National Council of Science Museums
(Ministry of Culture, Govt. of India)
Block-GN, Sector-V, Bidhan Nagar
Kolkata – 700 091

Aptitude test for selection of Curator 'B'

Name of the Candidate ....

Form no. ....

Date of Aptitude Test: 12/09/2019
Time: 10:30 A.M.

Total Time: 3 Hours

INSTRUCTIONS FOR THE CANDIDATES

01. Please write your name and form number legibly in the spaces provided;

02. The test contains two sections; viz., **Section-'A'** and **Section-'B'**;

03. The duration of the test is 3 hours for both sections and maximum marks are 100;

04. Read the instructions provided with the questions carefully and answer;

05. In questions having multiple choice answers, please tick legibly on the test paper the answer of your choice;

06. In case you need to change your answer, strike out the wrong one legibly and put a tick in the answer of your choice;

07. If more than one answer is ticked, the answer shall be considered invalid and no marks will be awarded for the answer;

08. Carry out your rough work, if any, on the labeled sheet separately provided with this test paper;

09. No mobile phone will be allowed inside the examination hall;

10. There is no negative marking;

11. The complete question paper with labeled attached sheet should be handed over to the instructor before leaving the room;

12. Candidates will not be allowed to leave the examination hall before 2 hours;

*****

Question No. 1 to 30 carry 1 mark each. Tick the correct answer or fill in the blanks with correct alternatives as may be needed in the question.

1. V, W and X are intelligent; V,Y and Z are laborious; Y, X and Z are hones and V, W and Z are ambitious. Which of the following are not laborious?

    a. Y & Z   b. W & X   c. V & W   d. X & Y

2. Fill in the correct option -   UTS : FDC :: WVU : ?

    a. YWV   b. WXY   c. UVW   d. HGF

3. Statement: Should smoking be prohibited?
    Argument I.   Yes, it damages the liver and the lung.
    Argument II.   No, it will drive millions of tobacco workers out of factory.

    a. Only Argument I is strong.   b. Only argument II is strong.
    b. Both the arguments are strong   d. Neither I or II is strong

4. Fill in the correct preposition in the sentence: Trespassers are liable ..... a fine of Rs 500.00.
    a. to   b. for   c. with   d. into

5. The appropriate meaning of the idiom *" plays fast and loose"* is:
    a. very skillful player   b. says one thing and does another
    c. sternly opposed   d. quite worthless

6. Fill in the blank with correct option:

    We need much more proactive and .... supervision of dam waters while releasing in case of overflow to avoid a flood like situation.

    a. punctilious   b. scrupulous   c. diplomatic   d. conforming

7. A person who write the life story of a saint or of another person's life story with only praise and no criticism is called a ....

    a. Chorographer   b. Pragiogrpaher   c. Hagiographer   d. Evangelographer

1

8. The word to express 'a long and complicated process that is annoying and seems unnecessary" is:

 a. Legionnaire   b. Rigmarole   c. Roll mop   d. Sacerdotal

9. A person whose natural body shape is thin is called:

 a. Mesomorph   b. Endomorph   c. Ectomorph   d. Entromorph

10. What is the next in the series: 1ZV03X, 3XT11U, 5VR27T, 7TP51R, ...

 a. 9QM81O   b. 9IM81L   c. 9NR83P   d. 9RN83P

11. If in a secret code DELHI is written as 1817101413, how can NOIDA be written in the same code?

 a. 0708141821   b. 0807131821   c. 1807131822   d. 0807131826

12. India is the largest producer of several food grains. Find the odd man out.

 a. Jute   b. Ginger   c. Onion   d. Banana

13. Every year 12th August is celebrated as International Youth Day. The theme of 2019 International Youth day was:

 a. Transforming the Nation   b. Transforming Education
 c. Transforming Sports   d. Youth Skill and Innovation

14. One of the country below is not a member of Visegrád group or V4 group of countries in central Europe. Identify the country.

