Kafr Elshiekh University
Faculty of Engineering
Department of
Physical and Mathematical Engineering
Preparatory Year

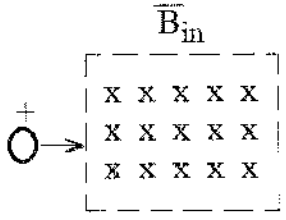
Engineering physics (1) (PHM0002)

26- 06- 2019
3 hours
90 Marks
Final exam: 4 pages

Answer the following questions:

Question(1) : (ILOs: A1,A2) ***(45 Marks)***

1.



(A) F → (B) F ↑ (C) F ← (D) F ↓

2. Proton is moving in a circular orbit of radius 14cm in a uniform 0.35T magnetic field perpendicular to the velocity of the proton. Find the speed of the proton ($q=1.6*^{10\text{-}19C}$, $m=1.67*10^{-27}Kg$)
(A) $4.7*10^6$m/s (B) $20*10^6$m/s (C) $3.1*10^6$m/s (D) $7.2*10^6$m/s

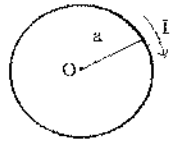
3. A rectangular coil of dimensions 5.4cm*8.5cm consists of 25 turns of wire and carries a current of 15mA. A 0.35T magnetic field is applied parallel to the plane of the coil. Calculate the magnitude of the magnetic dipole moment of the coil
(A) $4.7*10^4$ (B) $20*10^{-6}$ (C) $3.1*10^6$ (D) $1.72*10^{-3}$

4. The units of magnetic dipole moment is :
(A) m/s (B) Am^2 (C) Am (D) N.m

5. The units of torque is :
(A) m/s (B) Am^2 (C) N.m (D) Am

6. $\Delta V_H = \frac{R_H I B}{t}$, R_H *is?*
(A) Voltage (B) Current (C) Hall coefficient (D) Distance

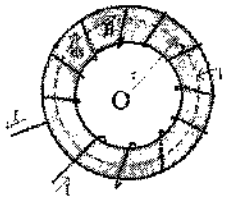
7. (i) - Magnetic field at point O is :



(A) $B = \frac{\mu_o I a^2}{2(a^2+x^2)^{3/2}}$ (B) $B = \frac{\mu_o I}{2a}$ (C) $B = \frac{\mu_o I}{4\pi a}\theta$ (D) $B = \frac{\mu_o I}{6a}$

8. (ii)- a=0.255m , I=10A, μ_o $4\pi*10^{-7}$T.m/A Calculate B at point O
(A) 24.7μT (B) 33T (C) 0.5T (D) 40μT

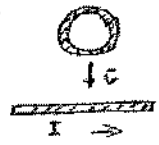
9. $\oint B.dA = ?$
(A) 1 (B) zero (C) F (D) I

10. 

Magnetic field at point O is:

(A) $B = \frac{\mu_o I}{6a}$ (B) $B = \frac{\mu_o I}{2a}$ (C) $B = \frac{N\mu_o I}{2\pi r}$ (D) $B = \frac{\mu_o I}{4\pi a}\theta$

11. A circular loop of wire falling toward a wire carrying a current to the **right.** What is the direction of the induced current in the loop of the wire?



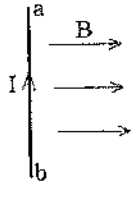
(A) Clock wise (B) Counter Clockwise (C) In (D) Out

12. The coil in AC generator consists of 8 turns of wire, each of area A=0.09m^2, The coil rotates in a 0.5 T magnetic field at a constant frequency of 60Hz. Find the maximum induced emf in the coil:

(A) 30V (B) 136V (C) 50V (D) 87V

13. A motor contains a coil with a total resistance of 10 ohm is supplied by a voltage of 120V. When the motor is running at its maximum speed, the back emf is 70V. Find the current in the coil when motor reaches its maximum speed.

(A) 3A (B) 4A (C) 5A (D) 6A

14. 

