the secondary coil are connected in parallel.
- B** The primary coil and the secondary coil are connected in series.
- C** The primary coil produces a changing magnetic field that links to the secondary coil.
- D** The primary coil produces a constant magnetic field that links to the secondary coil.
- 38 A current-carrying coil experiences a turning effect when it is placed in a magnetic field.

Which row gives two changes to the coil that each result in a greater turning effect?

	number of turns on the coil	current in the coil
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

39 Americium-241 (${}^{241}_{95}\text{Am}$) decays to neptunium-237 (${}^{237}_{93}\text{Np}$).

One or two particles are emitted during this decay.

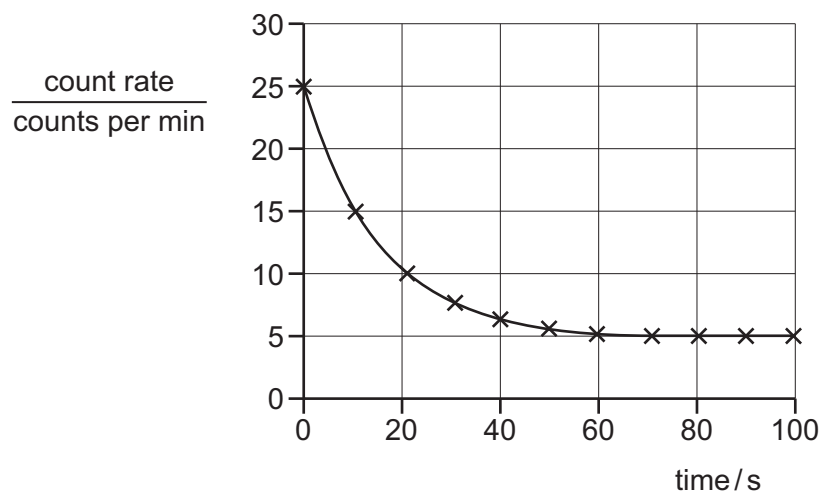
Which particles are emitted?

- A an α -particle only
- B a β -particle only
- C an α -particle and a β -particle
- D two β -particles

40 A teacher investigates the radiation emitted by a radioactive source.

She places a detector near the source and records how the count rate changes with time.

The results are shown on the graph.



Which row gives the count rate due to the source at the start of the experiment, and the count rate due to background radiation?

	count rate due to the source at start / counts per minute	count rate due to background radiation / counts per minute
A	20	5
B	20	20
C	25	5
D	25	20

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The Periodic Table of Elements

