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Eel izbar el izbaraSvil i

garemos dacva

(sal eqcio kursi)

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1.garemos gamaWuWyianebeL nivTierebaTa buneba da Tvisebebi

adami ani Tavisi sameurneo saqmi anobis Sedegad aWuWyianebs atmosferul haers, rac Tavis mxriv uaryofiTad ubrundeba TviT adami ans. garemos dabinZurebis wyaroebS Soris pirvel adgil zea naxSirbadebis wiaRiseul i. maTi miekuTvneba naxSiri, navTobi da gazi. maTi wvis Sedegad gamoyofil i narCenebi aWuWyianeben atmosferos da uaryofiT gavlenas axdenen adami aniS organizmze. atmosferos gamaWuWyianebeL i nivTierebebi adami aniS organizmze moqmedebis Tval sazrisiT axdenen fizikur da qimiur zemoqmedebas. fizikur zemoqmedebas axdens radiaqtiuri nivTierebebi, siTburi gaWuWyianeba(temperaturis gazrda), xmauri da dabal sixSiriani vibraciebi. qimiur zemoqmedebas axdens Txevadi naxSirwyal badebi, sarecxI saSual ebebi, pl astmasebi, pesticidebi da sxva sinTeTikuri nivTierebebi, azotis da gogirdis narCenebi, mZime metal ebi, ftoris SenaerTebi, myari minarevebi, organuli nivTierebebi.

warmoSobis mixedviT atmosferul i haeris gamaWuWyianebeL i nivTierebebi iyofa bunebrivi da xel ovnuri (antropogenuri) warmoSobis minarevebad. bunebrivi warmoSobis minarevebi atmosferoS i xvdeba vul kanuri moqmedebis, niadagisa da mTis qanebis gamofitvis, tyebebi xanZris, meteoritebis wvis Sedegad. antropogenuri warmoSobis minarevebi warmoiqmneba upirvel es yovl isa sawavis wvis procesSi - Sida wvis ZravebSi, Tboel eqtro

sadgurebSi, gamaTbobel sis temebSi da agreTve samrewvel o da yofiTi narCenebis wwis, birtvul i afeTqebebis da sxv. Sedegad.

erT wel iwadSi atmosferoSi moxvedril i msofi o samrewvel o yofiTi gamonabol qvebis saerto masa daaxl ovebiT 600 gega tonas Seadgens. gasul i saukunis ganmavl obaSi atmosferoSi moxvda 1,35 mega t kremniumi, 1,5 mega t miSiaki, 1mega t-ze meti nikel i 0,6 mega t cinki.

Semadgenl obis mxriv atmosferoSi moxvedril minarevebs Soris gasaxvaveben airovans, myars da Txevads. amastan airovan nivTierebaTa wil ze 90% modis. mas miekuTvneba naxSirbadis oqsidi, gogirdis dioqsidi, azotis oqsidi, naxSirwyal badebi. myar minarevebze mtveri, mZime metal ebi, mineral ebi da organuli SenaerTebi, radiaqtiuri nivTierebebi modis daaxl ovebiT 10%. Txevadi minarevebis masa (gogirdmJava) airovan da myar minarevebs Soris Zal ze mcirea.

atmosferos yvel aze gavr cel ebul i gazia naxSirbadis oqsidi (CO). misi ZiriTadi masa warmoiqmneba saTbobis wwis Sedegad, xol o ZiriTadi wyaro Sida wwis Zravaa. aSS-i avtomanqanebi yovel wl iurad gamoabol qveben 120 mega tona naxSirbadis oqsids. misi maqsimal uri mniSnel oba warmoiqmneba Zravas gaxurebis procesSi.

meore, masi sidi diT, atmosferos gamaWuWyianabel nivTierebaTa Soris gogirdis dioqsidia (SO₂). is ZiriTadad warmoiqmneba naxSiris wwis Sedegad. gamoTvl ebis Tanaxmad yovel wl iurad atmosferoSi xvdeba 145 mega

tona gogirdis dioqsidisa. amave dros am gamonabol qvebis 70% warmoiqmneba naxSiris, xol o 16%-Txevadi saTbobis, ZiriTadad mazuTis wvis Sedegad.