F=?

(A) F=zero (B) F=a*b*B (C) $F = \int_b^a I \times B$ (D) $F = I\int_b^a ds \times B$

15. A wire 2.8m in length carries a current of 5A in a region where a uniform magnetic field has a magnitude of 0.39T. Calculate the magnitude of the magnetic force on the wire assuming the angle between magnetic field and the current is 60°

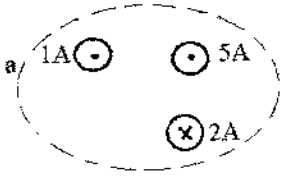
(A) 3.7N (B) 4.73N (C) 5.9N (D) 8.3N

16. The Biot-Savart law is:

(A) $B = \frac{\mu_o I}{4\pi}\int \frac{ds \times ar}{r}$ (B) $B = \frac{\mu_o I}{4\pi}\int \frac{ar}{r^2}$ (C) $B = \frac{\mu_o I}{4\pi}\int \frac{ds \times ar}{r^2}$ (D) $B = \frac{\mu_o}{4\pi}\int \frac{ds \times ar}{I.r}$

17. The magnetic field a distance 2cm from a long straight current-carrying wire is 2*10^{-5}T. The current in the wire is : $(\mu_o = 4\pi * 10^{-7} T.m/A)$

(A) 5A (B) 4A (C) 3A (D) 2A

18. 

The magnitude of $\oint B.ds$ for the closed path a is:

(A) μ_o (B) $5\mu_o$ (C) $4\mu_o$ (D) $2\mu_o$

19. Two parallel wires, 4cm apart, carry currents of 2A and 4A respectively. The force per unit length in N/m of one wire on the other is: ($\mu_o = 4\pi * 10^{-7} T.m/A$)
(A) 10^{-5}N/m (B) $2*10^{-5}$N/m (C) $3*10^{-5}$N/m (D) $4*10^{-5}$N/m

20. A vertical magnetic field change from zero to 1.5T in 120ms. Calculate emf produced in a horizontal circular ring with radius 1.6mm
(A) -25μV (B) -50μV (C) -100μV (D) -150μV

21. Motional emf is:
(A) $\varepsilon = -B/Lv$ (B) $\varepsilon = -BLv$ (C) $\varepsilon = -2BLv$ (D) $\varepsilon = -BL/v$

22. Calculate the inductance of the Solenoid if it contains 300 turns, its lengh is 25cm and its cross – section area is 4cm^2. ($\mu_o = 4\pi * 10^{-7} T.m/A$)
(A) 0.181mH (B) 2.18mH (C) 4.81mH (D) 6.081mH

23. An ideal Solenoid has an inductance of 4mH. To generate an emf of 2V the current should change at a rate of:
(A) 200A/s (B) 300A/s (C) 400A/s (D) 500A/s

Question(2) : (ILOs: A1) ***(20 Marks)***

(a) Choose the best answer:

1- There is a temperature at which the reading on the Kelvin scale is numerically:
A. equal to that on the Celsius scale B. lower than that on the Celsius scale
C. equal to that on the Fahrenheit scale D. less than zero
E. none of the above

2- When the temperature of a copper penny is increased by 100C°, its diameter increases by 0.17%. The area of one of its faces increases by:
A. 0.17% B. 0.34% C. 0.51% D. 0.13% E. 0.27%

3- The coefficient of linear expansion of iron is $1* 10^{-5}$ per C°. The surface area of an iron cube, with an edge length of 5 cm, will increase by what amount if it is heated from 10C° to 60C°?
A. 0.0125 cm^2 B. 0.025 cm^2 C. 0.075 cm^2 D. 0.15 cm^2 E. 0.30 cm^2

4- Heat is:
A. energy transferred by virtue of a temperature difference B. energy transferred by macroscopic work
C. energy content of an object D. a temperature difference
E. a property objects have by virtue of their temperatures

5- Heat has the same units as:
A. temperature B. work C. energy/time D. heat capacity E. energy/volume