 a. Poland   b. Czech Republic   c. Hungary   d. Austria

15. The world is celebrating 150 years of one of the following event. Identify it.

 a. Birth Anniversary Acharya P C Ray   b. Birth Anniversary of Einstein
 c. Periodic Table of Chemical elements   d. Discovery of Radioactivity

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16. National Technology Day is celebrated in India on ....

    a. 5ᵗʰ May   b. 28ᵗʰ February   c. 11ᵗʰ May   d. 21ˢᵗ April

17. In a secret artificial language:
    daftafoni means advisement; *imodafta* means misadvise; *imolokti* means misconduct
    Which word could mean "statement"?

    a. *kratafoni*   b. *kratadafta*   c. *loktifoni*   d. *daftaimo*

18. Chandrayaan 1 mission of ISRO which confirmed presence of water molecule on Moon's surface was launched in the year......

    a. 2009   b. 2008   c. 2010   d. 2007

19. The name of the lander, which has been sent by ISRO with the Chandrayaan 2 and which will land at South pole of moon is ....

    a. Vishal   b. Vikrant   c. Vikram   d. Pragyan

20. The Council of Scientific & Industrial Research (CSIR), known for its cutting edge R&D knowledgebase in diverse S&T areas, has a dynamic network of .... national laboratories.

    a. 39   b. 42   c. 40   d. 38

21. Government of India scheme of FAME is related to which of the following industry:

    a. Electronics b. Mobile phones c. Electric and hybrid vehicles d. AI, AR & VR

22. The number of elected members in the Upper House of Parliament in India is ....

    a. 250   b. 543   c. 238   d. 545

23. Who is the current Principal Scientific Advisor to the Government of India?

    a. Dr. R. Chidambaram   b. Dr. Anil Kakodkar

    c. Prof. K VijayRaghavan   d. Dr. V.S. Saraswat

24. The large scale physics experiment observatory called LIGO is meant to detect
..........................Radioisotopes which are used in medical diagnosis are known as:

   a. Radioisotopes in Earth's core
           b. Cosmic Gravitational waves
   c. Elements ejected during Solar flare
     d. Magnetic materials in Space

25. The AAYUSH system of medical practice in India consists of several traditional medicine practices. Find the odd man out?

   a. Yoga
        b. Unani
        c. Ayurveda
        d. Accupuncture

26. Here are two statements about the roots of the equation $x^2 - 8x + 12 = 0$.
   (i)   The roots are real and rational;   (ii)   The roots are equal
        Which of the following is true?

   a. Neither statement is correct
      b. Only statement (i) is correct
   c. Only statement (ii) is correct
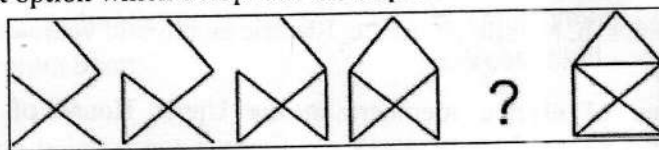   d. Both statements are correct

27. As of now, the total number of states & UTs respectively in India is :

   a. 29 & 7   b. 28 & 9   c. 30 & 6   d. 29 & 9

28. In 2019, DRDO tested its ballistic missile defence interceptor system called ASAT. The name of the mission was:

   a. LAKSHYA   b. NAGA   c. SHAKTI   d. VEDHA

29. Choose the best option which completes the sequence:

   a.   b.   c.   d.

30. India is not a member of which group of countries?

   a. G 7   b. G 20   c. G 5   d. G 4

राष्ट्रीय विज्ञान संग्रहालय परिषद
National Council of Science Museums
ब्लॉक –जीएन, सेक्टर-V, बिधान नगर Block –GN, Sector-V, Bidhan Nagar,
कोलकाताKolkata 700091

Aptitude Test for the post of Curator 'B' at NCSM - Part II

~~Duration – 3 Hours~~
Part A - Objective – 30 Marks
Part B - Descriptive – 40 Marks

Name of the Candidate : _____

Roll No. : _____

Signature with Date : _____

Instructions :
1. The answers should be marked with a ✓mark only for Part A Objective in the boxes provided below.
2. All questions are compulsory.
3. No Negative marking
4. Part – B Answers may be written in the question paper itself.
5. Worksheets may be attached along with the Question paper.

