# Neap

#### **HSC Trial Examination 2020**

## **Physics**

#### General Instructions

- Reading time 5 minutes
- Working time 3 hours
- Write using black pen
- Draw diagrams using pencil
- Calculators approved by NESA may be used
- A data sheet, formulae sheets and Periodic Table are provided at the back of this paper

## Total marks: 100

#### Section I - 20 marks (pages 2-6)

- Attempt Questions 1–20
- · Allow about 35 minutes for this section

#### Section II - 80 marks (pages 7-24)

- Attempt Questions 21–37
- Allow about 2 hours and 25 minutes for this section

Students are advised that this is a trial examination only and cannot in any way guarantee the content or the format of the 2020 HSC Physics Examination.

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#### Section I

#### 20 marks

#### Attempt Questions 1-20

#### Allow about 35 minutes for this section

Use the multiple-choice answer sheet for Questions 1-20.

1. To move against a gravitational field, work is required to be done.

What is this form of energy often referred to as?

- (A) Newton's Laws of Gravitation
- (B) gravitational potential energy
- (C) kinetic energy
- (D) Kepler's Laws
- 2. What is the name of the process whereby an atom changes into a different element?
  - (A) transmutation
  - (B) orbital decay
  - (C) the quantum model
  - (D) wave-particle duality
- **3.** Which of the following sentences correctly describes the relationship between mass, radius and centripetal force?
  - (A) A large mass results in more centripetal force, and a large radius results in more centripetal force.
  - (B) A large mass results in more centripetal force, and a large radius results in less centripetal force.
  - (C) A large mass results in less centripetal force, and a large radius results in more centripetal force.
  - (D) A large mass results in less centripetal force, and a large radius results in less centripetal force.
- **4.** What does the stator in a DC motor provide?
  - (A) a location for the current to enter within the DC motor
  - (B) a magnetic field either via permanent magnets or electromagnets
  - (C) constant connection between the rotating armature and the external circuit
  - (D) maximum resistance within a wire

- 5. Which of the following is NOT one of the six quarks proposed by scientists?
  - (A) charm
  - (B) strange
  - (C) bottom
  - (D) upper
- **6.** The surface temperature of the star Betelgeuse is 3500 K.

What is the peak wavelength of Betelgeuse's radiation?

- (A) 502 nm
- (B) 818 nm
- (C) 823 nm
- (D) 828 nm
- 7. Which of the following correctly describes Lenz's Law?
  - (A) An induced current flows in a direction such that its own magnetic field attracts the changing magnetic field that caused it.
  - (B) An induced current flows in a direction such that its own magnetic field opposes the changing magnetic field that caused it.
  - (C) Induced emf is always proportional to the rate of change of the magnetic flux.
  - (D) Induced emf is always inversely proportional to the rate of change of the magnetic flux.
- **8.** At a nuclear facility in Germany, 129 g of fuel was converted to energy.

What is the mass-energy equivalence of 129 g of matter?

- (A)  $3.87 \times 10^7 \text{ J}$
- (B)  $4.49 \times 10^{15} \text{ J}$
- (C)  $1.16 \times 10^{16} \,\mathrm{J}$
- (D)  $2.24 \times 10^{16} \,\mathrm{J}$
- **9.** A current-carrying conductor is 92 mm long and experiences a force of 1.84 N when placed at a right angle to a magnetic field.

What is the magnetic flux density when 3.6 amps of current are passed through the conductor?

- (A)  $5.56 \times 10^{-3} \text{ T}$
- (B) 5.16 T
- (C) 5.56 T
- (D) 6.09 T

10. At the beginning of the Big Bang, energy was converted into particles.

Which of the following particles would NOT have been present within the first 100 seconds of the beginning of the Big Bang?

- (A) helium
- (B) quarks
- (C) protons
- (D) antiprotons
- 11. What is the wavelength of a bowling ball with a mass of 5 kg travelling at  $12.6 \text{ m s}^{-1}$ ?
  - (A)  $3.78 \times 10^{-35}$  m
  - (B)  $1.05 \times 10^{-35}$  m
  - (C)  $2.14 \times 10^{-34}$  m
  - (D)  $1.55 \times 10^{-34} \text{ m}$
- **12.** Which of the following is a consequence of the law of conservation of energy?
  - (A) magnetic braking
  - (B) incomplete flux linkage
  - (C) AC generator
  - (D) magnetic flux density
- 13. When gaseous atoms have an electrical current passed through them, they can produce light. Gaseous atoms absorb electrical energy, and then their electrons transition from ground state to a higher energy state. Later, the electrons can return to ground state. As electrons return to ground state, they release light; this light is particular to atoms of a particular element.

What is observed when an electron moves from a higher energy state to ground state?

- (A) absorption spectra
- (B) continuous spectra
- (C) radioactive decay
- (D) emission spectra
- 14. A cannonball is launched at  $49 \text{ m s}^{-1}$ . It reaches a maximum height of 105 m above its origin.

To the nearest degree, what is the angle of elevation required to reach this height?

- (A) 45°
- (B)  $58^{\circ}$
- (C) 68°
- (D) 93°

15. A race-car travelling at 300 km h<sup>-1</sup> drives around a race-track corner with radius 750 m. The road of the race track is designed so that car tyres do not experience any friction.

To the nearest degree, at what angle is the road banked?

- (A) 13°
- (B) 23°
- (C) 33°
- (D) 43°
- **16.** The work function for tungsten is 4.5 eV.

What is the minimum wavelength of radiating photons that will have this threshold energy?

- (A)  $4.42 \times 10^{-16}$  m
- (B)  $2.74 \times 10^{-9}$  m
- (C)  $1.76 \times 10^{-7} \text{ m}$
- (D)  $2.76 \times 10^{-7}$  m
- 17. Spectroscopy allows scientists to study stars.

What type of spectral lines are produced by low-density stellar atmospheres?

- (A) sharper, narrower spectral lines
- (B) broadening spectral lines
- (C) sharper spectral lines that are slightly shifted towards the red end of the spectrum
- (D) sharper spectral lines that are slightly shifted towards the blue end of the spectrum
- **18.** The planet Venus has a mass of  $4.87 \times 10^{24}$  kg and a diameter of 12 100 km.

What is the value of acceleration due to gravity on the surface of Venus?

- (A)  $8.87 \text{ m s}^{-2}$
- (B)  $9.86 \text{ m s}^{-2}$
- (C)  $9.89 \text{ m s}^{-2}$
- (D)  $10.13 \text{ m s}^{-2}$

**19.** When uranium-235 is hit with a neutron, it absorbs it and then splits according to the following nuclear equation:

$${}_{0}^{1}n + {}_{92}^{235}U \rightarrow {}_{56}^{139}Ba + {}_{36}^{94}Kr + {}_{0}^{1}n + energy$$

During this reaction, there is a loss of mass of  $3.60 \times 10^{-28}$  kg.

What is the amount of energy released during the fission of a single uranium-235 atom?

- (A) 112 MeV
- (B) 186 MeV
- (C) 194 MeV
- (D) 202 MeV
- **20.** A proton is circulating inside the ring of a synchrotron. The proton has an orbital radius of 82 m and a velocity of  $1.25 \times 10^8$  m s<sup>-1</sup>.

What is the magnitude of the magnetic field required to keep the proton in orbit?

