OCR
Oxford Cambridge and RSA

Level 3 Cambridge Technical in Laboratory Skills

05847/05848/05849/05874/05879

Unit 2: Laboratory Techniques

Monday 5 June 2017 – Morning

Time allowed: 2 hours

You must have:
- a ruler

You may use:
- a scientific or graphical calculator

First Name		Last Name	
Centre Number		Candidate Number	
Date of Birth	D D M M Y Y Y Y		

INSTRUCTIONS
- Use black ink.
- Complete the boxes above with your name, centre number, candidate number and date of birth.
- Answer **all** the questions.
- Write your answer to each question in the space provided.
- If additional answer space is required, you should use the lined page(s) at the end of this booklet. The question number(s)must be clearly shown.
- The Periodic Table is printed on the back page.

INFORMATION
- The total mark for this paper is **90**.
- The marks for each question are shown in brackets **[ ]**.
- This document consists of **24** pages.

FOR EXAMINER USE ONLY	
Question No	**Mark**
1	/15
2	/15
3	/15
4	/15
5	/15
6	/15
Total	**/90**

Answer **all** the questions.

1 Appropriate laboratory procedures are essential at all times.

(a) For each of the following laboratory situations, state:

- a potential hazard
- a risk linked to the hazard
- one control measure to minimise the risk.

(i) Working with swabs from a suspected case of food poisoning.

Hazard .....

Risk .....

.....

Control measure.....

.....

[3]

(ii) Investigating the cleaning activity of a biological washing powder.

Hazard .....

Risk .....

.....

Control measure.....

.....

[3]

(iii) A radiographer looking for a possible fracture by producing an image of a patient's skeleton.

Hazard .....

Risk .....

.....

Control measure.....

.....

[3]

(b) A forensic scientist is calibrating a pH meter for use in her analyses.

It is essential that the readings taken from the pH meter are accurate.

State **three** procedures she must follow to achieve this accuracy.

1 .....

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2 .....

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3 .....

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[3]

(c) Describe how incubated agar plates are disposed of after use.

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[3]

2 Olivia is analysing the lipids found in samples of a cosmetic.

(a) She carries out a preliminary analysis of the samples using chromatography.

She can choose to use either paper chromatography or thin-layer chromatography (TLC).

(i) What is the stationary phase in paper chromatography?

.....

.....

[1]

(ii) State **two** stationary phases used in TLC.

1 .....

2 .....

[2]

(iii) Discuss the **advantages** and **disadvantages** of both paper chromatography and TLC.

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[4]

(b) Olivia uses a solvent system for TLC chromatography.

The solvent system contains the following solvents:

Hexane	60 parts
Diethyl ether	39 parts
Ethanoic acid	1 part

The chromatography tank requires approximately 150 cm^3 of the solvent system.

Calculate the required volume of hexane.

volume of hexane = ... cm^3

[1]

(c) Olivia locates the spots on the TLC plate using iodine vapour.

Suggest a **non-destructive** method of visualising the spots.

.....

.....

[2]

(d) Olivia runs her chromatogram in the solvent.

The completed chromatogram is shown in **Fig. 2.1**.