SO₂-is daSI a atmosferoSi xdeba masze ul traისferi radiaciis moqmedebis Sedegad, rac ganapirobebs gogirdis angidridis(SO₃) warmoqmnas. gaWuWyianebul notion atmosferoSi reaқciebis Sedegad warmoiqmneba agreTve gogirdmJava(H₂SO₄). atmosferoSi xvdeba agreTve gogirdwyal badi(H₂S), romel ic warmoiqmneba niadagis mikroorgani zmebsi da zRvis garemoSi.

benzinisa da dizel is wvis Sedegad Sida wvis Zravebsi warmoiqmneba azotis oqsidi da dioqsidi. azotis dioqsidi atmosferoSi rCeba daaxl ovebiT 3 dReRamis ganmavl obaSi. wyl is orTql Tan reaқciis Sedegad is gardaiqmneba azotmJavad da sxva nitratebad, roml ebi, nal eqebTan erTad, ubrundebian niadags. azotis dioqsidi iSI eba agreTve ul traისferi radiaciis zemoqmedebad da gardaiqmneba NO-d. misi daSI a xdeba agreTve maRal i temperaturebis (600-ze meti) dros.

naxSirwyal badis warmoqmnis ZiriTadi wyaro mcenareebia, antropogenuri wyaro-avtotransporti. naxSirwyal badebs miekuTvneba naxSirbadis da azotis oqsidebi.

atmosferoSi, rogorc bunebrivi, ise antropogenuri procesebis Sedegad xvdeba agreTve myari nawil akebi, anu aeroxol ebi. maT gansxvavebuli formebi aqvT. gaWuWyianebis ZiriTadi wyaroa saSeni masal ebis mopovebasTan da gamoyenebasTan dakavSirebuli mrewvel oba.

kerZod qanebis xerxva karierebSi, cementis damzadeba da sxva. myari nawil akebis did raodenobas-cinks, spil enZs, tyvias da al umins gamoabol qvebs feradi metal urgia.

2. atmosferos gaWuWyianebis gavl ena adamianze, mcnareTa da cxovel Ta samyaroze

atmosferoSi moxvedrili nivTierebaTa umravl esoba uaryofiT gavl enas axdens adamianis organizmze. isini xvdebian adamianis organizmSi sasunTqi organoebidan. nawil akebis 50% aRwevs fil tvebSi da il egeba. organizmSi SeRweul i nivTierebebi iweven toqsikur efeqts. dadgenilia sakmaod kargi statistikuri kavSiri haeris daWuWyianebis donesa da iset daavadebaTa Soris, rogorebic aris zeda sasunTqi organoebis daavadeba, gulis ukmarisoba, bronqiti, asTma, pnevmonia, fil tvebis emfizema da sxva. Cven ganvixil avT zogierTi mavne nivTierebebis uSual o gavl enis Sedegebs cocxal organizebze.

CO naxSirbadis oqsidis maRali koncentracia romelic aRemateba dasaSveb zRvars iwevs adamianis organizmSi fiziologiur cvililebbs, xolo zogjer sikvdil sac. es aixsneba imiT, rom CO advil aduertdeba hemoglobins. am SeerTebis dros warmoiqmneba karboqsil gemoglobini, rac iwevs mxedvel obis daqveitebas, gulis da fil tvebis moqmedebis gauaresebas, Tavis tkivils, spazmebs, sunTqvis darRvevasa da sikvdil s. CO-s gavl ena

organizmze fasdeba ara mxol od misi koncentraciit, aramed misi moqmedebis xangrZl ivobit anu eqspoziciit. sabednierod karboksil gemogl obinis warmoqmnis procesi Seqcevadia. gazis SesunTqvis SeCerebis Semdeg iweyeba misi TandaTanobiti gamosvl a sisxl idan. gansakuTrebit mavne gavl enas adami anebze da cocxal organizmebze axdens SO₂ da SO₃. maTi moqmedebiT aRini Sneba daavadetul Ta da sikvdil ianobis swrafi zrda, mcenareTa foTI ebis dazianeba da sxva.