No	A	B	C	D	No	A	B	C	D
1.					16.				
2.					17.				
3.					18.				
4.					19.				
5.					20.				
6.					21.				
7.					22.				
8.					23.				
9.					24.				
10.					25.				
11.					26.				
12.					27.				
13.					28.				
14.					29.				
15.					30.				

Part A - Objective

1. A light photon takes about 8 minutes to travel from the surface of the sun and reach the earth. What would be the time taken for a photon to travel from the central core to the surface of the sun?
   - (A) 8 minutes
   - (B) 40,000 years
   - (C) 16 minutes
   - (D) 10,000 years

2. Assume a situation. There is an earthquake which is one point higher on the Richter scale than another earthquake which is ten times powerful. Now how much powerful do you think the earthquake will be if it was just ½ a point higher on the Richter Scale?

   - (A) 3.16
   - (B) 10
   - (C) 2.16
   - (D) 5.16
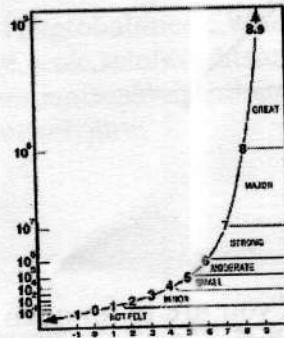
3. A solar year has 365 days. Is there a difference between lunar and solar year if so what is the difference?
   - (A) 0 days
   - (B) 11 days
   - (C) 10 days
   - (D) 7 days

4. During a race, a runner gets stuck with a hurdle. Why does he fall down?
   - (A) Inertia
   - (B) Centrifugal force
   - (C) Momentum
   - (D) Gravity

5. An elevator is moving upward with constant acceleration. The dashed curve shows the position y of the ceiling of the elevator as a function of the time t. At the instant indicated by the dot, aboltbreakslooseanddropsfromtheceiling.Whichcurvebestrepresentsthepositionofthe bolt as a function of time?
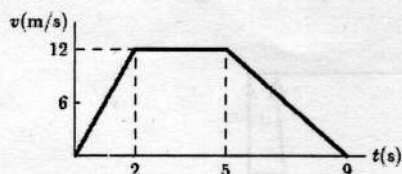
   - (A) A
   - (B) B
   - (C) C
   - (D) D
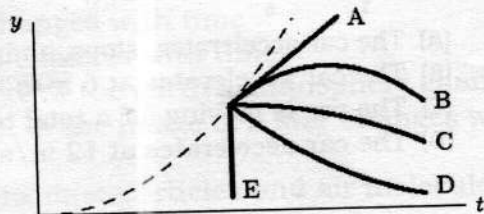
6. The diagram shows a velocity-time graph for a car moving in a straight line. At point Q the car must be:
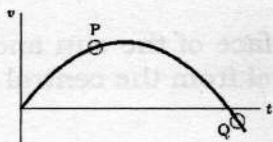

   (A) moving with zero acceleration
   (B) traveling downhill
   (C) traveling below ground-level
   (D) traveling in the reverse direction to that at point P

7. The graph represents the straight line motion of a car. How far does the car travel between $t = 2$ s and $t=5$ s?

   (A) 4m
   (B) 12m
   (C) 24m
   (D) 36m

8. During lighting, if you are in an open place which dress would you prefer to wear to be safe from a lightning strike.
   (A) Rain coat and cap
   (B) Thick Rubber dress with cap
   (C) Steel Armored dress
   (D) Normal cotton dress

9. The work done by gravity during the descent of a projectile:
   (A) is positive
   (B) is negative
   (C) is zero
   (D) depends for its sign on the direction of the y axis