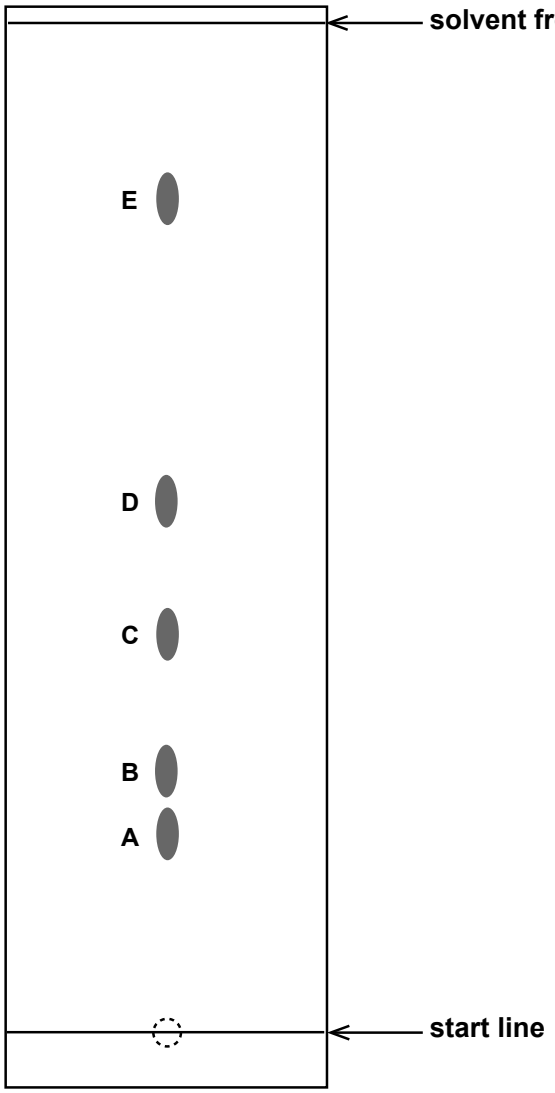

Fig. 2.1

To identify the spots, Olivia consults R_f values from a published scientific paper.

The published R_f values are shown in the table below (**Table 2.1**):

Class of lipid	**R_f value**
Free fatty acids	0.54
Diglycerides (diacylglycerols)	0.42
Monoglycerides (monoacylglycerols)	0.20
Triglycerides (Triacylglycerols)	0.85

Table 2.1

(i) Use **Fig. 2.1** to complete the table below (**Table 2.2**).

	Distance moved (mm)
Spot A	30
Spot B	39
Spot C	
Spot D	76
Spot E	118
Solvent front	

Table 2.2

[1]

(ii) Use the values in **Table 2.1** and **Table 2.2** to complete the table below.

The identification of one of the spots is unknown.

Spot	**R_f value**	**Suggested identification of class of lipid**
A		
B		
C		
D		
E		

[2]

(iii) Suggest and describe an alternative method for identifying the spots.

.....

.....

[2]

3 Matt is analysing a number of malt vinegar samples for their ethanoic acid concentration.

He titrates the samples against sodium hydroxide solution.

(a) Ethanoic acid is a weak acid. Matt decides to use an acid-base titration for his analyses.

Name the indicator to be used when titrating ethanoic acid.

Explain why.

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[3]

(b) Matt monitors a titration using a pH meter.

He takes a series of readings while adding standardised 0.2 mol dm^{-3} sodium hydroxide solution to 50 cm^3 of a 10% solution of the vinegar.

His titration curve is shown in **Fig. 3.1**.