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11 Na sodium 23	12 Mg magnesium 24	Key atomic number atomic symbol name relative atomic mass		13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium —	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium —	85 At astatine —	86 Rn radon —																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
87 Fr francium —	88 Ra radium —	89–103 actinoids	104 Rf rutherfordium —	105 Db dubnium —	106 Sg seaborgium —	107 Bh bohrium —	108 Hs hassium —	109 Mt meitnerium —	110 Ds darmstadtium —	111 Rg roentgenium —	112 Cn copernicium —	114 Fl flerovium —	116 Lv livermorium —	118 Og oganeson —	119 Uue unbinilium —	120 Uub unbihunium —	121 Uut untrium —	122 Uuq unquadium —	123 Uuq unquadium —	124 Uuq unquadium —	125 Uuq unquadium —	126 Uuq unquadium —	127 Uuq unquadium —	128 Uuq unquadium —	129 Uuq unquadium —	130 Uuq unquadium —	131 Uuq unquadium —	132 Uuq unquadium —	133 Uuq unquadium —	134 Uuq unquadium —	135 Uuq unquadium —	136 Uuq unquadium —	137 Uuq unquadium —	138 Uuq unquadium —	139 Uuq unquadium —	140 Uuq unquadium —	141 Uuq unquadium —	142 Uuq unquadium —	143 Uuq unquadium —	144 Uuq unquadium —	145 Uuq unquadium —	146 Uuq unquadium —	147 Uuq unquadium —	148 Uuq unquadium —	149 Uuq unquadium —	150 Uuq unquadium —	151 Uuq unquadium —	152 Uuq unquadium —	153 Uuq unquadium —	154 Uuq 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unquadium —	305 Uuq unquadium —	306 Uuq unquadium —	307 Uuq unquadium —	308 Uuq unquadium —	309 Uuq unquadium —	310 Uuq unquadium —	311 Uuq unquadium —	312 Uuq unquadium —	313 Uuq unquadium —	314 Uuq unquadium —	315 Uuq unquadium —	316 Uuq unquadium —	317 Uuq unquadium —	318 Uuq unquadium —	319 Uuq unquadium —	320 Uuq unquadium —	321 Uuq unquadium —	322 Uuq unquadium —	323 Uuq unquadium —	324 Uuq unquadium —	325 Uuq unquadium —	326 Uuq unquadium —	327 Uuq unquadium —	328 Uuq unquadium —	329 Uuq unquadium —	330 Uuq unquadium —	331 Uuq unquadium —	332 Uuq unquadium —	333 Uuq unquadium —	334 Uuq unquadium —	335 Uuq unquadium —	336 Uuq unquadium —	337 Uuq unquadium —	338 Uuq unquadium —	339 Uuq unquadium —	340 Uuq unquadium —	341 Uuq unquadium —	342 Uuq unquadium —	343 Uuq unquadium —	344 Uuq unquadium —	345 Uuq unquadium —	346 Uuq unquadium —	347 Uuq unquadium —	348 Uuq unquadium —	349 Uuq unquadium —	350 Uuq unquadium —	351 Uuq unquadium —	352 Uuq unquadium —	353 Uuq unquadium —	354 Uuq unquadium —	355 Uuq unquadium —	356 Uuq unquadium —	357 Uuq unquadium —	358 Uuq unquadium —	359 Uuq unquadium —	360 Uuq unquadium —	361 Uuq unquadium —	362 Uuq unquadium —	363 Uuq unquadium —	364 Uuq unquadium —	365 Uuq unquadium —	366 Uuq unquadium —	367 Uuq unquadium —	368 Uuq unquadium —	369 Uuq unquadium —	370 Uuq unquadium —	371 Uuq unquadium —	372 Uuq unquadium —	373 Uuq unquadium —	374 Uuq unquadium —	375 Uuq unquadium —	376 Uuq unquadium —	377 Uuq unquadium —	378 Uuq unquadium —	379 Uuq unquadium —	380 Uuq unquadium —	381 Uuq unquadium —	382 Uuq unquadium —	383 Uuq unquadium —	384 Uuq unquadium —	385 Uuq unquadium —	386 Uuq unquadium —	387 Uuq unquadium —	388 Uuq unquadium —	389 Uuq unquadium —	390 Uuq unquadium —	391 Uuq unquadium —	392 Uuq unquadium —	393 Uuq unquadium —	394 Uuq unquadium —	395 Uuq unquadium —	396 Uuq unquadium —	397 Uuq unquadium —	398 Uuq unquadium —	399 Uuq unquadium —	400 Uuq unquadium —	401 Uuq unquadium —	402 Uuq unquadium —	403 Uuq unquadium —	404 Uuq unquadium —	405 Uuq unquadium —	406 Uuq unquadium —	407 Uuq unquadium —	408 Uuq unquadium —	409 Uuq unquadium —	410 Uuq unquadium —	411 Uuq unquadium —	412 Uuq unquadium —	413 Uuq