- (A) 0.0175 T
- (B) 0.0185 T
- (C) 0.0188 T
- (D) 0.0196 T

#### Section II

#### 80 marks

#### Attempt Questions 21–37

#### Allow about 2 hours and 25 minutes for this section

Answer the questions in the spaces provided. These spaces provide guidance for the expected length of response.

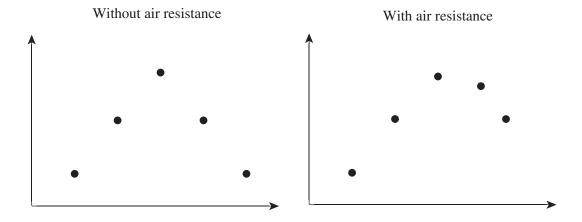
Show all relevant working in questions involving calculations.

Extra writing space is provided at the back of this booklet. If you use this space, clearly indicate which question you are answering.

#### Question 21 (4 marks)

A group of students analysed the effects of air resistance on projectile motion. The same experiment was performed twice – firstly in an evacuated chamber without air resistance, and then in the classroom with air resistance. The following graphs obtained from the results of both experiments show the paths taken by two identical projectiles.

4



Discuss the effects of air resistance on the individual projectiles. In your answer, describe how the graphs demonstrate these effects.

#### **Question 22** (4 marks)

On a class excursion, a student with a mass of 65 kg rides a merry-go-round. They are 4.4 m from the centre of rotation. Once the student reaches maximum speed, the class records the time it takes for the student to complete three revolutions. They record the time as 78 s.

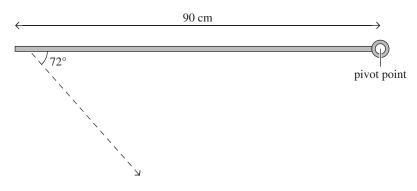
(a)	What is the student's linear speed?	2
(b)	What is the student's angular velocity?	1
(c)	What is the centripetal force acting on the student?	1

Que	stion 23 (6 marks)	
(a)	Describe Kepler's Second Law of equal areas. Include a labelled diagram in your answer.	3
(b)	Derive Kepler's Third Law of periods.	3

#### **Question 24** (2 marks)

A student opens their classroom door as seen in the diagram. The dashed arrow shows the direction from which the door is pulled.

2



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Ques	ation 25 (4 marks)	
	ng your Year 12 Physics course, you will have completed an investigation of historical contemporary methods used to determine the speed of light.	4
Discu	uss ONE historical and ONE contemporary method used to determine the speed of light.	
Ques	etion 26 (3 marks)	
When	onochromatic neon lamp with a wavelength of 854 nm was used to demonstrate diffraction. In the light from the lamp was shone through vertical parallel slits, an interference pattern was used on a screen 2.5 metres away. The slits were recorded to be 0.200 mm apart.	
(a)	Determine the angle of the first-order maximum.	2
(b)	Calculate the distance on the screen between the first-order maximum and the central maximum.	1

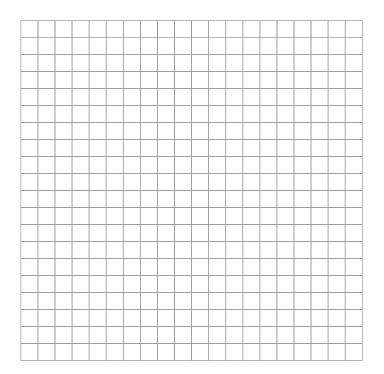
#### **Question 27** (8 marks)

A group of scientists at Australia's Nuclear Science and Technology Organisation (ANSTO) collected data on the decay of a radioactive isotope. Their results are shown in the following table.

Time (hours)	Recorded mass (g)
0	100
4	72.0
8	50.0
12	34.0
16	25.0
20	17.0
24	12.5
28	8.00
32	6.25

(a) Graph the results on the grid provided.

3



	Question 27 continues on page 13	
(b)	Determine the half-life of the isotope.	1

Question 27 (continu	Juestion	21	(continued	
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(c)		mple of another radioactive isotope was investigated by the same group of scientists. sample was found to have a half-life of 16 hours.	
	(i)	Calculate the decay constant of the isotope sample.	2
	(ii)	What percentage of the sample will be left undecayed after two days?	2

**End of Question 27** 

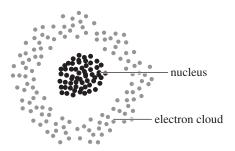
Question 28 (4 marks)	
Discuss the early experiments that examined the nature of cathode rays AND their role in the discovery of the electron.	4

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#### Question 29 (8 marks)

The atomic model has continually been changed and improved due to scientific advancements. It has been influenced by many scientists. The image below is the model suggested by Edwin Schrödinger. This model is often referred to as the quantum model of the atom.

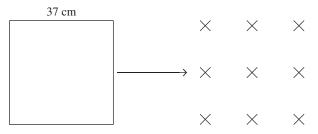
8



Explain now the atomic if	loder changed over thin	e and led to the model	proposed by Schrödinger.

#### **Question 30** (5 marks)

The diagram below shows a square single loop entering a perpendicular magnetic field of  $0.80\,\mathrm{T}$ . The square loop takes 0.04 seconds to enter the magnetic field.



(a)	What is the magnitude of induced emf in the square loop?	4
(b)	What direction does the induced current flow in the square loop?	1

Ouestion	31	(A marks)	
Question	31	(4 marks)	

A typical DC motor can produce 10-7000 revolutions per minute.

(a)	Identify TWO modifications that would increase the speed of a DC motor.	2
(b)	Outline the role of a commutator in a DC motor.	2

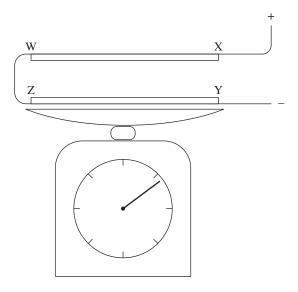
Question 32 (4 marks)
Compare the effects of electric and magnetic fields on a charged particle if the particle is initially moving perpendicular to the fields. Support your answer with a labelled diagram showing each field.

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#### Question 33 (4 marks)

A teacher demonstrates the forces on two parallel identical copper conductors, as shown in the diagram.





The top conductor WX is fixed, while the bottom conductor ZY lies on top of a balance. The distance between the conductors is 5 mm, and each conductor is 29 cm in length. Initially, the balance reads 4.5 grams for conductor ZY. When the current is switched on, the teacher records a reading of 4.56 grams.

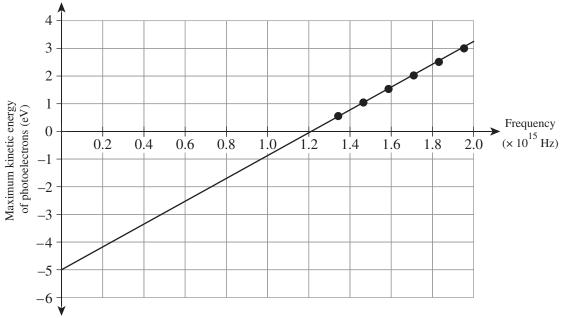
Calculate the magnit	tude of the current.	

#### **Question 34** (3 marks)

As an in-depth study, a group of students tested different transformers to calculate their efficiency. The students supplied a transformer with 0.02 Amps at 240 V and recorded the output of the transformer as 0.28 Amps at 12 V.	3
Calculate the efficiency of the transformer AND account for the loss of energy.	

#### **Question 35** (7 marks)

Ultraviolet light with a wavelength of 180 nm is shone on a polished nickel plate. The work function for the nickel plate is shown in the graph.