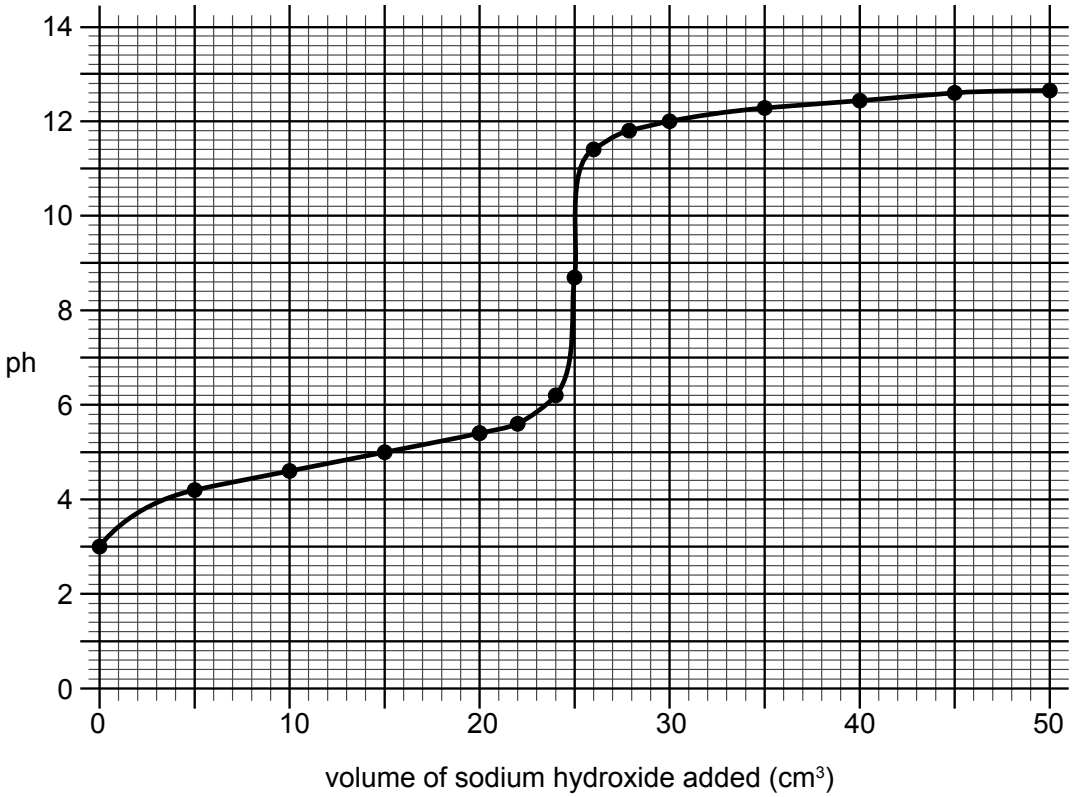

Fig. 3.1

Use **Fig.3.1** to complete the sentences.

Before any sodium hydroxide solution is added, the solution in the conical flask is

described as a ..... .

After the initial increase in pH and some more sodium hydroxide is added, the curve flattens out.

The solution at this flatter part of the curve is called a ..... .

After a total of 25 cm^3 of sodium hydroxide has been added,

the..... is reached.

The solution is then described as a ..... .

The conical flask now contains a mixture of .....

and ..... .

As more sodium hydroxide is added, the solution then becomes a

..... .

[6]

(c) Matt uses an autotitrator for the analyses.

Explain how an autotitrator works and why this method is preferred rather than using an indicator.

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[6]

4 Anitka is a forensic palynologist.

She is examining pollen grains collected from the clothes of a suspected drugs dealer.

(a) An image of two of the pollen grains found is shown in **Fig. 4.1**.

