Université Des Montagnes

(UdM)

B.P. 208 Bangangté

COMPETITIVE ENTRANCE EXAMINATION IN YEAR ONE

INSTRUCTIONS TO CANDIDATES

- Each paper is two hours duration.
- Each paper is made up of 20 questions. Each question is followed by five proposed answers labelled a), b), c), d), e)
- For each proposal, the candidate will state whether it is true (T) or false (F))
- A question is considered answered when at least one proposed answer is followed by the indication true (T) or false (F).
- The candidate earns one mark for each correct answer.
- The candidate loses half a mark for each wrong answer.
- Canceling an answer or abstaining from answering a question neither earns the candidate a mark or causes him/her to lose half a mark.
- Candidates are advised to avoid unsure answer.
- A bonus of one mark is granted whenever a question is answered correctly, i.e. when the indication true (T) or false (F) is correct as far as each proposed answer is concerned.

- Candidates should start by filling the administrative section of the answer sheet.

Entrance examination into First Year *Date : September 23rd, 2006*
Health Science Studies *Duration: 2 hours*

Biology paper
Calculators are authorised

Exercise 1
The "albédo" (reflecting power of a substance)
a) Is a relationship of area
b) Is an energy flow relationship
c) Expresses the ability of a planet to reflect light
d) Expresses the surface temperature
e) Depends on the light absorbing capacity of the surface

Exercise 2
Gases causing climate change
a) Are those that do not absorb infrared light
b) Are those that absorb infrared light
c) Are mainly carbondioxide and watervapour
d) Increase in the atmosphere as a result of human activity
e) Increase in the atmosphere as a result of the activity of the biosphere

Exercise 3
The different phases of photosynthesis are
a) A clair phase
b) A dark phase
c) In the chlorophyll
d) The production of water
e) The synthesis of organic substances

Exercise 4
In spermatophytes
a) The male reproductive organ is the stamen
b) The female reproductive organ is the pistil
c) The male gametophyte is the pollen grain
d) The female gametophyte is the oosphere
e) The female gametophyte is the embryonic sac

Exercise 5
The poor functioning of some of the following stpes of meiosis lead to anomalies in the chromosome patrimony of some formed gametes
a) Prophase I
b) Anaphase I
c) Telophase I
d) Anaphase II
e) Telophase II

Exercise 6
At the level of a neuro-neuronic synapse:
a) The frequency of presynactic action potentials is translated in the quantity of neurotransmitter released
b) The nerve message is coded in terms of quantity of chemical mediator released into the synaptic space
c) The nerve message is coded in terms of frequency modulation
d) The action potential is transmitted in terms of amplitude modulation
e) The chemical mediator is released through exocytosis from presynaptic vesicles rich in neurotransmitters

Exercise 7

Vasopressin is

a) Also called ADH
b) A neurotransmitter that regulates arterial blood pressure
c) A neuro-hormone whose target cells are located at the level of the nephron
d) A neuro-hormone released by neurones of the hypothalamus
e) A neuro-hormone which favours the retention of significant quantities of water at the level of the kidneys

Exercise 8

Phagocytosis and the action of the system of complements

a) Are non specific immunity responses
b) Complete the specific immunity response through humoral mediation
c) Complete the cell-mediated specific immunity response
d) Secrete the antibodies
e) Are specific immunity responses

Exercise 9

The thymus is

a) A central lymph organ
b) a lymph organ where T lymphocytes are produced
c) a lymph organ where T lymphocytes become immunocompetent
d) a central lymph organ without which there would be no defence immunity
e) a central lymph organ without which there would be no specific (defense) immunity

Exercise 10

The immune cells target of HIV – AIDES are

a) T4 lymphocytes
b) B lymphocytes and T8 lymphocytes
c) All cells
d) Those that possess CD4 molecules on the surface of their plasma membrane
e) Macrophages

Exercise 11

Meiosis

a) In prophase I, the chromosomes are still made up of a single chromatid
b) In prophase I, the number of tetrads is 2n
c) In anaphase I, there is movement to the poles of chromosomes each with two chromatids
d) At the end of telophase II, each daughter celle possesses n chromosomes each with one chromatid
e) At the end of telophase II, each daughter cell possesses n chromosomes each with two chromatids.