(a)	What is the work function for the nickel plate?	1
(b)	What is the kinetic energy of the fastest-moving electrons?	3

Question 35 continues on page 21

Question 3:	5 (cc	ontinu	ed)
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(c)

Demonstrate the cut-off frequency of the nickel plate mathematically AND through interpretation of the graph.	3

**End of Question 35** 

22

#### Question 36 (3 marks)

The National Aeronautics and Space Administration (NASA) recently sent a space probe to a newly discovered, potentially habitable planet 20 light years away. The space probe will travel at a velocity of 0.38 c to get there.

(a)	Calculate how long the journey will take.	1
(b)	The scientists placed an atomic clock on board the space probe to measure the duration of the journey.	2
	According to the atomic clock on board the space probe, calculate how long the journey will take.	

#### **Question 37** (7 marks)

A satellite with a mass of  $2550 \, \mathrm{kg}$  is orbiting the Earth at an altitude of  $35\,800 \, \mathrm{km}$  above the Earth's surface.

(a)	Calculate the total mechanical energy of the satellite.	2
(b)	Calculate the speed of the satellite.	3
. ,		
(c)	Identify the type of satellite that orbits at this altitude AND describe TWO uses of this type of satellite.	2

End of paper

Section II extra writing space
If you use this space, clearly indicate which question you are answering.

Section II extra writing space  If you use this space, clearly indicate which question you are answering.

#### Data sheet

Charge on electron, 
$$q_e$$
  $-1.602 \times 10^{-19}$  C

Mass of electron, 
$$m_e$$
 9.109 × 10<sup>-31</sup> kg

Mass of neutron, 
$$m_n$$
 1.675 × 10<sup>-27</sup> kg

Mass of proton, 
$$m_{\rm p}$$
 1.673 × 10<sup>-27</sup> kg

Speed of sound in air 
$$340 \text{ m s}^{-1}$$

Earth's gravitational acceleration, 
$$g$$
 9.8 m s<sup>-2</sup>

Speed of light, 
$$c$$
 3.00 × 10<sup>8</sup> m s<sup>-1</sup>

Electric permittivity constant, 
$$\varepsilon_0$$
 8.854 × 10<sup>-12</sup> A<sup>2</sup> s<sup>4</sup> kg<sup>-1</sup> m<sup>-3</sup>

Magnetic permeability constant, 
$$\mu_0$$
  $4\pi \times 10^{-7} \text{ N A}^{-2}$ 

Universal gravitational constant, 
$$G$$
 6.67 × 10<sup>-11</sup> N m<sup>2</sup> kg<sup>-2</sup>

Mass of Earth, 
$$M_{\rm E}$$
 6.0 × 10<sup>24</sup> kg

Radius of Earth, 
$$r_{\rm E}$$
 6.371 × 10<sup>6</sup> m

Planck constant, 
$$h$$
 6.626 × 10<sup>-34</sup> J s

Rydberg constant, *R* (hydrogen) 
$$1.097 \times 10^7 \text{ m}^{-1}$$

Atomic mass unit, 
$$u$$
 1.661 × 10<sup>-27</sup> kg

931.5 MeV/
$$c^2$$

$$1 \text{ eV}$$
  $1.602 \times 10^{-19} \text{ J}$ 

Density of water, 
$$\rho$$
 1.00 × 10<sup>3</sup> kg m<sup>-3</sup>

Specific heat capacity of water 
$$4.18 \times 10^3 \text{ J kg}^{-1} \text{ K}^{-1}$$

Wien's displacement constant, 
$$b$$
 2.898 × 10<sup>-3</sup> m K

#### Formulae sheet

#### Motion, forces and gravity

$$s = ut + \frac{1}{2}at^2$$

$$v = u + at$$

$$v^2 = u^2 + 2as$$

$$\overrightarrow{F}_{\text{net}} = \overrightarrow{ma}$$

$$\Delta U = mg\Delta h$$

$$W = F_{||}s = Fs\cos\theta$$

$$P = \frac{\Delta E}{\Delta t}$$

$$K = \frac{1}{2}mv^2$$

$$\sum_{i=1}^{\infty} \frac{1}{2} m v_{\text{before}}^2 = \sum_{i=1}^{\infty} \frac{1}{2} m v_{\text{after}}^2$$

$$P = F_{\parallel} v = F v \cos \theta$$

$$\Delta \overrightarrow{p} = \overrightarrow{F}_{\text{net}} \Delta t$$

$$\sum m \overset{\rightarrow}{v}_{\text{before}} = \sum m \overset{\rightarrow}{v}_{\text{after}}$$

$$\omega = \frac{\Delta \theta}{t}$$

$$a_{\rm c} = \frac{v^2}{r}$$

$$\tau = r_{\perp} F = rF \sin \theta$$

$$F_{\rm c} = \frac{mv^2}{r}$$

$$v = \frac{2\pi r}{T}$$

$$F = \frac{GMm}{r^2}$$

$$U = -\frac{GMm}{r}$$

$$\frac{r^3}{T^2} = \frac{GM}{4\pi^2}$$

#### Waves and thermodynamics

$$v = f\lambda$$

$$f_{\text{beat}} = \left| f_2 - f_1 \right|$$

$$f = \frac{1}{T}$$

$$f' = f \frac{(v_{\text{wave}} + v_{\text{observer}})}{(v_{\text{wave}} - v_{\text{source}})}$$

$$d\sin\theta = m\lambda$$

$$n_1 \sin \theta_1 = n_2 \sin \theta_2$$

$$n_{\rm x} = \frac{c}{v_{\rm x}}$$

$$\sin \theta_{\rm c} = \frac{n_2}{n_1}$$

$$I = I_{\text{max}} \cos^2 \theta$$

$$I_1 r_1^2 = I_2 r_2^2$$

$$Q = mc\Delta T$$

$$\frac{Q}{t} = \frac{kA\Delta T}{d}$$

#### Formulae sheet (continued)

#### **Electricity and magnetism**

$$E = \frac{V}{d}$$

$$\overrightarrow{F} = \overrightarrow{qE}$$

$$V = \frac{\Delta U}{q}$$

$$F = \frac{1}{4\pi\varepsilon_0} \frac{q_1 q_2}{r^2}$$

$$W = qV$$

$$I = \frac{q}{t}$$

$$W = qEd$$

$$V = IR$$

$$B = \frac{\mu_0 I}{2\pi r}$$

$$P = VI$$

$$B = \frac{\mu_0 NI}{L}$$

$$F = qv_{\perp}B = qvB\sin\theta$$

$$\Phi = B_{\parallel} A = BA \cos \theta$$

$$F = lI_{\mid} B = lIB \sin \theta$$

$$\varepsilon = -N \frac{\Delta \Phi}{\Delta t}$$

$$\frac{F}{I} = \frac{\mu_0 I_1 I_2}{2\pi r}$$

$$\frac{V_{\rm p}}{V_{\rm s}} = \frac{N_{\rm p}}{N_{\rm s}}$$

$$\tau = nIA_{\perp}B = nIAB\sin\theta$$

$$V_{\rm p}I_{\rm p} = V_{\rm s}I_{\rm s}$$

#### Quantum, special relativity and nuclear

$$\lambda = \frac{h}{mv}$$

$$t = \frac{t_0}{\sqrt{\left(1 - \frac{v^2}{c^2}\right)}}$$

$$K_{\text{max}} = hf - \phi$$

$$l = l_0 \sqrt{\left(1 - \frac{v^2}{c^2}\right)}$$

$$\lambda_{\max} = \frac{b}{T}$$

$$p_{v} = \frac{m_{0}v}{\sqrt{\left(1 - \frac{v^{2}}{c^{2}}\right)}}$$

$$E = mc^2$$

$$N_{\rm t} = N_0 e^{-\lambda t}$$

$$E = hf$$

$$\frac{1}{\lambda} = R \left( \frac{1}{n_{\rm f}^2} - \frac{1}{n_{\rm i}^2} \right)$$