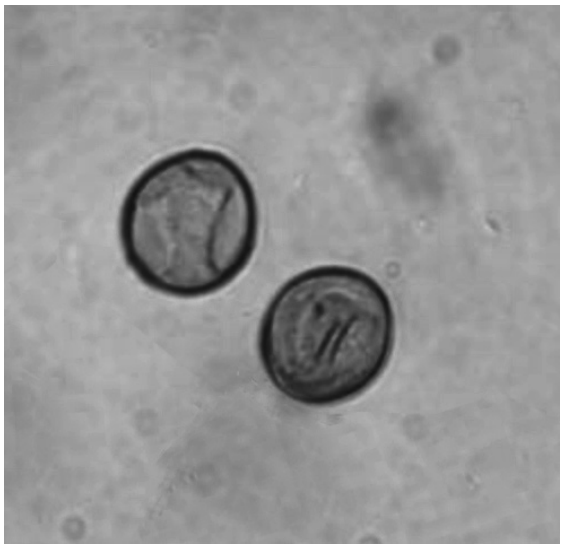


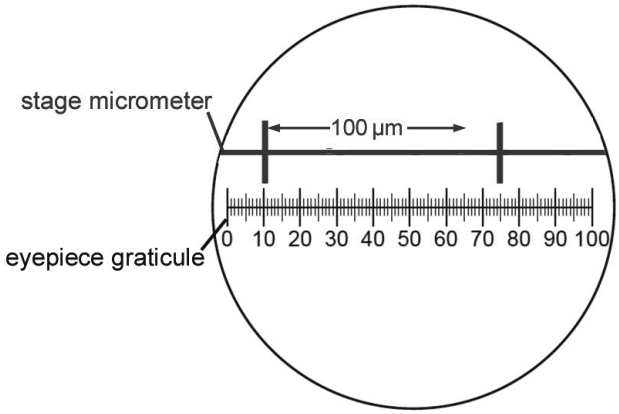
Fig. 4.1

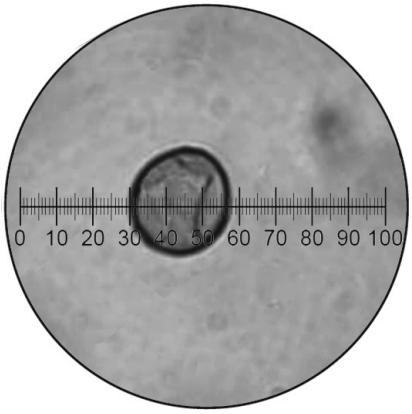
(i) What type of microscope was used to produce this image?

..... **[1]**

(ii) Anitka is measuring the diameter of one of the pollen grains.

She uses a stage micrometer to complete this task.





The eyepiece graticule is used to make measurements of a pollen grain

Fig 4.2

Calculate the diameter of the pollen grain shown in **Fig 4.2**.

Show your working.

diameter of pollen grain = ... µm

[3]

(iii) Describe the stages in the calibration of the eyepiece graticule.

.....

.....

.....

.....

[3]

(iv) Draw a scale bar alongside the pollen grain in **Fig. 4.3**.

Use your calculated measurement for the diameter of the pollen grain in part **(a)(ii)** to complete this task.

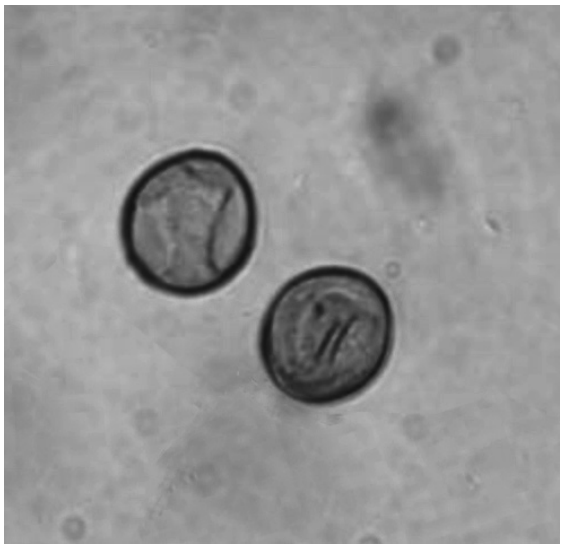


Fig. 4.3

Show your working.

[4]

(b) Anitka then uses a different type of microscope to view some of the pollen grains.

One of her images is shown in **Fig. 4.4**.

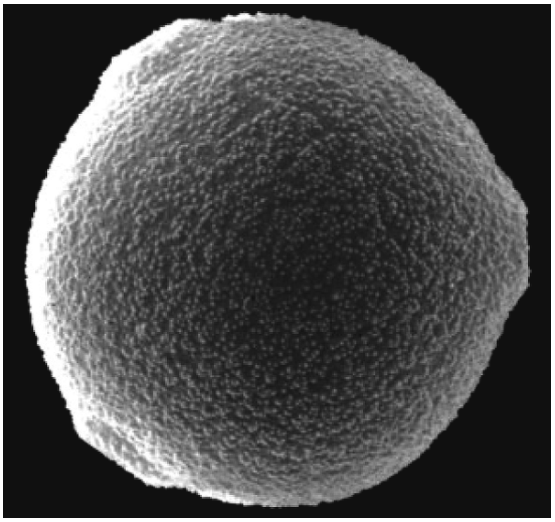


Fig 4.4

(i) What type of microscope did Anitka use to produce this image?