Exercise 12

In the human species, the female gamete is

a) Ovocyte I with n chromosomes
b) Ovocyte II with n chromosomes
c) The oven with n + n chromosomes
d) The spermatozoon
e) The ovary

Exercise 13

mRNA

a) Is synthesized on contact with DNA thanks to a DNA polymerase
b) Directs the synthesis of several polypeptide chains of identical sequences
c) Is synthesized on contact with DNA thanks to an RNA polymerase
d) Possess the base triplets called codons
e) Is synthesized in the nucleus of the cell in the human species

Exercise 14

DNA is a polymer

a) Of nitrogenous bases
b) Of nucleotides
c) Of deoxyriboses
d) Of anti-codon
e) Of chain nucleotides serving as a codon fragment or a fragment transcribed during protein synthesis

Exercise 15

Among angiosperms

a) There is always double fertilization
b) The embryonic egg is the one resulting from the fusion of the oosphere and the antherozoid
c) The fusion of antherozoid 2 with the central nucleus forms the albumen eff
d) The ovule changes into the grain
e) The ovary changes into the fruit

Exercise 16

A localized mutation leading to the replacement of an amino acid by another in the polypeptide chain coded for by the gene having undergone mutation is a

a) False sense mutation
b) Non sense mutation
c) Silent mutation
d) Transversion
e) Substitution

Exercise 17

Testosterone

a) Is a hormone produced by the seminiferous tubules
b) Has a constant blood level since its secretion is permanently exactly balanced by its degradation in he organism
c) Is secreted periodically
d) Is a hormone of a lipid nature
e) Is responsible for secondary sexual characteristics and ensures the maintenance of primary sexual characteristics

Exercise 18

The following cells possess receptors for FSH and LH

a) Cells of the endometrium
b) Cells of the myometrium
c) Cells of follicular granulosa
d) Cells of the internal theca
e) Cells of the corpus luteum

Exercise 19

Progesterone in the female ensures

a) Ovulation
b) Growth of the endometrium
c) Formation of uterine lacework
d) Maintenance of pregnancy
e) Development of menstruation

Exercise 20

Speciation

a) Is coming into being of new species from a mother species
b) Implies that some populations of the mother species present in the course of time, a genetic divergence such that they are no longer able to reproduce
c) Is perfectly explained by the mechanism of localized mutations producing new alleles
d) Can be obtained after geographical isolation of a population
e) Is an interfertily of compabable ecology

UNIVERSITE DES MONTAGNES

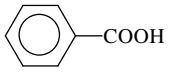
Entrance examination into First Year — Date : 23rd September 2006
Health Science Studies — Duration: 2 hours

Chemistry paper
Calculators are authorised

Exercise 1
An alcohol is an oxygenated organic compound in which the hydroxide group -OH is linked to a tetragonal carbon atom.

a) Prop-2-enol is an alcohol
b) The intramolecular dehydration of alcohols gives ether-oxides
c) Because of the electron pairs on the oxygen atom, alcohols are Brönsted bases
d) The boiling point of propan-1-ol is higher than that of propane
e) The hydrogen atom of the hydroxyl group is very acidic

Exercise 2
Carboxylic acids are products /f the mild oxidation of primary alcohols.

a) The compound of formula  is called benzenoic acid
b) Esters are isomers of carboxylic acids
c) A carboxylic monoacid with a saturated chain which is 9.8% hydrogen and 58.8% carbon, has a molecular formula $C_4H_8O_2$
d) Acid anhydrides are more reactive than the corresponding acids
e) Upon reaction with strong bases, long chain carboxylic acids give carboxylate ions in the form of salts (soap)

Exercise 3
Amines are alkyl or aryl derivatives of ammonia.

a) Amines are weaker bases than ammonia
b) The alkylation of ammonia is a method of preparation of an amine
c) The action of an amine on an acid anhydride leads to an amide
d) The alkylation of excess ammonia leads to the simultaneous formation of primary, secondary and tertiary amines
e) The formation of amides from acyl chlorides illustrates the nucleophilic le character of amines

Exercise 4
Alkanes are saturated hydrocarbons.

a) The staggered and eclipsed conformations are the only possible ones for ethane
b) The eclipsed conformation exists more at ambient temperature
c) The combustion of alkanes is very endothermic
d) Alkanes are inert compounds
e) Pyrolysis leads to the breaking of carbon-hydrogen bonds

Exercise 5
Chemical kinetics is the study of rates of reactions.

