MILITARY TECHNOLOGICAL COLLEGE

GFP EXIT EXAM PRE-SCREENING SPECIMEN PAPER

Module name	Physics	Module code	MTCG1017
Total Questions	25	Duration of exam	60 minutes

Instructions:

- Use of only non- programmable calculator is allowed.
- The figures shown, if any, are only for illustration.
- A short list of relevant **formulae** is attached at the back.

Answer the following questions. Each question carries 4 marks (25 × 4 = 100 Marks)

Circle the correct answer e.g.: (A)

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1. The SI unit of volume is the:

A) Cubic meter
B) Liter
C) Gallon

2. A bicycle's brakes can produce a **deceleration** of 2.5 m/s^2. How far will the bicycle travel before stopping, if it is moving at 10 m/s when brakes are applied?

A) 10 m
B) 20 m
C) 30 m

3. Which of the following is a vector quantity?

A) Speed
B) Velocity
C) Work

4. What is the atomic number of the element ${}^{13}_{6}X$?

A) 6
B) 7
C) 13

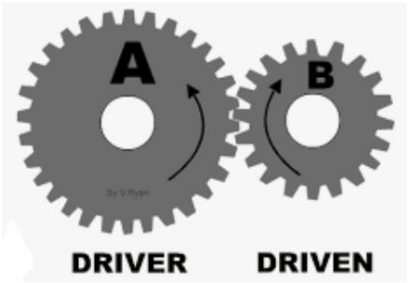
5. Isotopes of an element have different number of:

A) Electrons
B) Protons
C) Neutrons

6. Which physical quantity has Joule as unit?

A) Power
B) Energy
C) Frequency

7. In a gear train system, if a smaller gear B is driven by a larger gear A as shown in the opposite figure, which of the following statements is true?



A) The smaller gear B will rotate quicker than the larger gear A
B) The larger gear A will rotate quicker than the smaller gear B
C) Both gears have the same rotational speed.

8. A ball hits a wall horizontally at 6 m/s. It rebounds horizontally at 4.4 m/s. The ball is in contact with the wall for 0.040 s. What is the magnitude of acceleration of the ball?

A) 40 m/s^2
B) 260 m/s^2
C) 660 m/s^2

9. Two force vectors have magnitudes 5 N and 10 N. What is the magnitude of the resultant of these two forces if the angle between the forces is equal to 60˚.

A) 15 N
B) 7.5 N
C) 13.2 N

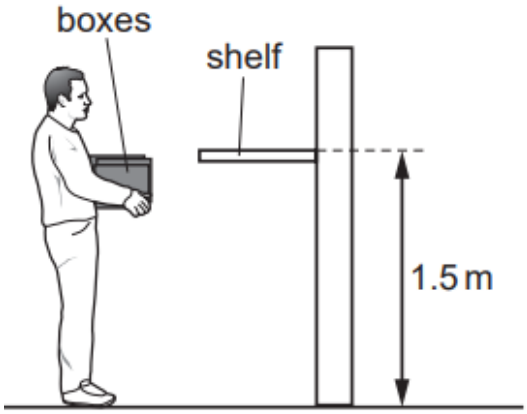
10. Whenever a material is loaded **within elastic limit**, then the produced normal stress and strain are:

A) Directly proportional
B) Inversely proportional
C) Equal

11. The relative density of a solid is equal to 3.5. If the volume of this solid is equal to 350 cm^3 then its mass is equal to: $\left(\text{Use: } \rho_w = 1\ \frac{g}{cm^3}\right)$

A) 1225 g
B) 1225 kg
C) 100 g

12. Three boxes **each** weigh 100N. A man lifts all the boxes together from the ground on to a shelf that is 1.5 m above the ground. The man takes 2.0 s to do this.



How much useful power does the man produce to lift the boxes?