mcenareTa da cxovel Ta samyaroze uaryofiT gavl enas axdens radiaqtiuri nivTierebani, isini daSl is Sedegad masaSi kl ebul oben da usasrul od didi drois Semdeg Teoriul ad unda gaqrnen. im dros, roml is ganmavl obaSiC radiaqtiuri elementis masa mcirdeba 2-jer, naxevar daSl is periods uwodeben. sxvadasxva nivTierebis naxevar daSl is periodi sxvadasxvaa da icvl eba ramodenime saaTidan, ramodenime mil iard wl amde.

gansakuTrebit saSiSia iseTi radiaqtiuri nivTierebani, romel Ta naxevar daSl is periodi ramodenime kviridan ramodenime wl amdea. es dro sakmarisia imisaTvis, rom radiaciam SeaRwios mcenareTa da cxovel Ta organizmSi. kvebis produqtebis saSual ebiT radiaqtiuri nivTierebebi xvdebian adamianis organizmSi, grovdebian da garkveuli dozis miRwevis Semdeg zians ayeneben mis janmrTel obas. radiaciT dasxivebis simZime damokidebul ia organizmis mier STanTqmul energiaze. am energiis erTeul ad miRebul ia 1 radi. is

warmoadgens dasxivebis dozas, rodesac cocxal i nivTierebis erTi grami STanTqavs 10^{-1} j energias. dadgenilia, rom Tu adamiani miiRebs dozas ≈ 1000 rads, igi iRupeba. 700 radis SemTxvevaSi sasikvdilo Sedegia 90%, 200 radis dros 10%-ia, xolo 100 radis SemTxvevaSi adamiani cocxal i rCeba, magram mniSvel ovrad izrdeba misi kiboti daavadebis da sruli paralizebis albatoba.

3.atmosferos gl obal uri gaWuWyianeba

sxvadasxva wyaroebidan gamoyofili atmosferos gawuWyial ebeli nivTierebebi gadaitanebian haeris masebis mier da vrcel debian sakmaod did manZil ebze. aseTi gziT warmoiqmneba atmosferos gl obal uri dawuWyianeba. am gawuWyianebaSi gansakuTrebuli adgili miekuTvneba radiaqtur minarevebs, radganac swored isini warmoadgenen udides saSiSroebas. atmosferos radiaqturi gawuWyianeba gansakuTrebit gaaqturda 20sk-is 50-60-ian wlebsi, rac dakavSirebuli iyo birtuli iaraRis masobrivi gamocdebTan. 1963 wels bieTvuli iaraRis gamocda atmosferosa da kosmosi akrZaluli iqna, Tumca zogierTi qveyana (CineTi, safrangeTi da sxva) ar Seuertda am konferencias da ganagrZo iaraRis gamocda. swored amitom, atmosferos radiaqturi gawuWyianebis problema dResac inarcuebs aqtual urobas. radiaqturi minarevebis atmosferosi moxvedris 4 wyaroada amis Sesabamisad maT yofen 4 jgufad: l-s

მიეკუთვნება დედამიწის გერკის ზოგირეტი რადიაქტიური ელემენტის ემინაციები და მათი დასლის პროდუქტები. II-ს უმნიან კოსმოგენური იზოტოპები, რომლებიც უარმოიკმნებიან ჰაერის ატომების კოსმოსურ სხივებთან ურთიერთქმედების შედეგად. III უგუფს უმნიან ბირთვული აფეთქების პროდუქტები, ხოლო IV-ს კი ატომური მრეწველობის ნარჩენები.