a) The rate of formation of products and the rate of disappearance reactants vary with time
b) The number of moles of a reactant influences the rate of a reaction
c) The rate of disappearance of a reactant given numerically by a negative number
d) The rate of disappearance of a reactant is independent of the rate of formation of a product
e) The rate of formation of a product decreases when the temperature decreases

Exercise 6
Esters are very common natural compounds; they are responsible for the odour of the aroma of many substances.

a) Heating, during an esterification reaction, improves its yield
b) The esterification of one mole of a primary alcohol always gives, at equilibrium, 0.67 mol of ester
c) The reaction between 0.15 mol of a monoacid and 0.25 mol of a monoalcohol produced 0.070 mol of water. The yield of the reaction is therefore 47%
d) It is possible to obtain an ester at a yield of 100%
e) The molar mass of an ester is the sum of the molar masses of the acid and of the alcohol

Exercise 7

Atmospheric pollution

a) Atmospheric air is made up of about 78% oxygen, 21% nitrogen and 1% other gases
b) Sulphur dioxide and oxides of nitrogen are the main pollutants of the atmosphere
c) The oxidation of sulphur dioxide in the atmosphere produces sulphuric acid
d) Acid rain is a pollutant. It pH is about 5.7
e) Sulphuric acid and nitric acid cause acid rain.

Exercise 8

The trimerisation of acetylene leads to benzene.

a) The nitration of benzene takes place at 400°C
b) The nitration of benzene in an excess of nitric acid gives trinitrobenzene and the reaction is 90% efficient. A little less than 250 g of product is obtained
c) The reaction of chlorine on benzene is catalysed by light
d) Strong light favours the chlorination of benzene
e) Pure acetylene makes it possible to prepare ethanol in the presence of mercury(II) sulphate

Exercise 9

Catalysis is a process of acceleration of a chemical reaction under the action of a catalyst.

a) The catalyst intervenes in the reaction mechanism
b) Each chemical reaction has its own catalyst
c) Enzymatic catalysis is homogeous catalysis
d) A solid catalyst is more active than a liquid catalyst
e) A homogeous catalysis can only exist in aqueous solution

Exercise 10

An acid-base couple est is made up of two conjugated species linked by a simple relation:

acid $\rightleftharpoons$ base + H^+

a) In a benzoic acid solution (pKa = 4.2), of pH equal to 3.6, it is the base which the entity of the acid-base couple, which predominates
b) The pKa of the couple $HCOOH/HCOO^-$ is 3.8. The pH of a solution containing 25% methanoic`acid in the molecular stage is close to de 4.3.
c) The pKa of the couple NH_4^+/NH_3 is 9.2. The titration reaction of a solution of ammonium chloride by a solution of sodium hydroxide is quantitative
d) A buffer solution can be prepared by mixing 10 cm^3 of a 0.1mol L^{-1} solution of ethanoic acid and 10 cm^3 of a 0.1 mol L^{-1} solution of sodium hydroxide
e) The couple hydrogenophosphate ion/orthophosphate ion is written as HPO_4^{2-}/PO_4^{3-}

Exercise 11

Solid sodium ethanoate is dissolved in water. The pH of the solution is 8.5. The pKa of the acid-base couple of the ethanoate ion is 4.75.

a) The system contains three acid-base couples
b) The preponderant reaction which takes place during dissolution is
$CH_3COO^- + H_2O \rightleftharpoons CH_3COOH + HO^-$
c) The reduced constant of the reaction is negligible with respect to 1
d) The preponderant species at equilibrium are H_2O and CH_3COO^-
e) The ratio $\frac{[CH_3COO^-]}{[CH_3COOH]}$ is less than 56

Exercise 12

The mild oxidation of alcohols gives products whose nature depends on the class of the alcohol.

a) In organic chemistry, an oxidation is said to be mild if it takes place without breaking the carbon chain of the oxidised compound
b) At high temperature, over a copper catalyst in the absence oxygen, an endothermic reaction of dehydration of primary and secondary alcohols is possible.
c) The oxidation of an acidified solution of butan-1-ol by a limited amount of potassium permanganate, leads to a mixture of butanal and butanoic acid.
d) In a flameless lamp experience, the reaction is endothermic
e) The catalytic dehydrogenation of a primary alcohol gives an aldehyde without the corresponding carboxylic acid.