$$l = \frac{\ln 2}{t_{\frac{1}{2}}}$$

# PERIODIC TABLE OF THE ELEMENTS

0	5         6         7         8         9           B         C         N         O         F           10.81         12.01         14.01         16.00         19.00           Boron         Carbon         Nitrogen         0xygen         19.00           10.81         12.01         14.01         16.00         19.00           Alu         Si         P         S         CI           26.98         28.09         30.97         32.07         35.45           Aluminium         Silicon         Phosphorus         Sulfur         Chlorine           30         31         32         33         34         35           Aluminium         Silicon         Phosphorus         Sulfur         Chlorine           30         31         32         33         34         35           Aluminium         Silicon         Phosphorus         Sulfur         Chlorine           30         31         32         33         34         35           48         69.72         72.64         74.92         78.96         79.90           Cd         In         Sn         Shenium         Bromine         Phoinim<	5         6         7         8         9           B cc         N         O         F           10.81         12.01         14.01         16.00         19.00           Boron         Garbon         Garbon         14.01         16.00         19.00           Boron         Garbon         Garbon         14.01         16.00         19.00           13         14         15         5         CI           26.98         28.09         30.97         32.07         35.45           Aluminium         Silicon         Phosphorus         Sulfur         Chlorine           31         32         33         34         35.45           Auminium         Silicon         Phosphorus         Sulfur         Chlorine           31         32         33         34         35.45           Ga         Ge         As         Se         Br           Gallium         Germanium         Ar.92         78.96         79.90           Gallium         Germanium         Ar.92         78.96         79.90           Gallium         Sh         56         72.69         72.69           Indium         Sn	8 9 0 F 16.00 19.00 0xygen Fluorine 16 S 32.07 35.45 Sulfur Chlorine 34 35 Se Br 78.96 79.90 Selenium Bromine 52 53 Te I 127.6 126.9 Tellurium Astatine 116 117 Lv Ts Livermorium Tennessine	9 Fuerine 117 CI 35.45 Chlorine 35 At 126.9 Bromine 53 Pt 126.9 Indine 85 At Atatine 117 Ts	Heitium 10 30.18 Neon 18 Argon 39.95 Argon 36 Krypton 54 Xe 131.3 Xenon 86 Radon 118 Og	
5         6         7         8           Boron         Carbon         7         8           AI         Si         C         N         O           29         30         31         32         33         34           Cu         Zn         Ge         As         Se           63.55         65.38         69.72         72.64         74.92         78.96           Copper         Zinc         Gallium         Gemanium         Arsenic         Selenium           Ag         Cd         In         Sn         Sh         Te           107.9         112.4         114.8         118.7         121.8         72.6           Silver         Gadmium         Indium         Ti         Antimony         Tellurium           79         80         81         82         83         84           Au         Hg         Ti         Pb         Bismuth         Polonium           79         80         204.4         207.2         209.0         Gold         Lv           6old         Mercury         Thellium         Fi         No         Lv         Lv         Lv           1111	Factor   F	5         6         7         8           B         C         N         O           10.81         12.01         14.01         16.00           Boron         Carbon         Nitrogen         0xygen           13         14         15         16           Al         Si         P         S           26.98         28.09         30.97         32.07           Aluminium         Silicon         Phosphorus         Suffur           31         32         33         34           Ga         Ge         As         Se           69.72         72.64         74.92         78.96           Gallium         Arsenic         Selenium           49         50         51         52           In         Sn         Sh         Te           114.8         118.7         121.8         Po           204.4         207.2         209.0         Thillinium           Insilicon         Bismuth         Polonium           113         114         I15         I16           Nh         FI         Moscovium         Livernorium	8 0 16.00 0xygen 16 \$\$32.07\$Suffur \$\$34 \$\$84 \$\$Po\$ Polonium 116 Livermorium			
5         6         7           Boron         Carbon         Nitrogen           10.81         12.01         14.01           Boron         Carbon         Nitrogen           13         14         15           Aluminium         Silcon         Nitrogen           26.98         28.09         30.97           Aluminium         Silcon         Phosphorus           29         30         31         32           47         48         49         50         51           Ag         Cd         In         Sn         Sb           107.9         112.4         114.8         118.7         121.8           Silver         Galfium         Germanium         Fin         Sh           79         80         81         82         83           Au         Hg         Ti         Pb         Bi           197.0         200.6         204.4         207.2         209.0           Gold         Mercury         Thallium         Fi         Mc           Rg         Fi         Fi         Mc         Mc	F	5         6         7           B         C         N           10.81         12.01         14.01           Boron         Carbon         Nitrogen           13         14         15           AI         Si         Phosphorus           31         32         33           Ga         Ge         As           69.72         72.64         74.92           Gallium         Germanium         Arsenic           49         50         51           In         Sn         Sh           In         Sn         Sh           Indium         Tin         Antimony           81         82         83           TI         Pb         Bismuth           113         114         115           Nh         FI         Mc           Nh         FI         Mc			9	Heitum Heitum 10 Neon 10 Neon 10 18 Argon 36 83.80 Krypton 54 Xenon 86 Rn Radon 118 Og
Section   Carbon   Carbon	S	5 6  B C  10.81 12.01 Boron Carbon  13 81 Sicon 31 26.98 28.09 Aluminium Silicon 31 32 Ga Ge 69.72 72.64 Gallium Germanium 49 50 In Sn 114.8 118.7 Indium Tin 81 82 Ti Pb 204.4 207.2 Thallium Lead 113 114 Nh FI	7	8 0 16.00 0xygen 16 8 32.07 Sulfur 34 8enium 52 Te 127.6 Tellurium 84 Po		
5   80   113   114.8   107.9   113   114.8	10.81   Boron   13   Al     10.81   Boron   13   Al     26.98   Aluminium   30   31     26.98   Aluminium   30   31     26.38   Ga   Ga     48   69.72   Gallium   0     112.4   114.8   Cadmium   112.4   Tellium   113     49   Cadmium   Indium   112   113     Copernicium   Nehonium   Nehonium   Copernicium   Nehonium   Nehonium	5 B 10.81 Boron 13 A1 26.98 Aluminium 31 Ga 69.72 Gallium 114.8 Indium 81 T1 204.4 Thallium 113 Nh	7		8 0 16.00 0xygen 16 8 32.07 Sulfur 34 8enium 52 Te 127.6 Tellurium 84 Po	9
29 30 Cu Zn Gpper Zinc Ag Cd 107.9 112.4 Silver Cadmium 79 80 Au Hg 197.0 200.6 Gold Mercury Rg Cn	30		T	7		8 9 0 F 16.00 19.00 0xygen Fluorine 16 C1 32.07 35.45 Sulfur Chlorine 34 35 Se Br 78.96 79.90 Selenium Bromine 52 53 Te I 127.6 126.9 Tellurium lodine 84 85 Po At Polonium Astatine 1116 117 Lv Ts
29 Cu 63.55 Copper 47 Ag 107.9 Silver 79 Au 197.0 Gold		30 2 Zn 2 Zn 2 Zinc 2 Zinc C Cd 112.4 112.4 112.4 112.6 112.6 C Cn	6 Carbon 1 1 2 .0 Carbon 1 2 8 .0 Silicon Silicon Silicon 5 5 0 Smanti Tin 8 2 8 .0 Carbon 1 1 1 4 Fleroviu		7 Nitragen 15 P 30.97 Phosphorus 33 As As 74.92 Arsenic 51 Sb 121.8 Antimony 83 Bi 209.0 Bismuth 115 Mc	7 8 9 9  N 0 F  14.01 16.00 19.00 Nitrogen 0xygen Fluorine 15 16 17 30.97 32.07 35.45 Phosphorus Sulfur Chlorine 33 34 35 As Se Br 74.92 78.96 79.90 Arsanic Selenium Bromine 51 52 53 Sb Te I 121.8 127.6 126.9 Antimony Tellurium Indine 83 84 85 Bi Po At 209.0 Bismuth Polonium Astatine 115 116 117 Moscovium Livermorium Tennessine