.....

[1]

(ii) Suggest **three** advantages of using this type of microscope to produce an image of the pollen grain.

1 .....

2 .....

3 .....

[3]

5 Atiq is a technician at a water company.

He is testing for lead ions in water samples from water pipes in an old house.

(a) Atiq completes a quick test on a water sample from the house using sodium hydroxide solution.

(i) Describe what happens in the test if lead ions are present.

.....

.....

.....

[3]

(ii) Write chemical equations for the reactions between lead ions and sodium hydroxide solution.

.....

.....

[2]

(iii) Which other cation behaves in a similar way when sodium hydroxide solution is added?

.....

[1]

(b) Atiq analyses the water samples for cations using an inductively coupled plasma-atomic emission spectroscopy (ICP-AES).

(i) Suggest why Atiq choses ICP-AES for the analyses.

.....

.....

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.....

[3]

(ii) Atiq prepares a series of standard solutions from a stock solution.

The stock solution is bought from a standard supplier, and not prepared in the water company laboratory.

Suggest **two** reasons why.

1 .....

2 .....

[2]

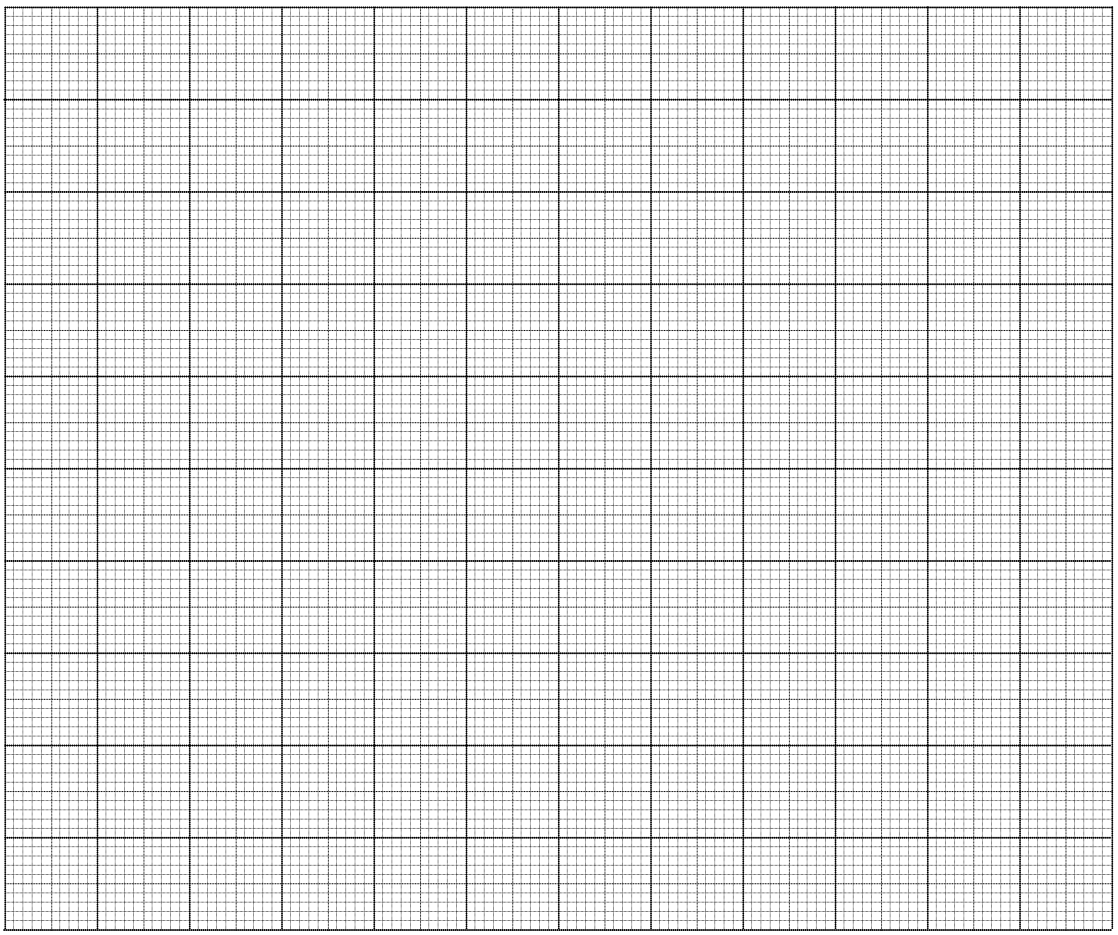
(iii) The standard solutions are used to produce a calibration graph.