Exercise 13

A volume of a 0.5 mol L^{-1} solution of sodium ethanoate is mixed with an equal volume of a 0.5 mol.L^{-1} solution acetic acid. The pKa of the CH_3COOH/CH_3COO^- couple is 4.8

a) The reaction produces the same compounds as the reactants.
b) The pH of the mixture is very close to 7
c) $[CH_3COO^-] = 0.25$ mol L^{-1}
d) H_3O^+ can be added to the mixture by adding a concentrated solution of nitric acid.
e) The mixture is a buffer solution

Exercise 14

Ethanoic acid is the active ingredient in vinegar. The label on a bottle of a vinegar carries the indication 8°.

a) 8° indicates the mass, in grams, ethenoic acid in 100 g of vinegar
b) When 100 cm^3 of this vinegar are weighed in a laboratory using a digital balance, a mass of 100.8 g is obtained. The concentration ethanoic acid in this vinegar is about 1.4 mol L^{-1}
c) It is desired to titrate 10 cm^3 of this vinegar using a sodium hydroxide solution of concentration 0.10 mol L^{-1}. It is therefore important to dilute the vinegar
d) It is more judicious to dilute this vinegar 10 times
e) 10 cm^3 of the diluted solution are titrated by pH-metry. Adding water to the solution gives a correct measure of the pH.

Exercise 15

The most represented oxygenated organic compounds are: alcohols, aldehydes, ketones and carboxylic acids.

a) Aldehydes and ketones are carbonylated compounds
b) All carboxylic acids have in common the carbonyl group
c) Long carbon chain carboxylic acids are quite soluble in water thanks to the hydrophilic character of the functional group of the carboxylic acid
d) In basic medium, aldehydes are oxidised into carboxylate ions
e) By adding a few drops of an aldehyde to few millilitres of ice-cold Schiff reagent, the reagent initially colourless, changes to fuchsia rose

Exercise 16

The dissolution of ionic compounds in water.

a) Dissolution exothermic for sodium hydroxide and pratically athermic for sodium chloride
b) Ionic compounds are soluble in benzene
c) In a saturated ionic solution, the introduced solute dissolves sparingly
d) Solubility is expressed by the maximum mass of solute that can be dissolved in 1 L of solution, at a given temperature
e) The process of dislocation of the network – dispersion of ions of an ionic solid put in aqueous solution is exothermic

Exercise 17

Fuels are extracted from petroleum crude fractional distillation.

a) Linear alkanes give a better quality to a fuel
b) The isomerisation of alkanes decreases the octane index of the corresponding fuels
c) Pyrolitic cracking increases the production fuels
d) The complete combustion of fuels in automobile engines produces carbon, de carbon dioxide and water
e) Tetraethyl lead is an additive commonly used to improve on the quality of fuels

Exercise 18

The Daniell cell is constructed with two metal half-cells Cu^{2+}/Cu and Zn^{2+}/Zn connected through an electrolytic bridge. $E°\ (Cu^{2+}/Cu) = 0.34$ V.

a) The electrolytic bridge insures electric continuity between the two half-cells
b) Inside the cell, the anions move in the direction of the current
c) The electromotive force of the cell is 1.10 V and the copper electrode constitutes the positive terminal. Therefore $E°\ (Zn^{2+}/Zn) = 1.44$ V
d) When the cell functions, the chemical energy release is entirely transformed into electrical energy
e) The net equation of the global reaction when the cell functions is: $Cu^{2+} + Zn \rightleftharpoons Cu + Zn^{2+}$

Exercise 19

A volume V distilled water and a mass m of white crystals of anhydrous copper sulphate are mixed and then shaken.

a) The liquid obtained is blue
b) The dissolution of copper sulphate gives off heat
c) The ratio m/V determines the mass concentration of the compound
d) The molar heat of dissolution of anhydrous copper sulphate being -17 kJ mol^{-1}, the quantity of heat accompanying the dissolution of 8.0 g of this compound is 0.85 kJ
e) To prepare one litre of a 0.10 mol L^{-1} solution of copper sulphate, 10^{-2} mol of this compound can be dissolved in a 1-litre measuring flask.