	10 0 C	0 L <sub>2</sub> V <sub>N</sub>		6 C 12.01 Carbon 14 Silicon 32 Ge 72.64 Germanium 50 Sn 118.7 Tin Tin Tin Flerovium Flerovium	6 7 C N 12.01 14.01 Carbon Nitrogen 14 15 Si Si 33 30.97 Silicon Phosphorus 32 As 72.64 As 72.64 74.92 Germanium Arsenic 50 51 Sn Sb 118.7 121.8 Tin Antimony 82 83 Pb Bi 207.2 209.0 Lead Bismuth 114 115 FI Mc	6         7         8         9           C         N         O         F           12.01         14.01         16.00         19.00           Carbon         Nitrogen         0xygen         Fluorine           Si         P         S         CI           Si         P         S         CI           28.09         30.97         32.07         35.45           Silicon         Phosphorus         Sulfur         Chlorine           32         As         Se         Br           72.64         74.92         78.96         79.90           Germanium         Arsanic         Selenium         Bromine           50         51         52         53         5           Sn         Sb         Te         1         1           82         83         84         85           Pb         Bi         Po         At           207.2         209.0         Polonium         Astatine           114         115         14         177           FI         Mc         Lv         Ts
8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8		29 Cu S3.55 Copper 47 Ag 107.9 Silver 79 Au 197.0 Gold Fig.	5 Boron 13 A1 26.98 Aluminium 31 Ga 69.72 Gallium 49 T1 T1 C04.4 Thallium 113 Nh	5 6  B C  10.81 12.01  Boron Carbon  13 14  A1 Si  26.98 28.09  Aluminium Silicon 31 32  Ga Ge 69.72 72.64 Gallium Germanium 49 50  In Sn 114.8 118.7 Indium Tin 81 82  TI Pb 204.4 207.2 Thallium Lead 113 114  Nh FI	5         6         7           Boron         Carbon         Nitrogen           10.81         12.01         14.01           Boron         Carbon         Nitrogen           13         14         15           AI         Si         Prosphorus           26.98         28.09         30.97           Aluminium         Silicon         Prosphorus           31         32         As           69.72         72.64         74.92           Gallium         Gemanium         Arsenic           49         50         51           81         Sn         Sb           114.8         118.7         121.8           Indium         Tin         Antimony           81         82         83           TI         Pb         Bismuth           113         114         115           Nh         FI         Mc	5         6         7         8         9           Boron         Carbon         Nitrogen         0xygen         Fluorine           10.81         12.01         14.01         16.00         19.00           Boron         Carbon         Nitrogen         0xygen         Fluorine           13         14         15         S         CI           26.98         28.09         30.97         32.07         35.45           Aluminium         Silicon         Phosphorus         Sulfur         Chlorine           31         32         33         34         35.45           Auminium         Silicon         Phosphorus         Sulfur         Chlorine           31         32         33.33         34         35.45           Autinium         Arsanic         Sulfur         Chlorine           49         50         51         52         53           Indium         Sn         Sh         Te         1           81         82         83         84         85           TI         Pb         Bismuth         Polonium         Astatine           113         114         115         14
28. Nick Nick Nick Nick Nick Nick Nick Nick	28 Nickel Nickel 46 Pd 106.4 Palladium 78 Pt 195.1 Platinum 110 Ds		10.81   Boron   13   Al   Boron   100.98   Aluminium   100.99   Cd   In   107.9   Cd   In   112.4   114.8   Silver   Cadmium   Indium   79   80   81   Au   Hg   Ti   112.4   Ti   113   Ti   113   Rg   Cn   Nh   Roentgenium   Copernicium   Nehonium   Nehonium   Copernicium   Nehonium   Nehonium   Copernicium   Nehonium   Neho	Cu         F         6           Boron         Carbon           10.81         12.01           Boron         Carbon           13         28.09           Aluminium         Silicon           29         30         31         32           63.55         65.38         69.72         72.64           Copper         Zinc         Gallium         Gemanium           47         48         49         50           Ag         Cd         In         Sn           107.9         112.4         114.8         118.7           Silver         Cadmium         Inditium         Lead           197.0         200.6         204.4         207.2           Gold         Mercury         Inallium         Lead           111         112         113         114           Rg         Cn         Nh         FI	5 6 7 7	5         6         7         8         9           B         C         N         O         F           10.81         12.01         14.01         16.00         19.00           Boron         Carbon         Nitrogen         0xygen         19.00           Boron         Carbon         Nitrogen         19.00         19.00           Boron         Carbon         Nitrogen         19.00         19.00           Al         Silcon         Phasphorus         Sulfur         17           Cu         Zn         Ga         As         Sc         CI           Au         Ap         33         34         35         As         35           Cu         Zn         Ga         As         Se         Br         Br         CI         Ar         As         As         As         CI         As         As         As         As         As         As         As         As         Br         Br         Ar         As
KEY 79 Au 197.0 6old Co 58.93 Cobatt 45 Rh 102.9 Rnodium 77 Iridium 109.2			10.81   Boron   13   Al   Boron   100.98   Aluminium   100.99   Cd   In   107.9   Cd   In   112.4   114.8   Silver   Cadmium   Indium   79   80   81   Au   Hg   Ti   112.4   Ti   113   Ti   113   Rg   Cn   Nh   Roentgenium   Copernicium   Nehonium   Nehonium   Copernicium   Nehonium   Nehonium   Copernicium   Nehonium   Neho	Cu         F         6           Boron         Carbon           10.81         12.01           Boron         Carbon           13         28.09           Aluminium         Silicon           29         30         31         32           63.55         65.38         69.72         72.64           Copper         Zinc         Gallium         Gemanium           47         48         49         50           Ag         Cd         In         Sn           107.9         112.4         114.8         118.7           Silver         Cadmium         Inditium         Lead           197.0         200.6         204.4         207.2           Gold         Mercury         Inallium         Lead           111         112         113         114           Rg         Cn         Nh         FI	5 6 7 7	5         6         7         8         9           B         C         N         O         F           10.81         12.01         14.01         16.00         19.00           Boron         Carbon         Nitrogen         0xygen         19.00           Boron         Carbon         Nitrogen         19.00         19.00           Boron         Carbon         Nitrogen         19.00         19.00           Al         Silcon         Phasphorus         Sulfur         17           Cu         Zn         Ga         As         Sc         CI           Au         Ap         33         34         35         As         35           Cu         Zn         Ga         As         Se         Br         Br         CI         Ar         As         As         As         CI         As         As         As         As         As         As         As         As         Br         Br         Ar         As
Symbol omic Weight Name Symbol omic Weight Name Fe 55.85 Iron 44 Ru 101.1 Ruthenium 76 Os 190.2 Osmium 108 Hs	79 Au 197.0 Gold Co 6old Co 58.93 Cobatt 45 Rh 102.9 Rhodium 77 Iridium 109 Mt	28 Nickel Nickel 106.4 Palladium 78 Pt 110 Damstadtium	10.81   Buron   13   Al     10.81   Al   Al     10.81   Buron   13   Al     10.81   Al   Al     10.81   Al	5         6           Brown         Carbon           10.81         12.01           8bronn         Carbon           13         28.09           13         28.09           14         AI           13         28.09           14         AI           13         28.09           28.09         28.09           Aluminium         Silicon           10 Cu         Cu           Aluminium         Silicon           10 Cu         Cu           Aluminium         Silicon           28.09         28.09           Aluminium         Silicon           26.98         28.09           Aluminium         Silicon           26.98         28.09           Aluminium         Silicon           26.98         28.09           Aluminium         Silicon           26.98         28.09           32         32           46         47           46         47           46         47           46         49           50         111           10	Particular         Fige         G         7           Boron         Carbon         Nitrogen           10.81         12.01         14.01           Boron         Carbon         Nitrogen           13         14         15           Aluminium         Silicon         Nitrogen           13         14         15           26.98         28.09         30.97           26.98         28.09         30.97           Aluminium         