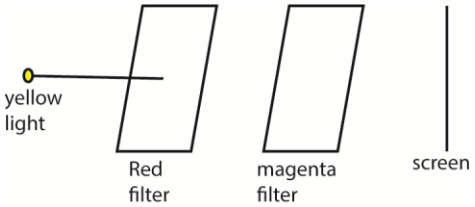
UCE physics 2013 paper 1

1. Which of the following is S.I unit of specific latent heat of fusion?
   A. JK^{-1} B. Jkg^{-1} C. $Jkg^{-1}K^{-1}$ D. Js^{-1}
   Answer is B
2. Which of the following forms of energy is conserved in bio gas
   A. Chemical energy B. potential energy C. kinetic energy D. heat energy
   Answer A
3. Which of the following optical devices can be used a solar concentrator?
   A. Concave mirror B. convex mirror C. concave lens D. convex lens
   Answer is A
4. The deflection of cathode rays by an electric field is due to the
   A. Voltage applied between electrodes
   B. Energy of the electrons
   C. Speed of electrons
   D. Charge of electrons
   Answer is D
5. The force which holds the molecules of water together is called
   A. Gravity B. adhesion C. cohesion D. electrostatic
   Answer is C
   Cohesion is the force of attraction between molecules of the same substances; e.g. molecules of water
   Adhesion is force of attraction between molecules of different substances; e.g. molecules of water and glass
6. Which of the following is correct about current that flows through resistor connected in series
   A. Current increases as it flows through the resistors
   B. Current decrease as it flows through the resistors
   C. Current through each of the resistor is proportional to the resistance
   D. Current through each of the resistor is the same
   Answer is D
7. When no external forces act on two bodies in a collision, the total momentum of the bodies
   A. Increases B. remain constant
   C. decreases D. is proportional to product of their masses
   Answer is C; i.e. principle of conservation of momentum

8. Which one of the following electromagnetic waves has the highest penetrating power?
   A. Gamma rays B. infrared C. ultraviolet D. microwaves
   Answer is A
9. Which of the following is a derived unit?
   A. Newton B. metre C. kilogram D. second
   Answer is A
10. A negatively charged pointed conductor mounted on an insulated stand loses charge in air due to
   A. Negatively charged ions are attracted to it
   B. Negatively charged ions are repelled by it
   C. Positively charged ions are repelled by it
   D. Positively charged ions are attracted to it
   Answer is D
11. An aircraft is able to experience a lift in air because
   (i) It can adjust the shape of the wing to create less pressure above the wing
   (ii) It can adjust the shape of its wings to create less pressure below the wings
   (iii) It can adjust the shape of its wings to reduce its apparent weight in air
   A. (i) only B. (ii) only C. (i) and (ii) only D. (ii) and (iii) only
   Answer C
12. An atom becomes positively charged when it loses electron because
   A. An atom has equal number of protons and electrons
   B. The nucleus contain protons and neutrons
   C. Electrons are negatively charged
   D. There will be more positive charged ion than negative charges
   Answer is D
   In neutral atom number of electrons = number of protons
   When electron is removed there be 1 positive charge not neutralized.
13. Which of the following statements is correct abut a wire stretched to yield point
   A. Its extension is to the applied load
   B. It will have undergone both elastic and plastic deformation
   C. A large force produces a small extension
   D. It breaks at the yield point
   Answer B
14. Which of the following is true about constructive interference
   (i) crest of one wave falls on the trough of another wave
   (ii) coherent waves of the same amplitude and frequency are super imposed on one another
   (iii) the waves must be travelling in the same direction
   A. (i) only B. (ii) only C. (i) and (ii) only D. (ii) and (iii) only
   Answer is D
15. The energy change that takes place when a hot metal releases an electron is
   A. Heat energy to potential energy
   B. Potential energy to kinetic energy
   C. Heat energy to kinetic energy
   D. Heat energy to electrical energy

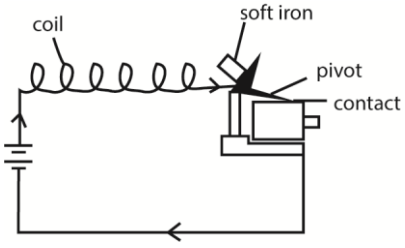
   Answer is C

16. Which one of the following statements is correct about diffusion?
    A. It takes place at the same rate in all the state of matter
    B. It is faster in gases than in liquids
    C. It is faster in liquids than in gases
    D. It does not depend on temperature
    Answer is B; gas molecules move faster than liquid molecules
17. A beam of yellow light is incident on the red filter as shown below



    Which colour of light will be seen on the screen?