The data collected for the calibration plot are shown in **Table 5.1**.

Concentration of lead(II) (mg dm^{-3})	**Intensity of emission**
0.00	0.00
0.10	0.08
0.20	0.15
0.30	0.24
0.40	0.32
0.50	0.39
0.60	0.48
0.70	0.54
0.80	0.62
0.90	0.71
1.00	0.78

Table 5.1

On the graph paper on the opposite page draw a graph to show the calibration plot produced by the data in **Table 5.1**.



[4]

6 Jason is a hospital technician.

He is culturing samples taken from a patient.

The samples are suspected of containing the pathogenic bacterium, *Staphylococcus aureus*.

(a) Throughout the procedure, Jason uses aseptic technique.

(i) Explain why aseptic technique is necessary under these conditions.

.....

.....

[2]

(ii) State **two** measures required to work aseptically.

1 .....

2 .....

[2]

(b) Jason uses a controlled airflow cabinet (**Fig. 6.1**) when preparing bacterial cultures.

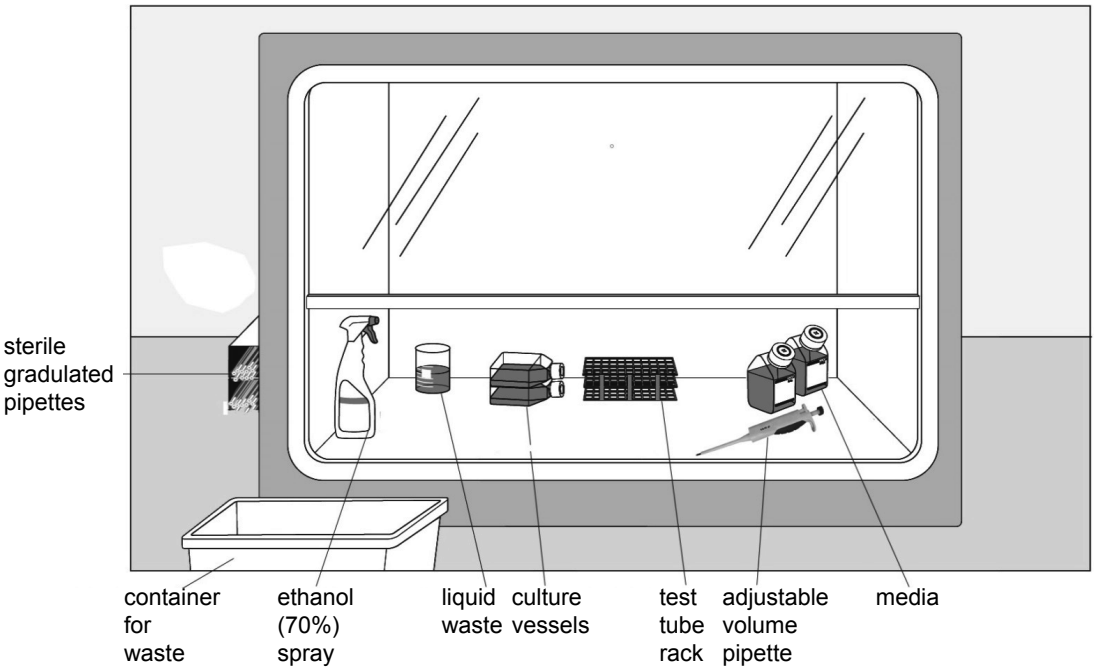


Fig. 6.1

(i) Explain the function of the controlled airflow cabinet (**Fig.6.1**).