გამოტვლების თანამდებობა დადგენილია, რომ ბირთვული აფეთქებები იწვევენ არა მხოლოდ ლოკალური მასშტაბის შედეგებს, არამედ სერიოზულ, გლობალურ დარღვევებს, რამაც შესაძლოა მიგვიყვანოს ჰაერის შეუქცევად ცვილილებამდე, დედამიწის ოზონის ფენის გარღვევამდე და ბიოსფეროს არსებით გარდაკმნამდე. ბირთვული აფეთქების დროს უარმოიკმნება გავარვარებულის ცეცხლოვანი სფერო, რომელიც უარმოდგენს სინათლის გამოსხივებას და დარტყმითი ტალღის უაროს. აფეთქების მომენტში გავარვარებულის სფეროს ტემპერატურა შეადგენს რამდენიმე მილიონ გრადუსს. აფეთქებიდან დაახლოებით 10-15 წამის შემდეგ ტემპერატურა ეცემა 2000-3000-მდე და ამავდროს ცეცხლოვანი სფერო კარგავს სიკაშკაშეს. ერთმანეთისაგან განასხვავებენ: საჰაერო, მიწისზედა და მიწისქვეშა ან ურალკვესა ბირთვული აფეთქებებს.

საჰაერო აფეთქების დროს ცეცხლოვანი სფერო არ ეხება დედამიწის ზედაპირს და მთელი რადიაქტიური მთვერი შედეგება მხოლოდ ბომბის რადიაქტიური ნარჩენებისაგან, კერძოდ ნამსხვერვებისაგან. ისინი აფეთქების დროს ერთკლდებიან, ხოლო შემდგომი გაცივებისას განიცდიან კონდენსაციას.

miwiseda afeTqebis dros cecxl ovani sfero exeba dedamiwis zedapirs, ris gamoc is itacebs gruntis mniSvnel ovan masas. am dros gruntis zedapirul i fena, ramodenime aseul i metris radiusSi orTql deba da ereva afeTqebis radiaqtiur produqtebs. gacivebis Sedegad warmoqmnili myari nawil akebi warmoadgenen radiaqtiurobis ZiriTad gadamtanebs. rodesac sfero kargavs sikaSkaSes warmoiqmneba TeTri an nacrisferi radiaqtiuri Rrubel i, is Rebul obs sokosmagvar formas da TandaTan zemoT miwevs. am Rrubel is aRmasvl a grZel deba manam, sanam misi temperatura ar gautol deba garemos temperatures. amis Semdeg Rrubel is moZraoba damokidebul ia or ZiriTad faqtorze: I _ simZimis Zal is moqmedebaze haeris winaaRmdegobis Zal ebTan erTad da II _ qaris vel ze.

pirveli faqtoris moqmedebiT xdeba nawil akebis daSveba, xol o meores moqmedebiT _ Rrubel is gadatana horizontal uri mimarTul ebiT. radiaqtiuri produqtebis daSvebis saerto dro, saSual o da didi simZl avris bombebisatvis Seadgens 6-8 saaTs, xol o maTi horizontal uri gavrcelebis zomebi icvl eba did sazRvrebSi, romelic dakavSirebul ia qaris siCqareze da misi simaRl is cvl il ebaze.

4.atmosferos galWuWyiane moZravi wyaroebidan

avtotransportis da aviaciis ganviTarebam arsebiTad gazarda maTgan gamonabol qvi airebis

wil i atmosferoSi. Sefasebebi gviCvenebs, rom saSual o raodenobis mosaxl eobis samrewvel o qal aqSi avtotransportis wil ze modis gamonabol qvis saerTo masis 30-70%. amerikis SeerTebul StatebSi damaWuWyianebebi i nivTierebebis 40% modis moZravi wyaroebis gamonabol qvze, maT Soris satvirTo da samgzavro avtomobil ebze, orTqmavl ebze da sahaero transportze. ZiriTadi wil i moZravi wyaroebidan atmosferos dabinZurebaSi modis benzinze momuSave avtomobil ebze. a.S.S.-Si maTi xvedriTi wil i Seadgens 75%-s, TviTmfrinavebis gamonabol qvisa _ 5% da a.S.