Silicon         Phosphorus           28         29         30           31         32         33           33         34         32           Aluminium         Silicon         Phosphorus           Aluminium         Silicon         Aluminium	Boron         C         N         O         F           10.81         12.01         14.01         16.00         19.00           28         29         N         O         F           28         29         30         31         32.07         35.45           Aliminium         Silicon         Physphorus         Sulfur         Chlorine           28         29         30         31         32         33         34         35           Nickel         Copper         Zinc         Gallium         Generanium         Ar.92         78.96         79.90           Nickel         Copper         Zinc         Gallium         Gemanium         Ar.92         78.96         79.90           Nickel         Copper         Zinc         Gallium         Gemanium         Ar.92         78.96         79.90           Pd         Ag         Co         T1.8.7         127.8         78.96         79.90           Palladium         Silver         Cadrium         Tin         Ar.92         78.96         79.90           Ph         Au         Hg         T1.8.7         127.8         127.6         126.9           Palladium         <
		KEY  79  Au  197.0  Gold  Co  Gold  Co  Si  Si  Si  Si  Si  Si  Si  Si  Si  S	KEY           79         Au           197.0         10.81           Gold         10.81           Co         Ni           Cobat         27           Cobat         28           Cobat         29           Rhodium         20           Rhodium         20           102.9         106.4           102.9         106.4           102.9         200.6           102.9         200.6           109.2         106.4           109.2         106.4           107.9         112.4           114.8           Rhodium         Silver           Cadmium         Indium           77         78           79         80           80         81           192.2         195.1           192.2         195.1           109         110           110         111           111         112           113           Mketrnerium         Netonigenium           Copenicium         Netonium	KEY           Au         Pa         C         C           197.0         197.0         10.81         12.01           197.0         197.0         10.81         12.01           197.0         10.81         12.01         14           Co         Ni         Cu         2n         26.98         28.09           Aluminium         Silicon         31         32         32           Ball         Cu         Ag         48         49         50           Rho         Ag         Ag         Ag         Ag         Ag           In         Pt         Au	KEY           Au         79           Au         B         C         N           197.0         6old         10.81         12.01         14.01           197.0         6old         10.81         12.01         14.01           197.0         10.81         12.01         14.01           197.0         13         14         15           Al         Sicon         13.09         30.97           Al         Sicon         14.01         14.01           Bobat         Con         In         In         In           Ab         63.55         65.38         28.09         30.97           Aluminium         Silcon         Phosphous         31.0         31.0           58.93         58.69         63.55         65.38         69.72         72.64         74.92           Cobatt         Nickel         Copper         Zinc         Gallium         Gentum         Arsenic           45         46         47         48         49         50         51           Rhodium         Palladium         Silver         Cadmium         Indium         Indium           102.9         106.4 <td>  National Parasadulum   National Parasadulum</td>	National Parasadulum   National Parasadulum
Ato  25  Mn 54.94  Manganese 43  Tc  Technetium 75  Re 186.2 Rhemium 107  Bh	L = + 0	KEY  79  Au  197.0  Gold  Co  Gold  Co  Si  Si  Si  Si  Si  Si  Si  Si  Si  S	KEY           79         Au           197.0         10.81           Gold         10.81           Co         Ni           Cobat         27           Cobat         28           Cobat         29           Rhodium         20           Rhodium         20           102.9         106.4           102.9         106.4           102.9         200.6           102.9         200.6           109.2         106.4           109.2         106.4           107.9         112.4           114.8           Rhodium         Silver           Cadmium         Indium           77         78           79         80           80         81           192.2         195.1           192.2         195.1           109         110           110         111           111         112           113           Mketrnerium         Netonigenium           Copenicium         Netonium	KEY           Au         Pa         C         C           197.0         197.0         10.81         12.01           197.0         197.0         10.81         12.01           197.0         10.81         12.01         14           Co         Ni         Cu         2n         26.98         28.09           Aluminium         Silicon         31         32         32           Ball         Cu         Ag         48         49         50           Rho         Ag         Ag         Ag         Ag         Ag           In         Pt         Au	KEY           Au         79           Au         B         C         N           197.0         6old         10.81         12.01         14.01           197.0         6old         10.81         12.01         14.01           197.0         10.81         12.01         14.01           197.0         13         14         15           Al         Sicon         13.09         30.97           Al         Sicon         14.01         14.01           Bobat         Con         In         In         In           Ab         63.55         65.38         28.09         30.97           Aluminium         Silcon         Phosphous         31.0         31.0           58.93         58.69         63.55         65.38         69.72         72.64         74.92           Cobatt         Nickel         Copper         Zinc         Gallium         Gentum         Arsenic           45         46         47         48         49         50         51           Rhodium         Palladium         Silver         Cadmium         Indium         Indium           102.9         106.4 <td>  National Parasadulum   National Parasadulum</td>	National Parasadulum   National Parasadulum
0.5 ME 0.5	Standard Atomic Number Symbol Standard Atomic Weight Name  25	Atomic Number Symbol Symbol Symbol Symbol Symbol Symbol Symbol Symbol Standard Atomic Weight Mn Fe Co Ni Gold S4.94 55.85 58.93 58.69 Manganese Iron Cobalt Nickel Tc Ru Rh Pd To 1.01.1 102.9 106.4 Technetium Ruthenium Rhodium Palladium 75 76 77 78 Re Os Ir Pt 186.2 190.2 192.2 195.1 Rhenium Osmium Iridium Platinum 107 108 109 110 Bshrium Hassium Meitnerium Darmstadtium	Standard Atomic Number   79   Standard Atomic Number   79   Standard Atomic Weight   197.0   Au   10.81	Standard Atomic Number   79   Standard Atomic Number   79   Standard Atomic weight   197.0   Au   13   14   12.01	Standard Atomic Number   79   Standard Atomic Number   79   Standard Atomic Neight   197.0   Au	KEY   Standard Atomic Weight   197.0   Atomic Weight
24 Cr Cr Chromium 42 Mo 95.96 Molybdenum 74 W 183.9 Tungsten 106 Sq	Standard Atomic Number   Symbol Standard Atomic Weight Name   52.00   54.94   55.85   Iron   42   Tc   Ru   95.96   Mohybdenum   Technetium   Ruthenium   74   75   76   Wohybdenum   Technetium   Ruthenium   106   107   108   Seaborgium   Bohrium   Hassium   Hassium   Bohrium   Hassium   Hassiu	Standard Atomic Number   79   Symbol Symbol Symbol Standard Atomic Weight	Standard Atomic Weight   79   Standard Atomic Weight   197.0   Au   197.0   Standard Atomic Weight   197.0   Au   197.0   Standard Atomic Weight   197.0   Au   197.0   Seaborgium   Standard Atomic Weight   197.0   Au   197.0   Seaborgium   Standard Atomic Weight   197.0   Au   197.0   Seaborgium   Standard Atomic Windows   Seaborgium   Standard Atomic Name   Seaborgium   Standard Atomi	Crampic Number   79   Standard Atomic Name   6 old   10.2 01   8 ord   12.01   9 ord   12.01   9 ord   10.01   1 ord   10.02	Standard Atomic Number   79   Standard Atomic Weight   197.0   Atomic Number   79   Standard Atomic Weight   197.0   Atomic Bearram Silicon   Nitrogen   13   Atomic Bearram Silicon   Nitrogen   13   Atomic Bearram Silicon   Nitrogen   14   Atomic Bearram   15   Atomic Bearram   16   Atomic Bearram   16   Atomic Bearram   16   Atomic Bearram   17   Atomic	Standard Atomic Number   79   Standard Atomic Number   70   Stan