A) 75 W
B) 225 W
C) 300 W

13. If the angle between the force applied to an object and a displacement vector is equal to 80˚, then the work done by this force during this displacement is:

A) Equal to zero
B) Negative
C) Positive

14. Which physical quantity remains constant in an isochoric process?

A) Temperature
B) Pressure
C) Volume

15. By which heat transfer mode, the heat from the sun is transferred to the earth?

A) Convection
B) Radiation
C) Both radiation and convection

16. An ideal gas at 27ºC is heated at constant pressure till its volume is doubled. The final temperature of the gas is equal to:

A) 54 ºC
B) 327 ºC
C) 600 ºC

17. A 40 cm tall glass is filled with water to a depth of 30 cm. The absolute pressure at the bottom of the glass is equal to: $\left(\text{Use: } \rho_w = 1000\ \frac{kg}{m^3}\ , P_0 = 1.01\ \times\ 10^5 Pa\right)$

A) 2.9×10^3 Pa
B) 1.04×10^5 Pa
C) 3.03×10^4 Pa

18. The loudness of a sound wave depends on:

A) Amplitude of the wave
B) Frequency of the wave
C) Time period of the wave

19. Which quantity remains constant when a ray of light travels from one medium to the other?

A) Speed
B) Wavelength
C) Frequency

20. If the angle between the incidence ray and the reflected ray is 120 º, what is the angle of incidence?

A) 30º
B) 50º
C) 60º

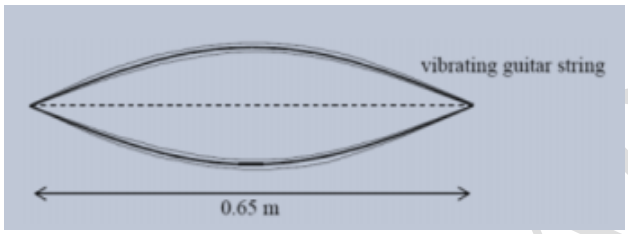
21. When a liquid is **cooled** its viscosity:

A) Decreases
B) Increases
C) Does not change

22. The boiling temperature of water in the Fahrenheit scale is equal to:

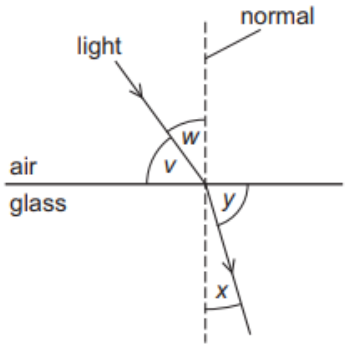
A) 32 ºF
B) 100 ºF
C) 212 ºF

23. The diagram below shows a guitar string stretched between supports 0.65 m apart. The string is vibrating at its first harmonic. The speed of sound in the string is 500 m s^{-1}. What is the frequency of vibration of the string?



A) 385 Hz
B) 340 Hz
C) 650 Hz

24. The diagram shows light travelling from air into glass. Four angles v, w, x and y are shown.



Which formula is used to calculate the refractive index n of the glass?