Exercise 20

The net equation of the oxydo-reduction reaction between copper (II) ions and metal iron is written as:

Cu^{2+}+Fe □ ⟶ Cu + Fe^{2+}.

a) This reaction is slow
b) Electrons are present in aqueous solution
c) Each iron atom has gained two electrons
d) Fe^{2+} ions are capable of oxidising metal copper
e) When a few drops of a concentrated solution of sodium hydroxide are added to a test tube containing about 1 mL of a solution of Fe^{2+} ions, a greenish precipitate which slowly turns brown in contact with air

UNIVERSITE DES MONTAGNES

Entrance examination into First Year — Date : 23rd September 2006
Health Science Studies — Duration: 2 hours

Physics paper
Calculators are authorised

Exercise 1: Elastic pendulum

A solid of mass m =200 g is attached at one end of a spring of constant K=40 N/kg. The solid moves along a straight line. It is initially displaced on a distance xo=5 cm and released with a velocity Vo=0.70m/s directed towards the equilibrium position. A referential (O, **i**) is considered where O is the position of the centre of gravity of the solid at rest and **i** is the unit vector having the same direction as Vo.

a) The mechanical energy Eo of the system spring plus solid is 9.9 $x10^{-2}$ J.
b) The velocity of the solid when passing the equilibrium position is 9.95 $x10^{-2}$ J.
c) The maximal reduction of length of the spring is 3 cm.
d) The differential equation of motion is $\ddot{x} + \frac{m}{k}x = 0$
e) The period To of motion is 0.44 s.

Exercise 2: Radioactivity

1curie =$3.7x10^{10}$ disintegrations/s; 1 year= $3.15x10^{7}$ s ; Avogadro constant N=$6.02x10^{23}$ mol^{-1}

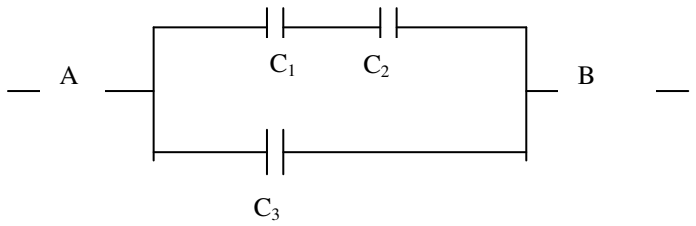
A radioactive source, made of cobalt 60, is placed on the plane window of a device monitoring the impacts caused by disintegrations. The device efficiency is 5%. One counts 600 000 impacts per minute.

a) The value of the activity of the source in curie is 5.4 $x10^{-6}$.
b) The period of Cobalt is T=5.2 years. The activity of the source after 20 years is A= 3.75 $x10^{-7}$ Curie.
c) The mass of cobalt in the source is 4.71 $x10^{-9}$ g.
d) The mass of cobalt in the source after 20 years is 3.28 $x10^{-9}$ g.
e) The radioactive period of cobalt after 20 years is T=5.2 years.

Exercise 3: Condensers

Consider the figure. The electric charge in the capacitor C3 is Q3=10^{-3} C.

a) The capacitance of the device is Ce= 11.6 µF
b) The potential across C3 is U3=100 V
c) The potential across the branch constituted of C1 and C2 is 220 V
d) The potential across C1 is U1=20 V
e) The energy stored in C2 is 0.0064 J=6.4 $x10^{-4}$ J



Exercise 4: (Progressive waves).

a. A wave is transversal when the medium is perturbed in a direction perpendicular to the direction of signal propagation.
b. A sound wave can propagate in the vacuum.
c. The end of a cord undergoes a sinusoidal transversal motion of frequency $N = 10Hz$ and the wavelength is 2m. The propagation velocity is 20m/s.
d. The in-phase planes of coordinates x_1 and x_2 obey the relation $x_1 - x_2 = n\lambda$ (n being an integer).
e. The out-of phase planes obey the relation $x_1 - x_2 = (2n+1)\lambda$.

Exercise 5: Stationary waves

The wave form along the Melde cord with a referential (O,i) is U(x,t)= $a\cos\frac{\pi}{6}x\cos\frac{\pi}{4}t$ (cm).

a) Such a wave is progressive.
b) The amplitude of the wave is 4 cm.
c) The wavelength is 12 cm
d) The wave velocity along the cord is 1.5 m/s
e) The plane x=0 is a place of high amplitude of vibration.

Exercise 6: Radiocativity

Americium (Am) 241 gives radioactivity α. The resulting daughter particle is Neptinium Np. The particle Am is at rest in the terrestrial referential. The particle is emitted in the fundamental state.

a) The fundamental state corresponds to the state of higher energy.
b) The mass variation Δm during the reaction is 0.0061 u
c) The energy produced during the reaction is ΔE=5.68215 Mev
d) The emitted α particle is relativistic.
e) The Neptinium is emitted in the excited state. The γ ray emitted comes from the heat produced during the reaction.
Am=241.0567 u, Np=237.048 u, He=4.0026 u, 1 u= 931.5 Mev/C^2.