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[4]

(ii) Bunsen burners are often used to sterilise microbiological equipment.

Give **three** reasons why the use of Bunsen burners is **not** recommended in controlled airflow cabinets.

1 .....

2 .....

3 .....

[3]

(c) Describe how the following are sterilised before use.

(i) Graduated pipettes

.....

.....

[2]

(ii) Culture media

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[1]

(iii) Test tube rack

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.....

[1]

END OF QUESTION PAPER

ADDITONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

The Periodic Table of the Elements

(1)	(2)												(3)	(4)	(5)	(6)	(7)	(0)
1													13	14	15	16	17	18
1 H hydrogen 1.0	2												5 B boron 10.8	6 C carbon 12.0	7 N nitrogen 14.0	8 O oxygen 16.0	9 F fluorine 19.0	2 He helium 4.0
3 Li lithium 6.9	4 Be beryllium 9.0												13 Al aluminium 27.0	14 Si silicon 28.1	15 P phosphorus 31.0	16 S sulfur 32.1	17 Cl chlorine 35.5	10 Ne neon 20.2
11 Na sodium 23.0	12 Mg magnesium 24.3	3	4	5	6	7	8	9	10	11	12							18 Ar argon 39.9
19 K potassium 39.1	20 Ca calcium 40.1	21 Sc scandium 45.0	22 Ti titanium 47.9	23 V vanadium 50.9	24 Cr chromium 52.0	25 Mn manganese 54.9	26 Fe iron 55.8	27 Co cobalt 58.9	28 Ni nickel 58.7	29 Cu copper 63.5	30 Zn zinc 65.4		31 Ga gallium 69.7	32 Ge germanium 72.6	33 As arsenic 74.9	34 Se selenium 79.0	35 Br bromine 79.9	36 Kr krypton 83.8
37 Rb rubidium 85.5	38 Sr strontium 87.6	39 Y yttrium 88.9	40 Zr zirconium 91.2	41 Nb niobium 92.9	42 Mo molybdenum 95.9	43 Tc technetium	44 Ru ruthenium 101.1	45 Rh rhodium 102.9	46 Pd palladium 106.4	47 Ag silver 107.9	48 Cd cadmium 112.4		49 In indium 114.8	50 Sn tin 118.7	51 Sb antimony 121.8	52 Te tellurium 127.6	53 I iodine 126.9	54 Xe xenon 131.3
55 Cs caesium 132.9	56 Ba barium 137.3	57–71 lanthanoids	72 Hf hafnium 178.5	73 Ta tantalum 180.9	74 W tungsten 183.8	75 Re rhenium 186.2	76 Os osmium 190.2	77 Ir iridium 192.2	78 Pt platinum 195.1	79 Au gold 197.0	80 Hg mercury 200.6		81 Tl thallium 204.4	82 Pb lead 207.2	83 Bi bismuth 209.0	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		

Key
atomic number
Symbol
name
relative atomic mass

57 La lanthanum 138.9	58 Ce cerium 140.1	59 Pr praseodymium 140.9	60 Nd neodymium 144.2	61 Pm promethium 144.9	62 Sm samarium 150.4	63 Eu europium 152.0	64 Gd gadolinium 157.2	65 Tb terbium 158.9	66 Dy dysprosium 162.5	67 Ho holmium 164.9	68 Er erbium 167.3	69 Tm thulium 168.9	70 Yb ytterbium 173.0	71 Lu lutetium 175.0
89 Ac actinium	90 Th thorium 232.0	91 Pa protactinium	92 U uranium 238.1	93 Np neptunium	94 Pu plutonium	95 Am americium	96 Cm curium	97 Bk berkelium	98 Cf californium	99 Es einsteinium	100 Fm fermium	101 Md mendelevium	102 No nobelium	103 Lr lawrencium

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