A) n= sin v/sin y
B) n= sin x/sin y
C) n= sin w/sin x

25. The speed of light in a glass block of refractive index 2 will be (in kms^{-1}) :

$\left(\text{Use: } c = 300000\ \frac{km}{s}\right)$

A) 150,000
B) 200,000
C) 275,000

Formula Sheet

Acceleration due to gravity, $g = 9.8\ m/s^2$

$$sin\theta = \frac{opposite}{hypotenuse}$$

$$cos\theta = \frac{adjacent}{hypotenuse}$$

$$A_x = Acos\theta$$

$$A_y = Asin\theta$$

$$|R| = \sqrt{R_x^2 + R_y^2}$$

$$tan\theta = \frac{R_y}{R_x}$$

$$|R|^2 = |A|^2 + |B|^2 + 2|A||B|cos\theta$$

$$v = \frac{s}{t}$$

$$v = u + at$$

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

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

$$s = \left(\frac{v+u}{2}\right)t$$

$$F = ma$$

$$Momentum, p = mv$$

$$Impulse, I = F\Delta t = \Delta p$$

$$F = \frac{m\Delta v}{\Delta t}$$

$$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$$

$$Friction, f_{s,k} = \mu_{s,k}N$$

$$\frac{A}{sin\,\alpha} = \frac{B}{\sin\beta} = \frac{C}{\sin\gamma}$$

$$Work, W = Fxcos\theta$$

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

$$P.E. = mgh$$

$$\Delta K.E. = -\Delta P.E.$$

$$KE_i + PE_i = KE_f + PE_f$$

$$Power, P = \frac{W}{t}$$

$$VR = \frac{distance\ moved\ by\ the\ effort}{distance\ moved\ by\ the\ load}$$

$$MA = \frac{load}{effort} = \frac{distance\ from\ effort\ to\ fulcrum}{distance\ from\ load\ to\ fulcrum}$$

$$Efficiency = \frac{work\ output}{work\ input} \times 100\%$$

$$Efficiency = \frac{MA}{VR} \times 100\%$$

$$s = r\theta$$

$$v = \frac{s}{t}$$

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

$$v = r\omega$$

$$a_{radial} = \frac{v^2}{r}$$

$$F_c = \frac{mv^2}{r}$$

$$Torque\ or\ moment\ of\ force, \tau = F \times d\ sin\theta$$

$$Moment\ of\ inertia, I = mr^2$$

$$Angular\ Momentum, L = I\omega$$

$$\tau = \frac{\Delta L}{\Delta t}$$

$$stress = \frac{F}{A}$$

$$strain = \frac{\Delta l}{l_0}$$

$$Y = \frac{stress}{strain}$$

$$\rho = \frac{mass}{volume} = \frac{m}{V}$$

$$\boldsymbol{\rho_{rel} = \frac{\rho_{subs}}{\rho_{water}}}$$

$$P = \frac{F}{A}$$

$$P = \rho gh$$

$$P = P_0 + \rho gh$$

$$B.F = \rho g V_{displaced\ fluid} = \rho g V_{submerged\ object}$$

$$B.F = W_{air} - W_{water}$$

$$\frac{F_1}{A_1} = \frac{F_2}{A_2}$$

$$P + \frac{\rho v^2}{2} + \rho gh = constant$$

$$A_1 v_1 = A_2 v_2$$

$$K = ℃ + 273$$

$$℉ = 1.8 * (℃) + 32$$

$$Q = mc\Delta T$$

$$Q = mL_f$$

$$Q = mL_v$$

$$pV = nRT$$

$$dQ = dU + dW$$

$$P_1 V_1 = P_2 V_2$$

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

$$Heat\ engine\ efficiency = \frac{Work_{output}}{Work_{input}} \times 100\% = \frac{T_H - T_C}{T_H} \times 100\% = \frac{Q_H - Q_c}{Q_H} \times 100\%$$

$$Coefficient\ of\ Performance\ (CP) = \frac{Q_H}{Q_H - Q_C} = \frac{T_H}{T_H - T_C}$$

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

Nth harmonic = N × fundamental frequency

Mach number = $\frac{True\ air\ speed\ of\ aircraft}{Speed\ of\ sound\ (at\ given\ temp.)}$

$$v_{sound} = 331 m/s \sqrt{\frac{T(K)}{273K}}$$

$$v = \lambda f$$

$$n = \frac{c}{v}$$

$$n = \frac{1}{sin\theta_c}$$

$$\frac{n_2}{n_1} = \frac{sin\theta_1}{sin\theta_2} = \frac{v_1}{v_2} = \frac{\lambda_1}{\lambda_2}$$

ANSWERS

1) A

2) B

3) B

4) A

5) C

6) B

7) A

8) B

9) C

10) A

11) A

12) B

13) C

14) C

15) B

16) B

17) B

18) A

19) C

20) C

21) B

22) C

23) A

24) C

25) A