10. The diagram represents the straight line motion of a car. Which of the following statements is true?
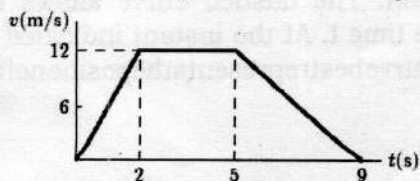
   (A) The car accelerates, stops, and reverses
   (B) The car accelerates at 6 m/s^2 for the first 2s
   (C) The car is moving for a total time of 12s
   (D) The car decelerates at 12 m/s^2 for the last 4s

11. A heavy ball is suspended as shown. A quick jerk on the lower string will break that string but a slow pull on the lower string will break the upper string. The first result occurs because:

(A) the force is too small to move the ball
(B) action and reaction is operating
(C) the ball has inertia
(D) air friction holds the ball back

upper string
lower string
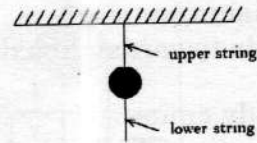
12. The following material namely cork ball, granite, metal keys and glass jar are put into a mixer grinder. Which one of them cannot be powdered.
(A) Metal Keys
(B) Granite
(C) Cork Ball
(D) All the four can be powdered

13. An object placed on an equal-arm balance requires 12 kg to balance it. When placed on a spring scale, the scale reads 12 kg. Everything (balance, scale, set of weights and object) is now transported to the Moon where the free-fall acceleration is one-sixth that on Earth. The new readings of the balance and spring scale (respectively) are:
(A) 12 kg, 12 kg
(B) 2 kg, 2 kg
(C) 12 kg, 2 kg
(D) 2 kg, 12 kg

14. A glass tumbler is filled with water and its mouth tied with a cotton banian. Now if the tumbler is inverted what happens to the water in the glass tumbler.
(A) Spills down
(B) Remains in the tumbler
(C) Partially spills
(D) None of the above

15. Identical guns fire identical bullets horizontally at the same speed from the same height above level planes, one on the Earth and one on the Moon. Which of the following three statements is/are true?
I. The horizontal distance traveled by the bullet is greater for the Moon.
II. The flight time is less for the bullet on the Earth.
III. The velocity of the bullets at impact are the same.
(A) III only
(B) I and II only
(C) I and III only
(D) II and III only

16. Stars twinkle because
(A) the intensity of light emitted by them changes with time
(B) the distance of the stars from the earth changes with time
(C) the refractive index of the different layers of the earth's atmosphere changes continuously, consequently the position of the image of a star changes with time
(D) the light from the star is scattered by the dust particles and air molecules in the earth's atmosphere

17. The entropy of the universe–
    (A) tends towards a minimum
    (B) tends to zero
    (C) remains constant
    (D) tends towards a maximum

18. A black body emits–
    (A) Radiation of all wavelengths
    (B) No radiation
    (C) Radiation of single wavelength
    (D) Radiation of selected wavelength

19. Muons belong to which category of fundamental particles?
    (A) Leptons
    (B) Baryons
    (C) Quarks
    (D) Bosons

20. Three rectangular containers are taken, the first one is filled with icecream, the second one is filled with corn starch pudding, and the third one is filled with chocolate syrup and placed on a platform at a height of one meter. A shooter fires at the containers from a distance of 30mtr with a 0.303 gun. Which container would be the least damaged or even able to stop the bullet?
    (A) Ice
    (B) Corn starch pudding
    (C) Chocolate syrup
    (D) None of the above

21. Hysteresis is desirable in Schmitt-trigger, because
    (A) energy is to be stored/discharged in parasitic capacitances.
    (B) effects of temperature would be compensated.
    (C) devices in the circuit should be allowed time for saturation and desaturation.
    (D) it would prevent noise from causing false triggering.