    A. Yellow B. green C. blue D. red
    Answer is D
    Yellow is made of red and green; a red filter allows only red to go through
    Magenta is made of red and blue and therefore allows red to go through
18. Thermionic emission occurs
    (i) In all metals
    (ii) When electrons gain enough thermal energy
    (iii) When accelerating voltage is applied at the anode
    A. (i) only B. (ii) only C. (ii) and (iii) only D. (i) and (iii) only
    Answer is B
19. When current is passed through a wire placed perpendicular to magnetic field, the wire
    A. Becomes magnetized
    B. Becomes demagnetized
    C. Produces a neutral point below it
    D. Experiences a force
    Answer is D
20. The figure below shows a simple circuit breaker

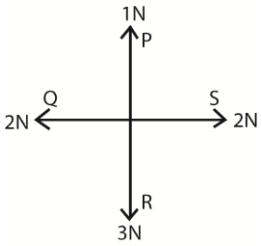


    The purpose of the coil is to
    A. Produce heat energy
    B. stop the flow of current
    C. create magnetic field
    D. increase the amount of current
    answer is C
21. S is a mode of heat transfer in glass but not in vacuum and T is a mode of heat transfer in vacuum, identify S and T

	S	T
A.	Convection	Conduction
B.	Conduction	Radiation
C.	Radiation	Convection
D.	Convection	Radiation

Answer is B

22. Which of the following is correct about resonance in tube
    (i) It occurs at different length of air column
    (ii) The frequency of vibrating air is the same as that of the body producing it
    (iii) The velocity of sound varies each time resonance occurs in the same tube
    A. (i) only B. (i) and (ii) only C. (ii) and (iii) only D. (i), (ii) and (iii)
    Answer is B
23. Which one of the following is a set of machines that depend on turning effect of forces for their operation?
    A. The lever, gear and wedge
    B. Hydraulic press, wheel barrow and spanners
    C. Spanners, pulley and wedges
    D. The lever, spanner and hammers.
    Answer is D
24. Which of the following minimizes leakage of magnetic flux in a transformer?
    (i) Laminating the iron core
    (ii) Winding the wires on soft iron
    (iii) Reducing air between the coils
    A. (i) and (ii) only B. (ii) and (iii) only C. (i) and (iii) only D. (i) only
    Answer is B
25. ${}^{234}_{x}Th \rightarrow {}^{234}_{91}Pa + {}^{0}_{-1}e + energy$
    The equation above represents decay of radioisotope by beta emission. Find the value of x.
    A. 90 B. 92 C. 143 D. 144
    Answer is A
    When a beta ray is emitted the atomic number increases by 1 but atomic mass remains unchanged
26. Which one of the following statements is true about the self-induced e.m.f of a coil?
    A. It acts to increase the e.m.f if the current through the coil is increasing
    B. It acts to decrease the e.m.f if the current through the coil is increasing
    C. It is always in the same direction as the current
    D. It depends on the rate of change of current.
    Answer is D
27. The time that elapses between the lightning flash and thunder is 5s. Find the distance of the cloud from observer. (Speed of sound in air is $330ms^{-1}$)
    A. 66m B 132m C. 1650m D. 3300m
    Answer is C
    Distance = v x t = 330 x 5 = 16500m
28. The figure below shows four forces of 1N, 2N, 2N and 3N acting on particle X

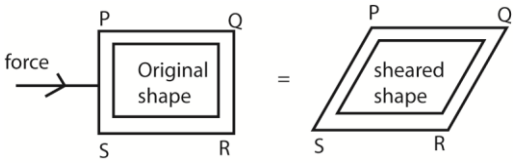


Find the direction of the resultant force on X

A. P B. Q C. R D. S

Answer is C

29. Figure 4 shows a rectangular framework which can be sheared by force.



The framework will resist the shear due to the force if the beam is fixed along

A. SQ B. PQ C. PR D. SR

Answer is C

30. A heating element of resistance 40Ω produces 360kJ of heat in 5mins. Find the current flowing through the element.

A. 5.5A B. 27.4A C. 30.0A D. 42.4A

Answer is B

E = IRt

I = $\frac{360\ x\ 1000}{40\ x\ 5\ x\ 60}$ = 30A

31. A power of 0.5W is developed when a body of mass 200gis raised to the top of the wall in 20s. Find the height of the wall.