6- During the time that latent heat is involved in a change of state:
A. the temperature does not change B. the substance always expands
C. a chemical reaction takes place D. molecular activity remains constant
E. kinetic energy changes into potential energy

7-Of the following which might NOT vanish over one cycle of a cyclic process?
A. the change in the internal energy of the substance B. the change in pressure of the substance
C. the work done by the substance D. the change in the volume of the substance
E. the change in the temperature of the substance

8-The unit of thermal conductivity might be:
A. J. cm/(s / C°) B. J /(cm. s . C°) C. J. s /(cm . C°) D. J. s cm / C° E. cm. s /(J . C°)

9- 273 cm^3 of an ideal gas is at 0 C°. It is heated at constant pressure to 10 C°. It will now occupy:
A. 263 cm^3 B. 273 cm^3 C. 283 cm^3 D. 278 cm^3 E. 293 cm^3

10-The internal energy of an ideal gas depends on:
A. the temperature only B. the pressure only C. the volume only

D. the temperature and pressure only E. temperature, pressure, and volume

11-During a slow adiabatic expansion of a gas:

A. the pressure remains constant B. energy is added as heat C. work is done on the gas

D. no energy enters or leaves as heat E. the temperature is constant

12-The energy absorbed as heat by an ideal gas for an isothermal process equals:

A. the work done by the gas B. the work done on the gas C. the change in the internal energy of the gas

D. the negative of the change in internal energy of the gas E. zero since the process is isothermal

13-The focal length of a spherical mirror is N times its radius of curvature where N is:

A. 1/4 B. 1/2 C. 1 D. 2 E. 4

14-A man stands with his nose 8 cm from a concave shaving mirror of radius 32 cm. The distance from the mirror to the image of his nose is:

A. 8 cm B. 12 cm C. 16 cm D. 24 cm E. 32 cm

15-A convex spherical mirror has a focal length of 12 cm. If an object is placed 6 cm in front of it the image position is:

A. 4 cm behind the mirror B. 4 cm in front of the mirror C. 12 cm behind the mirror

D. 12 cm in front of the mirror E. at infinity

(b) The heat capacity of object B is twice that of object A. Initially A is at 300K and B is at 450K. They are placed in thermal contact and the combination is isolated, find the final temperature.

Question(3) : (ILOs: A1, A2) ***(25 Marks)***

(a) Define the:

1-Tripl point.

2- First law of thermodynamics.

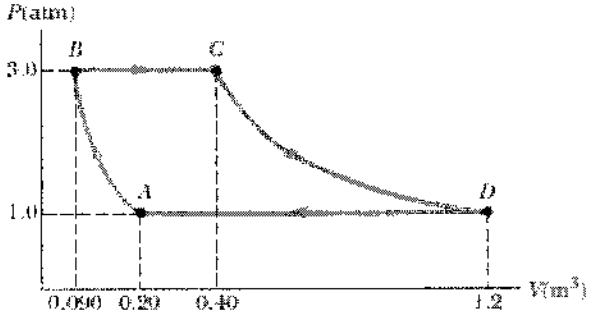
3- Second law of thermodynamics.

4- Seebeck effect.

5- Seebeck coefficient.

(b) Explain Carnot engine using PV and TS diagrams.

(c) A sample of an ideal gas goes through the process shown in the Figure. From A to B, the process is adiabatic; from B to C, it is isobaric with 100 kJ of energy entering the system by heat. From C to D, the process is isothermal; from D to A, it is isobaric with 150 kJ of energy leaving the system by heat. Determine the difference in internal energy U_B & U_A.



(d) A step-index fiber 0.0025 inch in diameter has a core index of 1.53 and a cladding index of 1.39. See drawing. Such clad fibers are used frequently in applications involving communication, sensing, and imaging.

(e) Discuss three different types of thermometers.

Assume any missing data.

Best Wishes

Dr. Ahmed Saeed **Dr. Demyana Adel Abdel Masieh**