22. A radio frequency signal contains three frequency components, 870 KHz, 875 KHz and 880 KHz. The signal needs to be amplified. The amplifier used should be
    (A) audio frequency amplifier
    (B) wide band amplifier
    (C) tuned voltage amplifier
    (D) push-pull amplifier

23. When a lighted matchstick is shown before another light source, the shadow of the matchstick is formed on a screen but not the shadow of the flame. Why?
    (A) Flame is red in color
    (B) Flame is a light source
    (C) Flame shadow is not visible
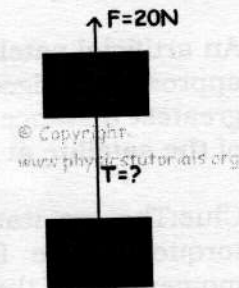   (D) The light source obstructs the flame

24. In the system given below ignore the friction and masses of the pulleys. If masses of X and Y are equal find the acceleration of the X? ($g=10m/s^2$)

    (A) $2m/s^2$
    (B) $4 m/s^2$
    (C) $6 m/s^2$
    (D) $1 m/s^2$
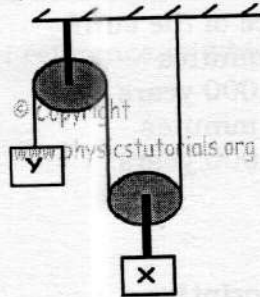
25. When system is in motion, find the tension on the rope.

    (A) 10N
    (B) 12N
    (C) 20N
    (D) 5N

26. If the distance between two masses is increased by a factor of 2, the gravitational force of attraction between them will
    (A) reduce by a factor of 4
    (B) reduce by a factor of 2
    (C) remain Same
    (D) increase by a factor of 2

27. A child throws a ball downward from a tall building. Note that the ball is thrown, not dropped and disregard air resistance. What is the acceleration of the ball immediately after it leaves the child's hand?
    (A) Freefall
    (B) $9.8 m/sec^2$
    (C) infinite
    (D) $10.8m/ sec^2$

28. A space station that has a physical shape of wheel achieves artificial gravity by spinning around its axis. If the station is of size 2 km, how fast should it be spinning for the people inside to feel the samegravitational acceleration as on earth?
(Hint: $a= rw^2$ and $g =9.8 m/sec^2$)
    (A) 0.07rad/s
    (B) 9.8 rad/s
    (C) 0.10 rad/s
    (D) 980 rad/ s

29. A boy of mass 40 kg wishes to play on pivoted seesaw with his dog of mass 15 kg. When the dog sits at 3 m from the pivot, where must the boy sit if the 6.5 m long board is to be balanced horizontally?
    (A) 2 metre
    (B) 1.12metre
    (C) 0 .12metre
    (D) 3 metre

30. A light photon takes about 8 minutes to travel from the surface of the sun and reach the earth. What would be the time taken for a photon to travel from the central core to the surface of the sun?

    (A) 8 minutes

    (B) 40,000 years

    (C) 16 minutes

    (D) 10,000 years

Part B – Descriptive

1   An artificial satellite is placed in an elliptical orbit about the earth. Its point of closest approach (perigee) is at a distance r_p from the centre of the earth, while its point of greatest distance (apogee) is at a distance r_a from the centre of the earth. If the speed of the satellite at the perigee is v_p, find the speed at the apogee.

Clue:The gravitational force on the satellite is, not very significant and, exerts no torque as the force passes through the axis of rotation. Hence, the angular momentum of the satellite is constant at all times :

2 How fast must an unstable particle move to travel 20 m before it decays ? The mean lifetime of the particle at rest = 2.6 X 10^{-8} s.

Clue : The mean lifetime of 2.6 X 10^{-8} s is in a frame of reference in which the particle is at rest. That is, Δt = 2.6 X 10^{-8} s.

3 A Raman line is observed at 4768.5 Å when the substance was excited by 4358.3 Å radiation. Calculate the vibrational frequency in cm^{-1} that causes this Raman shift.

4   Calculate the speed of the electron at its mean energy at 0 K, if the Fermi energy is 8eV.

5   Analyze the reaction $\pi^- + p \rightarrow \Lambda^0 + K^0$ in terms of the component quarks.

6   The half-life of ^{198}Au is 2.7 days. (i) What is its decay constant ? (ii) If at some time, a sample contains 1.0 µg of ^{198}Au, what is its activity ? (iii) How many decays per second occur when the sample is 8 days old ?