22 23 24 Ti V Cr 47.87 50.94 52.00 Titanium Vanadium Chromium 40 41 42 Zr Nb Mo 91.22 92.91 95.96 Zirconium Niobium Molybdenum 72 73 74 Hf Ta W 178.5 180.9 183.9 Hafmium Tantalum Tungsten 104 105 59	Standard Atomic Number   Standard Atomic Number   Symbol     Ti	XEFY           Atomic Number Symbol Symbol         Au         79           Ti         V         Cr         Nin         Fe         Co         Ni           47.87         50.94         52.00         54.94         55.85         58.93         58.69           Titanium         Vanadium         Chromium         Manganese         Iron         Cobalt         Nickel           40         41         42         43         44         45         46           Zr         Nb         Mo         Tc         Ru         Rb         100-9         106-4           91.22         92.91         95.96         101.1         102.9         106-4           Zirconium         Niobium         Molybdenum         Technetium         Ruthenium         Rhodium         Palladium           72         73         74         75         76         77         78           Hf         Ta         W         Re         0s         Ir         Pt           178.5         180.9         183.9         186.2         190.2         192.2         195.1           Hafmium         104         105         107         108         109 <td>  Color   Colo</td> <td>  Color   Colo</td> <td>  Titanium   Nandalum   To   To   To   To   To   To   To   T</td> <td>  Fraction   Particular   Parti</td>	Color   Colo	Color   Colo	Titanium   Nandalum   To   To   To   To   To   To   To   T	Fraction   Particular   Parti
23 24 Cr 50.94 52.00 Vanadium Chromium 41 42 Mo 92.91 95.96 Niobium Molybdenum 73 74 Ta W 180.9 183.9 Tantalum Tungsten 105 Db Sq	Standard Atomic Number   Standard Atomic Number   Symbol     Ti	XEFY           Atomic Number Symbol Symbol         Au         79           Ti         V         Cr         Nin         Fe         Co         Ni           47.87         50.94         52.00         54.94         55.85         58.93         58.69           Titanium         Vanadium         Chromium         Manganese         Iron         Cobalt         Nickel           40         41         42         43         44         45         46           Zr         Nb         Mo         Tc         Ru         Rb         100-9         106-4           91.22         92.91         95.96         101.1         102.9         106-4           Zirconium         Niobium         Molybdenum         Technetium         Ruthenium         Rhodium         Palladium           72         73         74         75         76         77         78           Hf         Ta         W         Re         0s         Ir         Pt           178.5         180.9         183.9         186.2         190.2         192.2         195.1           Hafmium         104         105         107         108         109 <td>  Color   Colo</td> <td>  Color   Colo</td> <td>  Titanium   Nandalum   To   To   To   To   To   To   To   T</td> <td>  Care   Care  </td>	Color   Colo	Color   Colo	Titanium   Nandalum   To   To   To   To   To   To   To   T	Care
22 23 24 Ti V Cr 47.87 50.94 52.00 Titanium Vanadium Chromium 40 41 42 Zr Nb Mo 91.22 92.91 95.96 Zirconium Niobium Molybdenum 72 73 74 Hf Ta W 178.5 180.9 183.9 Hafmium Tantalum Tungsten 104 105 59	Standard Atomic Number   Standard Atomic Number   Symbol     Standard Atomic Weight   Standard Atomic Weight     Standard Atomic Weight   Standard Atomic Weight     Standard Atomic Weight   Name   Standard Atomic Weight     A4.96	Standard Atomic Number   79   Symbol Symbol   197.0   Au   Standard Atomic Number   79   Symbol   197.0   Au   Standard Atomic Neight   197.0   Standard Atomic Neight   197.0   Standard Atomic Neight   197.0   Standard Atomic Noight   197.0   1	Scandard Atomic Number   79   Standard Atomic Number   70   Standard Number   70   Sta	Standard Atomic Weight   Total Standard   Total Standard Atomic Weight   Total Standard	Color   Colo	Standard Atomic Number   79   Standard Atomic Number   70   Standard Number   70   Stan
		0 - 2 2 2 3		6 C 12.01 Carbon 14 Silicon 32 Ge 72.64 Germanium 50 Sn 118.7 Tin Tin Tin Flerovium Flerovium	6 7 C N 12.01 14.01 Carbon Nitrogen 14 15 Si Si 33 30.97 Silicon Phosphorus 32 As 72.64 74.92 Germanium Arsenic 50 51 Sn Sb 118.7 121.8 Tin Antimony 82 83 Pb Bi 207.2 209.0 Lead Bismuth 114 115 FI Mc	6         7         8         9           C         N         O         F           12.01         14.01         16.00         19.00           Carbon         Nitrogen         0xygen         Fluorine           14         15         S         CI           Si         P         S         CI           28.09         30.97         32.07         35.45           Silicon         Phosphorus         Sulfur         Chlorine           32         Ax         S         CI           Ge         Ax         S         S           Ax         Sulfur         Chlorine         Br           Ax         S         S         F           Sh         Te         I         I           Sn         Sh         Te         I           Sh         Te         I         At           Sn         Sh         R         S5           Pb         Bi         Po         At           Bismuth         Polonium         Astatine           Lud         LV         Ts           FI         MC         Lv         Ts
29 Cu 63.55 Copper 47 Ag 107.9 Silver 79 Au 197.0 Gold		30 <b>30</b> <b>5.38</b> Zinc <b>Cd</b> 112.4 Indepinium 80 Hg 000.6 letroury 112 Cn		6 C 12.01 Carbon 14 Silicon 32 Ge 72.64 Germanium 50 Sn 118.7 Tin Tin Tin Flerovium Flerovium	6 7 C N 12.01 14.01 Carbon Nitrogen 14 15 Si Si 33 30.97 Silicon Phosphorus 32 As 72.64 As 72.64 74.92 Germanium Arsenic 50 51 Sn Sb 118.7 121.8 Tin Antimony 82 83 Pb Bi 207.2 209.0 Lead Bismuth 114 115 FI Mc	6         7         8         9           C         N         O         F           12.01         14.01         16.00         19.00           Carbon         Nitrogen         0xygen         Fluorine           14         15         S         CI           Si         P         S         CI           28.09         30.97         32.07         35.45           Silicon         Phosphorus         Sulfur         Chlorine           32         Ax         S         Br           72.64         74.92         78.96         79.90           Gemanium         Arsanic         Selenium         Bromine           50         51         52         53         5           Sh         Te         I         I         I           82         83         84         85           Pb         Bi         Po         At           207.2         209.0         Polonium         Astatine           114         115         116         117           FI         Mc         Lv         Ts
29 30 Cu Zn Copper Zinc Ag Cd 107.9 112.4 Silver Cadmium 79 80 Au Hg 197.0 200.6 Gold Mercury Rg Cn	30				7 Nitragen 15 P 30.97 Phosphorus 33 As As Arsenic 51 Sb 121.8 Antimony 83 Bi 209.0 Bismuth 115 Mc	7 8 9  N O F  14.01 16.00 19.00  Nitrogen 0xygen Fluorine  15 P  30.97 32.07 35.45  Phosphorus Sulfur Chlorine  33 34 35  As Se Br  74.92 78.96 79.90  Arsenic Selenium Bromine  51 52 53  Sb Te I  121.8 127.6 126.9  Antimony Tellurium lodine  83 84 85  Bi Po At  209.0  Bismuth Polonium Astatine  115 116 117  Moscovium Livermorium Tennessine
5         6         7         8           B C N O Buron         Carbon Carbon         Nitrogen Oxygen           10.81 12.01         14.01 16.00           Buron Carbon         Nitrogen Oxygen Oxygen           13 31 32 28.09         30.97 32.07           26.98 28.09 30.97         32.07 32.07           Aluminium Silicon Phosphorus Sulfur Sulfur Silver         Sulfur Sulf	Factor   F	5         6         7         8           B         C         N         O           10.81         12.01         14.01         16.00           Boron         Carbon         Nitrogen         0xygen           13         14         15         5           Al         Si         P         S           26.98         28.09         30.97         32.07           Aluminium         Silicon         Phosphorus         Suffur           31         32         33         34           Ga         Ge         As         Se           69.72         72.64         74.92         78.96           Gallium         Germanium         Arsenic         Selenium           49         50         51         52           In         Sn         Sh         Te           Indium         Tin         Antimony         Tellurium           81         B         B         Po           204.4         207.2         209.0         Tal           Inallium         Lead         Bismuth         Polonium           113         114         IT5         IV           Nh <td>8 0 16.00 0xygen 16 \$\$32.07\$Suffur \$\$34 \$\$84 \$\$Po\$ Polonium 116 Livermorium</td> <td></td> <td></td> <td></td>	8 0 16.00 0xygen 16 \$\$32.07\$Suffur \$\$34 \$\$84 \$\$Po\$ Polonium 116 Livermorium			