Exercise 7: (Photoelectric effect).

The extraction work of an electron in zinc is W_s= 3.3 eV

a) The threshold frequency of the metal is N_s= 8.x 0^{16} Hz
b) The wavelength is $\lambda_s = 0.37\,\mu m$

The metal receives from an electric arc, a light of wavelength $\lambda = 0.25\,\mu m$

c) The incident photons power is E=7.96 x 10^{-19} eV, *h*=6, 6 x10^{-34} USI
d) The kinetic energy of the electron is 9x10^{-31} kg.
e) The emitted electron is relativistic. (The electron mass is $9\times10^{-31} Kg$).

Exercise 8: Electricity

a) The energy efficiency of a generator is $r_d = 1-\frac{r}{E}$ where r and E are the characteristics of the generator.
b) The electric power delivered by the generator is P=EI.
c) A generator is a dipole for which the current-potential characteristic passes at the origin.
d) The Joule law $P=RI^2$ applies only in ohmic dipoles.
e) A generator is a passive dipole.

Exercise 9: (Work done by Weight).

a) A crane lifts up a charge of intensity. The charge moves with the velocity 0.20m/s. The power used by the crane is P =200 W .
b) The work done by an object of weight *p=10 N* when it falls down from a position at height 15 m is $W = -150J$.
c) The work done by an object of weight *P=15 N* when it goes up at height 20m is $W = 300N$.
d) During the sliding of a solid on a rough surface, the work done by the fraction force is a driving work.
e) The work of the weight is independent of the trajectory.

Exercise 10: (Light).

a) Light propagation requires a material medium.
b) Light always propagates on straight lines.
c) One can isolate a light ray.
d) In a transparent medium, the light velocity is greater than the velocity in the vacuum.
e) The light velocity in the vacuum is $3x10^6 m/s$.

Exercise 11: (Application of the laws of dynamics).

a) A geostationary satellite has a period of one year.
b) The projection of motion in the vertical axis is an accelerated motion.
c) The velocity of a satellite in a circular orbit depends on the mass.

A point of mass *m=0.8Kg* descends an inclined line of angle 10 ° relative to the horizontal. The friction force, assumed constant, has magnitude *f=3N*. The gravity is $g=10m/s^2$.

d) The magnitude of the accelerator is $2m.s^{-2}$.
e) The motion is uniform.

Exercise 12: Electricity

a) Outside the generator, current flows in the direction of decreasing potentials.
b) In an electric circuit, the voltmeter is sometimes set in series.
c) In electrolytes, the current is due to the sole displacement of cations.
d) The resistance of an ohmic conductor increases with the temperature.
e) In electrolytes, the conventional direction of current is that of the cations displacement.

Exercise 13: Kinematics

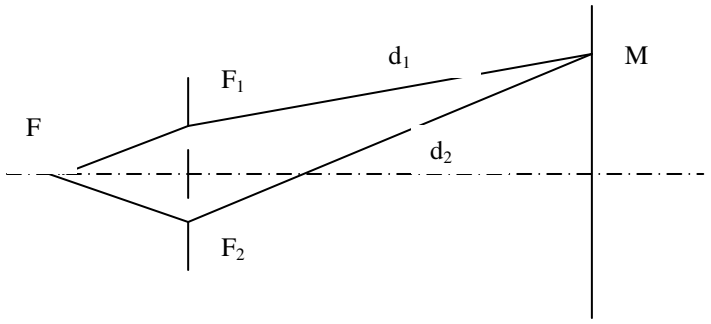
A mobile M describes a rectilinear trajectory in the referential (O,i). Its acceleration is constant during all the duration of motion. The duration is equal to 5 s. At t=0, the mobile moves from Mo of coordinate xo=-0.5 m with velocity Vo=-1 m/s. Then it passes at point M1 of coordinate x1=5 m with velocity V1=4.7 m/s.

a) The mobile motion is rectilinear and uniform during all the duration of the motion.
b) The mobile acceleration is 1.92 m/s^2.
c) The velocity of the mobile at every time t is expressed as V=1.92 t-1.
d) The mobile passes at M1 at t1=2.968 s.
e) At t=1s, the mobile velocity is equal to V=0.92 m/s.