Clue :

The decay constant, $\lambda = \dfrac{0.693}{t_{1/2}}$

7   A Mass 'm' is at point 'o' as shown in the figure below in equalibrim . Suppose it is displaced by a distance X_0 as shown and released. The restoring force F_r will pull the mass back to point 'o' and will vibrate around 'o' as Center. The displacement 'x' of the mass is $x = x_0 \cos \dfrac{2\pi t}{T}$ where 'T' is the period and 't' is the time. Explain and identify the type of motion and the components in the above equation with a graph of displacement on (y-axis) and time t on (x-axis)
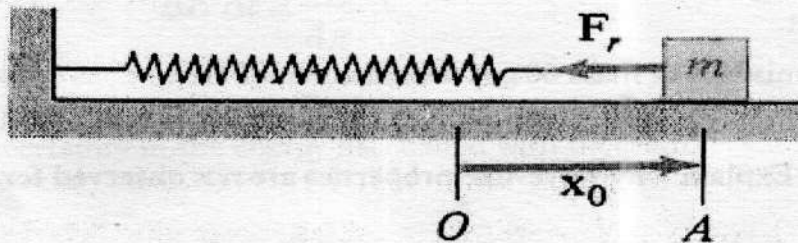
8   Draw the Carnot Cycle and explain what is happening in each portion of the Cycle :

9
(a) (i)   Electrons exhibit wave-like behaviour.

Give **one** example of experimental evidence which supports this statement.

(ii) Electrons can also exhibit particle-like behaviour.

Give **one** example of experimental evidence which supports this statement.

(b) De Broglie showed that it is possible to calculate a wavelength for a moving object.

A tennis ball of mass 60 g is served at $55 \, \text{m s}^{-1}$.

(i)   Calculate the de Broglie wavelength for this ball.

(ii) Explain why wave-like properties are not observed for this ball.

10   An electron passes through a slit and then the width of the slit Δx is reduced.
      a) What will this change do to the uncertainty of the position of the electron at
         theslit?
      b) Will the diffraction effect of the electron at the slit increase or decrease witha
         narrowerslit?
      c) i) What will the narrower slit do to the range of possible directions after
         passing theslit?
         ii) Will the uncertainty of the electron direction and momentum increase or
      decrease?

11   The uncertainty relationship between the energy and time of a quantumparticle is
      givenby

$$\Delta E \, \Delta t \geq \frac{h}{4\pi}$$

      a. State what each of the quantitiesmean.
      b. If the time taken for an event is not known precisely then how will this affect
          the uncertainty in the energy associated with theevent?

12   a) State what each of the quantities are in the **Time Dilation Equation given** below.

$$t' = \frac{t}{\sqrt{1 - \left(\frac{v^2}{c^2}\right)}}$$

b) The **Lorentz Factor** often used in the study of Special relativity is given as

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

State the equation obtained when the Lorentz factor is substituted into the Time Dilation Equation.

c) Which quantity is always **greater t' or t**?

Calculate the unknown quantities in the table below.

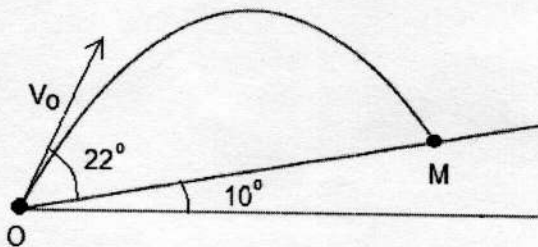| Dilated Time	Proper Time	Speed of the Object (ms⁻¹)
(a)	16 hours	1.80×10^8
8.5ms	**(b)**	2.35×10^8
12 minutes	10 minutes	**(c)**