A. 5.0 x 10^{-3}m B. 5.0 x 10^{-1}m C. 5.0 x 10^{-2}m D. 5.0 x 10^{0}m

Answer = D

P = $\frac{work\ done}{time} = \frac{F\ x\ d}{time}$

Distance, d = $\frac{0.5\ x\ 20\ x\ 1000}{200\ x\ 10}$ = 5m

32. Three cells each 2V are connected in parallel. What is the effective e.m.f of the arrangement?

A. 2 x 3V B. 2V C. $\frac{2}{3}V$ D. $\left(\frac{1}{2} + \frac{1}{2} + \frac{1}{2}\right)V$

Answer is B

33. An alloy is made of 70g of tin and 30 g of lead. Find the volume of the alloy in cm^3. (density of tin =7.3gcm^{-3}, density of lead = 11.3gcm^{-3})

A. 4.81 x $10^{-1}cm^3$ B. 5.38 x $10^{0}cm^3$ C. 1.03 x $10^{-1}cm^3$ D. 1.23 x $10^{1}cm^3$

Answer is D

Volume = $\frac{mass}{density} = \frac{70}{7.3} + \frac{30}{11.3}$ = 12.3

34. A trolley of mass 1.5kg moves with an acceleration of 2ms^{-2} when pulled by an elastic cord. If the tension in the cord is 5N find the frictional force

A. 2.0N B. 2.5N C. 3.0N D. 8.0N

Answer is A

Accelerating force =ma = 1.5 x 2 = 3N

Friction = tension in the cord – accelerating force = 5 -3 = 2N

35. An object of height 1cmis placed 4cm from a convex lens forms an image five times the height of the object. Find the distance of the image from the lens

A. 0.80cm B. 1.25cm C. 4.00cm D. 20.00cm

Answer is D

M = $\frac{image\ distance}{object\ distance}$

Image distance = 5 x 4 = 20

36. In an electric appliance, a fuse is connected to a live wire in order to

A. Increase the current entering the appliance
B. Protect the appliance in case of too much current entering it
C. Protect the person using the appliance from getting electric shock
D. Quicken the conversion of electric energy to heat energy by appliance

Answer is B

37. A kettle rated 1200W contains 2kg of water at 25^0C. How long would it take to raise the temperature of water to 85^0C if 80% of the electrical energy supplied is absorbed by the water?

A. 5.60mins B. 7.00mins C. 8.02mins D. 8.75min

Answer is D

Heat supplied by heater = heat gained by water

Pt = $\frac{100}{80} mc\theta$

t = $\frac{100}{80}\ x\ 2\ x\ 4200\ x\ (85-25)\ x\ \frac{1}{1200}$ = 525s or 525/60 = 8.75min

38. A body starts from rest and accelerated uniformly at a rate of $8ms^{-2}$. Find the time it takes to cover a distance of 100m.

A. 25.0s B. 12.5s C. 5.0s D. 3.5s

Answer is C

$s = ut + ½\ at^2$

$100 = 0 + ½ \times 8 \times t^2$

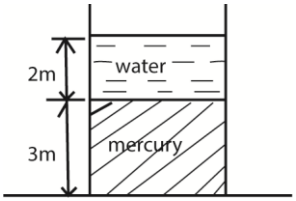
t = 5s

39. Two objects P and Q are placed along a straight line in front of a plane mirror. If Q is 1m from the mirror and the image of P is 4m from Q, find the distance of P from the mirror

A. 2.0m B. 3.0m C. 5.0m D 6.0m

Answer is B

40. The figure below shows a tank containing mercury and water



Find the pressure exerted by the two liquids on the bottom of the tank. (Density of water 1.0 x $10^3 kgm^{-3}$, density of mercury is 1.36 x $10^4 kgm^{-3}$)

A. 2.00 x 10^4Pa B. 3.88 x 10^5Pa C. 4.08 x 10^5Pa D. 4.28 x 10^5Pa

Answer is D

P = hρg = 2 x 1000 x 10 + 3 x 13600 x 10 = 4.28 x 10^5Pa

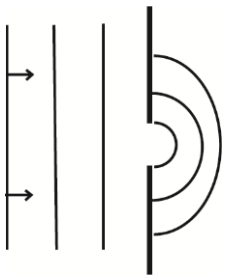
Section B (40marks)

41. (a) What are isotopes (01mark)
    They are atoms with the same number of protons but different number of neutrons
    (b) In what ways does the nucleus of uranium 238 differ from the nucleus of uranium 235? (01mark)
    Uranium 238 contains 3 neutrons more than uranium 235
    (c) Why can't isotopes be separated by chemical methods? (02marks)
    Isotopes have the same chemical properties
42. (a) State the law of conservation of energy. (01marks)
    Energy can neither be created or destroyed but can be transformed from one form to another.
    (b) Write in order of occurrence the energy changes which occur in a lighting solar system. (02marks)
    Solar energy → electrical energy → chemical energy → electrical energy → heat + light
    (c) Name one device which converts electric energy to sound energy. (01mark)