Exercise 14: (Light waves).

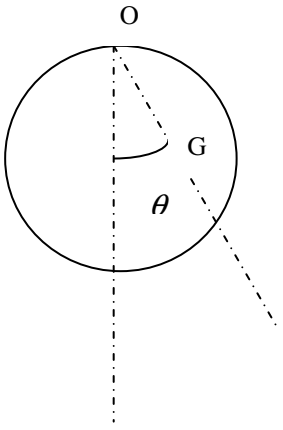
Two splits F_1 and F_2 receive a monochromatic light of wavelength $\lambda = 0.64\,\mu m$ from a light source F. The splits are considered as two in-phase sources. The inference figure is on the screen. On considers a point M of the screen located at d_1 from F_1 and d_2 from F_2.

a) The light vibrations coming from F_1 and F_2 are coherent.
b) There is a destructive interference at a point $d_2-d_1 = (2k-1)\frac{\lambda}{2}$.
c) $d_2-d_1 = 0 \Rightarrow M$ is at dark fringe.
d) $d_2-d_1 = 3.20\,\mu m \Rightarrow M$ is a brilliant fringe.
e) $d_2-d1 = 2.24\,\mu m \Rightarrow$ M is a dark fringe.



Exercise 15: Compound pendulum.

A device having the form of a circle and made of wood is attached at the point O of the horizontal axis Δ (perpendicular to the plane of the device). The device mass is m and its radius is R. The moment of inertia of the device is $J_\Delta = 2mR^2$ and its centre of gravity is G. The position of the device is measured by the angular displacement θ between OG and the vertical axis. All the friction forces are neglected. The device receives an initial kinetic energy Eo=$2x10^{-2}$ J at t=0.



a) During the oscillations, the potential energy due to weight is transformed into kinetic energy and inversely.
b) b- The potential energy due to weight is equal to Ep= mgR(1-cos θ).

The reference level is the horizontal plane passing at the centre of gravity of the device at equilibrium.

c) The oscillator is not harmonic.
d) The system oscillator-earth is conservative.
e) The device receives an initial kinetic energy Eo=2 J. The oscillator is still harmonic.

Exercise 16: Electricity.

An accumulator of capacity 24000 Ah is in circuit of current I=2 A.

a) The accumulator can be assimilated to a Leclanche battery.
b) The accumulator works as a receiver.
c) The accumulator discharges entirely after 72000 mn.
d) The accumulator discharges during the functioning.
e) The accumulator has been charged with a current of 5 A during 500 h.

Exercise 17: (Magnetic field).

a) Electric currents can create a magnetic field.
b) b-The value of a magnetic is measured with a galvanometer.
c) c-The magnetic field at the centre of a solenoid doubles when one doubles the current.
d) d-The magnetic field at the centre of a solenoid changes direction when the current changes direction.
e) e- One can isolate the poles of a magnet

Exercise 18: (Undamped mechanical oscillators).

a) A weight pendulum is always an harmonic oscillator.
b) The unit of the phase φ at the origin is m/s.
c) The natural period T_0 of an harmonic oscillator depends on the initial amplitude.
d) If the natural period of an oscillator increases, its frequency also increases.

e) If the mechanical energy of an oscillator does not appear constant, one can conclude that there are damping forces.

Exercise 19 (Newton laws).

a) The principle of inertia is applied in all referentials.
b) The origin of the heliocentric referential is the centre of the earth.
c) When a solid is not isolated, nor pseudo-isolated, one can say that the velocity vector of its centre of gravity is constant.
d) The geocentric referential is Galilean.
e) The theorem of the centre of inertia is valid only in a Galilean referential.

Exercise 20 (Mechanical oscillations).

a) A pendulum "beats the second) means that a half-oscillation takes 1 second.
b) The period of such a pendulum is *T=1s*.
c) The mechanical energy of a mechanical oscillator is always constant.
d) In a place where $g = 9.8m/s^2$, a pendulum of length *l=20cm* is displaced of 60^0 from its equilibrium position. The value of its velocity at the equilibrium position is 1.4m/s where there is no damping.
e) An horizontal elastic pendulum is characterized by an elastic constant *k=25N/m* and mass *m=300g*, and velocity of *0.8m/s*. the amplitude of motion is *8.8cm.*