unquadium —	414 Uuq unquadium —	415 Uuq unquadium —	416 Uuq unquadium —	417 Uuq unquadium —	418 Uuq unquadium —	419 Uuq unquadium —	420 Uuq unquadium —	421 Uuq unquadium —	422 Uuq unquadium —	423 Uuq unquadium —	424 Uuq unquadium —	425 Uuq unquadium —	426 Uuq unquadium —	427 Uuq unquadium —	428 Uuq unquadium —	429 Uuq unquadium —	430 Uuq unquadium —	431 Uuq unquadium —	432 Uuq unquadium —	433 Uuq unquadium —	434 Uuq unquadium —	435 Uuq unquadium —	436 Uuq unquadium —	437 Uuq unquadium —	438 Uuq unquadium —	439 Uuq unquadium —	440 Uuq unquadium —	441 Uuq unquadium —	442 Uuq unquadium —	443 Uuq unquadium —	444 Uuq unquadium —	445 Uuq unquadium —	446 Uuq unquadium —	447 Uuq unquadium —	448 Uuq unquadium —	449 Uuq unquadium —	450 Uuq unquadium —	451 Uuq unquadium —	452 Uuq unquadium —	453 Uuq unquadium —	454 Uuq unquadium —	455 Uuq unquadium —	456 Uuq unquadium —	457 Uuq unquadium —	458 Uuq unquadium —	459 Uuq unquadium —	460 Uuq unquadium —	461 Uuq unquadium —	462 Uuq unquadium —	463 Uuq unquadium —	464 Uuq unquadium —	465 Uuq unquadium —	466 Uuq unquadium —	467 Uuq unquadium —	468 Uuq unquadium —	469 Uuq unquadium —	470 Uuq unquadium —	471 Uuq unquadium —	472 Uuq unquadium —	473 Uuq unquadium —	474 Uuq unquadium —	475 Uuq unquadium —	476 Uuq unquadium —	477 Uuq unquadium —	478 Uuq unquadium —	479 Uuq unquadium —	480 Uuq unquadium —	481 Uuq unquadium —	482 Uuq unquadium —	483 Uuq unquadium —	484 Uuq unquadium —	485 Uuq unquadium —	486 Uuq unquadium —	487 Uuq unquadium —	488 Uuq unquadium —	489 Uuq unquadium —	490 Uuq unquadium —	491 Uuq unquadium —	492 Uuq unquadium —	493 Uuq unquadium —	494 Uuq unquadium —	495 Uuq unquadium —	496 Uuq unquadium —	497 Uuq unquadium —	498 Uuq unquadium —	499 Uuq unquadium —	500 Uuq unquadium —	501 Uuq unquadium —	502 Uuq unquadium —	503 Uuq unquadium —	504 Uuq unquadium —	505 Uuq unquadium —	506 Uuq unquadium —	507 Uuq unquadium —	508 Uuq unquadium —	509 Uuq unquadium —	510 Uuq unquadium —	511 Uuq unquadium —	512 Uuq unquadium —	513 Uuq unquadium —	514 Uuq unquadium —	515 Uuq unquadium —	516 Uuq unquadium —	517 Uuq unquadium —	518 Uuq unquadium —	519 Uuq unquadium —	520 Uuq unquadium —	521 Uuq unquadium —	522 Uuq unquadium —	523 Uuq unquadium —	524 Uuq unquadium —	525 Uuq unquadium —	526 Uuq unquadium —	527 Uuq unquadium —	528 Uuq unquadium —	529 Uuq unquadium —	530 Uuq unquadium —	531 Uuq unquadium —	532 Uuq unquadium —	533 Uuq unquadium —	534 Uuq unquadium —	535 Uuq unquadium —	536 Uuq unquadium —	537 Uuq unquadium —	538 Uuq unquadium —	539 Uuq unquadium —	540 Uuq unquadium —	541 Uuq unquadium —	542 Uuq unquadium —	543 Uuq unquadium —	544 Uuq unquadium —	545 Uuq unquadium —	546 Uuq unquadium —	547 Uuq unquadium —	548 Uuq unquadium —	549 Uuq unquadium —	550 Uuq unquadium —	551 Uuq unquadium —	552 Uuq unquadium —	553 Uuq unquadium —	554 Uuq unquadium —	555 Uuq unquadium —	556 Uuq unquadium —	557 Uuq unquadium —	558 Uuq unquadium —	559 Uuq unquadium —	560 Uuq unquadium —	561 Uuq unquadium —	562 Uuq unquadium —	563 Uuq unquadium —	564 Uuq unquadium —	565 Uuq unquadium —	566 Uuq unquadium —	567 Uuq unquadium —	568 Uuq unquadium —	569 Uuq unquadium —	570 Uuq unquadium —	571 Uuq unquadium —	572 Uuq unquadium —	573 Uuq unquadium —	574 Uuq unquadium —	575 Uuq unquadium —	576 Uuq unquadium —	577 Uuq unquadium —	578 Uuq unquadium —	579 Uuq unquadium —	580 Uuq unquadium —	581 Uuq unquadium —	582 Uuq unquadium —	583 Uuq unquadium —	584 Uuq unquadium —	585 Uuq unquadium —	586 Uuq unquadium —	587 Uuq unquadium —	588 Uuq unquadium —	589 Uuq unquadium —	590 Uuq unquadium —	591 Uuq unquadium —	592 Uuq unquadium —