    - loud speaker, telephone receiver

43. (a) What are girders? (01mark)
    These are beams in a structure
    (b) State two ways of reducing the notch effect from spreading in a piece of wood. (01mark)
    - ensure that all parts near the notch are in compression force
    - laminate the part of wood where the notch is found

    (c) A mass of 10kg stretches a spring by 4cm. find the spring constant. (02marks)
    F = ke
    k = $\frac{10\ x\ 10}{0.04}$ = 2500Nm^{-1}
44. (a) What is a magnetic field (01mark)
    It a region around a magnet where magnetic force are experienced
    (b) What is meant by magnetic saturation? (01mark)
    It is a state where the strength of a magnet cannot be increased any further
    (c) Explain why a freely suspended bar magnet swings until it points North-South (02marks)
    Because the magnet's North Pole is attracted by the Earth's South Pole and the magnet's south Pole is attracted by the Earth's North Pole
45. A block and tackle pulley system is used to raise a load of 400N steadily through a height of 15m. if work done against friction is 1000J
    Calculate the
    (i) Work input (02marks)
    Work input = work output + work done against friction
    = 400 x 15 + 1000
    = 7000J
    (ii) Efficiency of the system (02marks)
    Efficiency = $\frac{work\ output}{work\ input}\ x\ 100\%$ = $\frac{6000}{7000}\ x\ 100\%$ = 85.7%
46. (a)(i) Draw a diagram to show the effect of a narrow gap in the path of plane wave (01mark)



(ii) Define interference of waves

Interference is the resultant effect when two identical waves moving in the same direction are superposed.

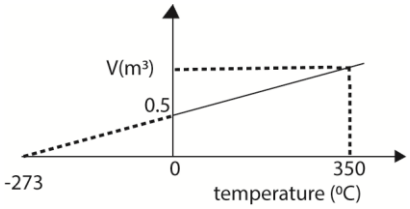
(b) A radio wave has wavelength of 300m. Calculate the frequency of the radio wave. (Speed of light = 3.0 x $10^8 ms^{-1}$)(02marks)

f = $\frac{v}{\lambda} = \frac{3\ x\ 10^8}{300} = 10^6 Hz$

47. (a) State Charles' law. (01mark)

The volume of fixed mass of a gas at constant pressure is directly proportional to temperature

(b) The graph of volume against temperature of a fixed mass of a gas at constant pressure is as shown in the figure below



Calculate the value V in the graph (03marks)

$\frac{V}{T} = constant$

$\frac{0.5}{(0+273)} = \frac{V}{(350+273)}$

V = $1.14m^3$

48. (a) State two factors that affect pressure exerted by a solid on a surface. (02marks)
    - weight of solid
    - area of contact between the solid and surface

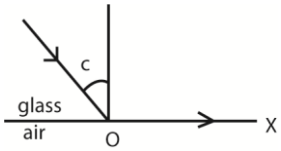
    (b) Calculate the pressure at a depth of 20.0cm in a liquid of density $13600kgm^{-3}$. (02marks)

    P = hρg = 0.2 x 13600 x 10 = 27,200Pa

49. (a) what is meant by refractive index of a medium? (01mark)

    This the ratio of the speed of light in a vacuum to the speed of light in the medium

    (b)(i) A ray of light travelling from glass to air is refracted along the boundary OX as shown in the figure below



If the refractive index of glass is 1.52, find angle c. (02marks)

c = $\sin^{-1}(\frac{1}{n}) = \sin^{-1}\left(\frac{1}{1.52}\right) = 41.2^0$

(c) State two applications of total internal reflection. (01mark)

- formation of mirage
- Optical fibre
- Prism periscope
- binoclars

50. A 3kW immersion heater is used for 8h each week, and a 200W filament lamp is used for 5h daily in a week.
    Find the
    (i) Total energy consumed each week. (02marks)
    3 x 1000 x 8 x 3600 + 200 x 5 x 3600 x 7 = 1.116 x 10^8J
    (ii) Total cost of using these appliances each week if one unit of electricity costs shs. 1000. (02marks)
    Converting energy into kWh = $\frac{1.116\ x\ 10^8}{1000\ x\ 3600}$ = 31kWh
    Cost = 31 x 1000 = shs. 31000