13   A graph of **Lorentz Factor versus Speed of light** is shownbelow. Explain in detail
      what this graph shows.
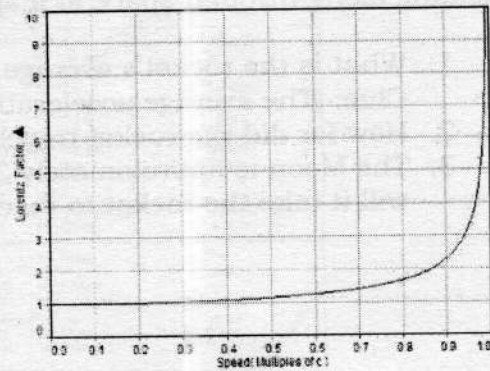
14   State four statements of evidence in favour of Big Bang theory? Give a brief
      description for each of the evidences

15   ISRO is launching a rocket into space from Earth. This particular rocket burns its
     fuel for 5 minutes and then turns off its engines. At this point, the rocket keeps
     floating along through space at a speed of 10 km/s.

     1. What is the rocket's average acceleration during these first 5 minutes?
        Clue: (The average acceleration is the rate of speed change)
     2. How far did the rocket travel during the first 5 minutes?
     3. The Moon is approximately $3.8 \cdot 10^5$ km from Earth. At its final speed, how long
        will it take the rocket to reach the Moon?

.16   A projectile is launched from point O at an angle of 22° with an initial velocity of 15
      m/s up an incline plane that makes an angle of 10° with the horizontal. The projectile
      hits the incline plane at point M.
      a) Find the time it takes for the projectile to hit the incline plane.

Symbol	Quantity	Value	Multiplier and units SI	cgs
c	Speed of light in vacuo	2·997 924 590(8)	10^8 m s^{-1}	10^{10} cm s^{-1}
μ_0	Permeability of free space	4π	10^{-7} H m^{-1}	—
ε_0	Permittivity of free space	8·854 19(1)	10^{-12} F m^{-1}	—
e	Elementary charge	1·602 192(7)	10^{-19} C	10^{-20} e.m.u.
		or 4·803 25(2)	—	10^{-10} e.s.u.
h	Planck's constant	6·626 20(5)	10^{-34} J s	10^{-27} erg s
$h/2\pi$		1·054 592(8)	10^{-34} J s	10^{-27} erg s
h/e	Quantum charge ratio	4·135 708(14)	10^{-15} J s C^{-1}	10^{-7} e.m.u.
		or 1·379 523(5)	—	10^{-17} e.s.u.
α	Fine structure constant $=\dfrac{e^2}{2h\varepsilon_0 c}$	7·297 351(11)	10^{-3}	10^{-3}
$1/\alpha$		1·370 360(2)	10^2	10^2
G	Gravitational constant	6·673(3)	10^{-11} N m^3 kg^{-2}	10^{-8} dyn cm^2 g^{-2}
Z_0	Impedance of free space	3·767 304(1)	10^2 Ohm	10^{11} e.m.u.
m_e	Electron rest mass	9·109 56(5)	10^{-31} kg	10^{-28} g
$m_e c^2$	Electron rest energy	8·187 26(6)	10^{-14} J	10^{-7} erg
		or 5·110 041(16)	10^{-1} MeV	—
e/m_e	Electron charge-mass ratio	1·758 803(5)	10^{11} C kg^{-1}	10^7 e.m.u.
		or 5·272 759(16)	—	10^{17} e.s.u.
λ_c	Compton wave length of electron	2·426 310(7)	10^{-12} m	10^{-10} cm
r_e	Classical radius of electron	2·817 939(13)	10^{-15} m	10^{-13} cm