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20	γp	173.1	Ytterbium
69	۳	168.9	Thulium
89	ù	167.3	Erbium
29	유	164.9	Holmium
99	Dy	162.5	Dysprosium
65	Тр	158.9	Terbium
64	P <b>g</b>	157.3	Gadolinium
63	Ш	152.0	Europium
62	Sm	150.4	Samarium
61	Pm		Promethium
09	β	144.2	Neodymium
29	ፈ	140.9	Praseodymium
28	ပီ	140.1	Cerium
22	Га	138.9	Lanthanum

71 **Lu** 175.0 Lutetium

# Actinoids

103	ב	Lawrencium
102	ON N	Nobelium
101	MI	Mendelevium
100	Ē	Fermium
66 6	ES	Einsteinium
86	ל	Californium
97	ž	Berkelium
96	E .	Curium
95	AB	Americium
94	2	Plutonium
86	o Z	Neptunium
92	0.00	238.0 Uranium
91	e ?	231.0 Protactinium
06 <b>i</b>	u l	232.0 Thorium
68 •	Ac	Actinium

Standerd atomic weights are abridged to four significant figures. Elements with no reported values in the Elements (November 2016 version) is the principal source of all other data. Some data may have been modified.

The International Union of Pure and Applied Chemistry Periodic Table of the Elements (Febuary 2010 version) is the principal source of all other data. Some data may have been modified. Ē

# Neap HSC Trial Examination 2020 Physics

# DIRECTIONS: Write your name in

Write your name in the space provided.

Write your student number in the boxes provided below. Then, in the columns of digits below each box, fill in the oval which has the same number as you have written in the box. Fill in **one** oval only in each column.

Read each question and its suggested answers. Select the alternative A, B, C, or D that best answers the question. Fill in the response oval completely, using blue or black pen. Mark **only one** oval per question.

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

If you change your mind and have crossed out what you consider to be the correct answer, then indicate this by writing the word *correct* and draw an arrow as follows.

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STUDENT NAME:

#### STUDENT NUMBER:

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5	5	5	5	5	5	5	5	5
6	6	<b>6</b>	6	<b>6</b>	6	6	6	6
1	1	1	1	1	1	1	1	1
8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9
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## SECTION I MULTIPLE-CHOICE ANSWER SHEET

1.	Α	$\bigcirc$	В	$\bigcirc$	C	$\bigcirc$	D	$\bigcirc$
2.	Α	$\bigcirc$	В	$\bigcirc$	C	$\bigcirc$	D	$\bigcirc$
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5.	Α	$\bigcirc$	В	$\bigcirc$	C	$\bigcirc$	D	$\bigcirc$
6.	Α	$\bigcirc$	В	$\bigcirc$	C	$\bigcirc$	D	$\bigcirc$
7.	Α	$\bigcirc$	В	$\bigcirc$	C	$\bigcirc$	D	$\bigcirc$
8.	Α	$\bigcirc$	В	$\bigcirc$	C	$\bigcirc$	D	$\bigcirc$
9.	Α	$\bigcirc$	В	$\bigcirc$	C	$\bigcirc$	D	$\bigcirc$
10.	Α	$\bigcirc$	В	$\bigcirc$	C	$\bigcirc$	D	$\bigcirc$
11.	Α	$\bigcirc$	В	$\bigcirc$	C	$\bigcirc$	D	$\bigcirc$
12.	Α	$\bigcirc$	В	$\bigcirc$	C	$\bigcirc$	D	$\bigcirc$
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15.	Α	$\bigcirc$	В	$\bigcirc$	C	$\bigcirc$	D	$\bigcirc$
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17.	Α	$\bigcirc$	В	$\bigcirc$	C	$\bigcirc$	D	$\bigcirc$
18.	Α	$\bigcirc$	В	$\bigcirc$	C	$\bigcirc$	D	$\bigcirc$
19.	Α	$\bigcirc$	В	$\bigcirc$	C	$\bigcirc$	D	$\bigcirc$
20.	Α	$\bigcirc$	В	$\bigcirc$	C	$\bigcirc$	D	$\bigcirc$

### STUDENTS SHOULD NOW CONTINUE WITH SECTION II

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