Symbol	Quantity	Value	Multiplier and units SI	cgs
m_p	Proton rest mass	1·672 614(11)	10^{-27} kg	10^{-24} g
$m_p c^2$	Proton rest energy	1·503 271(15)	10^{-10} J	10^{-3} erg
		or 9·382 59(5)	10^2 MeV	—
e/m_p	Proton charge-mass ratio	9·578 97(11)	10^7 C kg^{-1}	10^3 e.m.u.
		or 2·871 70(3)	—	10^{13} e.s.u.
λ_{cp}	Proton Compton wavelength	1·321 441(9)	10^{-15} m	10^{-13} cm
γ	Gyromagnetic ratio	2·675 197(8)	10^8 s^{-1} T^{-1}	10^4 e.m.u.
γ'	Gyromagnetic ratio (uncorrected for diamagnetism)	2·675 127(8)	10^8 s^{-1} T^{-1}	10^4 e.m.u.
m_n	Neutron rest mass	1·674 920(11)	10^{-27} kg	10^{-24} g
$m_n c^2$	Neutron rest energy	1·505 343(15)	10^{-10} J	10^{-3} erg
		or 9·395 53(5)	10^2 MeV	—
R	Rydberg constant	1·097 373 1(1)	10^7 m^{-1}	10^5 cm^{-1}
a_0	Bohr radius	5·291 772(8)	10^{-11} m	10^{-9} cm
μ	Bohr magneton	9·274 10(6)	10^{-24} J T^{-1}	10^{-21} e.m.u.
μ_n	Nuclear magneton	5·050 95(5)	10^{-27} J T^{-1}	10^{-24} e.m.u.
μ/hc	Zeeman splitting constant	4·668 60(7)	10^1 m^{-1} T^{-1}	10^{-5} e.m.u.
N	Avogadro constant	6·022 17(4)	10^{23} mol^{-1}	10^{23} mol^{-1}
		or 6·022 17(4)	10^{26} kg mol^{-1}	—
F	Faraday	9·648 67(5)	10^4 C mol^{-1}	10^3 e.m.u. mol^{-1}
		or 2·892 599(16)	—	10^{14} e.s.u. mol^{-1}
V_0	Normal volume of perfect gas	2·241 36(30)	10^{-2} m^3 mol^{-1}	10^4 cm^3 mol^{-1}
R	Gas constant	8·314 3(3)	10^0 J K^{-1} mol^{-1}	10^7 erg K^{-1} mol^{-1}
k	Boltzmann constant	1·380 62(6)	10^{-23} J K^{-1}	10^{-16} erg K^{-1}
σ	Stefan's constant	5·669 6(9)	10^{-8} W m^{-2} K^{-4}	10^{-5} erg cm^{-2} K^{-4} s^{-1}

1 Astronomical Unit (au) $a_{\odot-\oplus}$ $= 1.4960 \times 10^{11}$ m

1 lightyear (ly) $= 9.46 \times 10^{15}$ m

$= 6.324 \times 10^4$ au

1 parsec (pc) $\leftarrow$ 206265 A.U $= 3.0856 \times 10^{16}$ m

$= 3.262$ ly

Distance to the galactic centre $d_{GC} = 8.3 \pm 0.3$ kpc

Speed of Light $c = 2.99792458 \times 10^8$ m/s

Universal Gravitational Constant $G = 6.6726 \times 10^{-11}$ $Nm^2 kg^{-2}$

Planck Constant $h = 6.62 \times 10^{-34}$ $J \cdot s$

Hubble Constant $H_0 = (67.80 \pm 0.77)$ Km/s/Mpc

Age of the Universe $t_0 = 13.77 \times 10^9$ years

Stephan's Constant $\sigma = 5.67 \times 10^{-8}$ $Wm^{-2}K^{-4}$

Boltzmann Constant $\kappa_B = 1.38 \times 10^{-23}$ JK^{-2}

Wien's displacement law $\lambda_m T = 2.898 \times 10^{-3}$ m·K

Charge of a electron $q_e = 1.602 \times 10^{-19}$ C

Mass of a electron $m_e = 9.1 \times 10^{-31}$ kg

Mass of a proton $m_p = 938.27$ MeV$/c^2$

Mass of a neutron $m_n = 939.56$ MeV$/c^2$

Mass of a Deuterium atom $m_D = 1875.60$ MeV$/c^2$

Mass of a Helium-3 atom $m_{He3} = 2808.30$ MeV$/c^2$

Mass of a Helium-4 atom $m_{He} = 4.002603$ a.m.u.

$= 3727.40$ MeV$/c^2$

Mass of a Carbon atom $m_C = 12.000000$ a.m.u.

Rest frequency of spin-flip transition of hydrogen $\nu_{21} = 1420.406$ MHz