ZiriTadi gamaWuWyianebebi i nivTierebebia naxSirbadis oqsidi, naxSirwyal badebi da azotis oqsidebi. naxSirwyal badebisa da naxSirbadis oqsidis udidesi gamonabol qvi aRiniSneba avtotransportis damuxruWebisa da Tavisufali svl is dros, xol o azotis oqsidisa Seesabameba did siCqareebs. saerTod avtomobilebi Zier AaWuWyianeben haers gaCerebisa da daZvris dros. dizel is Zravebi SedarebiT ekonomiuria da gamoabol qveben zogierTi nivTierebis SedarebiT nakl eb raodenobas, magram dizel is Zrava didi raodenobiT gamoabol qvebs dauwvav naxSirbads, amitom isini ufro metad aWuWyianeben garemos da ufro cudad moqmedeben adamianis janmrTel obaze. TviTmfrinavis gamonabol qvebi nakl ebad moqmedeben qal aqis haerze, is ZiriTad gavlenas axdens haeris gaWuWyianebazemxol od aeroportis raionSi. Sefasebul ia, rom sawvavis 42% ixarjeba TviTmfrinavis gamoyvanaze asafren bil ikamde da Seyvanaze misi daj domis

Semdeg. am dros dauwvavi da atmosferoSi gamonabol qvi sawvavi gacil ebiT metia vidre mTel i frenis ganmavl obaSi.

zogierTi siCqaris TviTmfrinavebi da kosmosuri xomal debi aWuWyianeбен stratosferos azotisa da gogirdmJavas moqmedebiT, agreTve aluminis oqsidis nawil akebiT. isini uaryofiTad moqmedeben ozonis fenaze da haeris gl obal ur temperaturaze. ql or-ftor meTanebi, freoni 11, freoni 12, isini warmoadgenen gazs, roml ebic warmoiqmnebian im aeroxol uri preparatebis aorTql ebisas, roml ebic gamoiyeneba Tmebis SesaRebad. aRniSnul i gazebi vrcel debian da xangrZl ivad arseboben troposferoSi.

freonebi aZl iereben saTburis efeqts, gamoTvl ebis Tanaxmad daaxl oebiT 2030 wel s freonebis gavl enis Sedegad ozonis saerTo raodenoba Semcirdeba 18%-iT, xol o qveda stratosferoSi 40 %-iT. yovel ive amis sabol oo Sedegad, gl obal uri miwispera temperatura gaiyarda 12-21C-iT.

atmosferos mavne gamWuWyianebel Ta ricxvs miekuTvneba agreTve xmauri, is gamaRizianebl ad moqmedebs adami anze, misi gavl ena damokidebul ia mis intensivobaze, mis speqtral ur Sedgenil obaze da moqmedebis xangrZl ivobaze. adami anze gansakuTrebiT moqmedebs xmauri 3000-5000 herci sixSiris di apazoniT. xmauri damRupvel ad moqmedebs sasmen aparatze, central ur da vegetatur nervul sistemaze da gul is muSaobaze. gansakuTrebiT aRsaniSnavia zebgeriT TviTmfrinavebis xmauri, igi iwvevs xmis tal Ris

darťymas da vibraciebs aeroportis axl os ganl agebul binebSi. Tanamedrove zebgeriT iTviTmfrinavebi gamoscemen xmas, roml is intensivobac gacil ebiT aRemateba dasaSveb normebS.

5.qal aqis kl imatis antropogenuri cvl il ebebi

qal aqis sahaero sivrceSi moxvedrili gamaWuWyianebel i nivTierebani atmosferuli da sxva procesebis urTierTqmedebiT arsebiT gavlenas axdenen qal aqis da misi Semogarenis mikro- da mezoklimatur reJimze. am gavlenis Sedegad qal aqSi xdeba garkveuli cvl il ebebi temperaturis, sinotivis, qaris sicqaris, radiaciis, mxedvelobis, nal eqebis, Rrublebis da nisl is ganawil ebaSi.

qal aqisa da mis Semogarens Soris temperaturaTa sxvaobis Sesaxeb miuTita inglisel ma mecnierma l ouk houardma jer kidev 1820 wels. misi monacemebiT l ondonSi saSualo Tviuri temperatura zogjer 1,2-iT aRemateba temperaturas mis SemogarenSi.

didi qal aqis mikrokl imati ganisazRvrebamTel i rigi faqtorebiT:

1. gamonabol qebisa da mtrvis arsebobiT, rac cvl is radiaciul reJims da wyl is ortqlis kondensaciis pirobebs;
2. qvefenili zedapis TaviseburebiT, romelic xasiaTdeba kargi siTbogamtarobiT;
3. qal aqis Zlier danawevrebuli reliefiT(quCaTa qseli, moednebi,

skverebi, parkebi, nagebobebi), rac ganapirobebs qarisi qarisi da mimartul ebis, agreTve turbul enturi cvl is intensivobis Secl as.

qal aqi mniSvel ovan gavlenas axdens radiaciul rejime. centraluri evropis did qal aqebSi Catarebuli dakvirvebebis Sedegad dadgina, rom atmosferos gawuwyianebebis Sedegad mzis radiaciis nakadi qal aqSi mis Semogarentan Sedarebit Semcirebul ia 29-36%-mde. gawuwyianebebi nivTierebani araxol od ancireben mzis radiaciis nakads, aramed cvl ian mis spektralur Sedgenil obas. magalitad parizSi jamuri radiaciis nakadSi ul traansferib radiaciis wil ze modis 0,3%, qal aqgaretki-3% da a.S.

radiaciuli balansis Secl a da sitbos damatebiti modena atmosferosi ganapirobebs qal aqis maral temperaturul fons. o.drozdovis Tanaxmad sasualo wliuri temperaturebi garebantant Sedarebit moskovsa da Tbilisi momatebul ia $0,8^{\circ}\text{iT}$, parizsa da stokholmSi $-0,7^{\circ}\text{iT}$, milanSi $-1,3^{\circ}\text{iT}$, xolo niu-iorksi $-1,8^{\circ}\text{iT}$.

qal aqis rolis gavlena haeris temperaturaze gansakutrebit didia gazafxul ze, rac am dros turbul enturi cvl is gaaqtiurebis Sedegia.

qal aqis gavlena SeiniSneba agreTve Rrublianobisa danaleqebis mniSvel obebSi. qal aqis Tavze haeris swrafi gatbobis, turbul entobis gazlierebis danTropogenuli warmosobis aerazol ebis koncentraciis

gazrdis gamo warmoiqmneba Rrubl ebis ganviTarebis xel sayrel i pirobebi. amitom Rrubl ianoba da nal eqebi qal aqis centrSi izrdeba. sxvaoba udidesia zafxul is TveebSi, rac konveqciuri procesebis gaaqtiurebas da turbul enturi cvl is gaZl ierebas ukavSirdeba.

did gavl enas atmosferos gaWuWyianebl doneze axdens qari. sacxovrebel i da samrewvel o nagebobani cvl ian haeris nakadis siCqares da mimarTul ebas. amiT isini gavl enas axdenen qal aqSi gamaWuWyianebl nivTierebaTa ganl agebaze. qal aqis atmosferos gaWuWyianebl xel s uwyobs mxedvel obis gauaresebas, nisl is sixSiris gazrdas.

6.wyl is ZiriTadi momxmarebl ebi

wyl is resursebis racional urad gamoyeneblsaTvis upirvel esyovl isa saWiroa vicodeT Tu misi ra raodenobaa saWiro yvel a momxmarebl is dasakmayofil ebl ad ara mxol od dRevandel pirobebSi, aramed perspeqtivaSic. meurneobis dargebs wyl is resurseblTan mimarTebaSi hyofen or kategoriad:wyl ismomxmarebl ebad da

wyl isgamoyenebl ebad. wyl ismomxmarebl ebi wyal s gamoyeneben samrawvel o da sasofl o-sameurneo produqciis Sesaqmnel ad, xol o wyl isgamoyenebl ebi wyal s gamoyeneben, rogorc garemos (wyl is transporti, meTevzeoba) an rogorc energiis wyaros (hidroel eqtrosadgurebi).

wyl is resursebis Tanamedrove kompl eqsuri gamoyeneblis etapze zRvari am or kategorias

Soris iSl eba da orives uwodeben wyl ismomxmarebl ebs. qvemod ganvixil avT wyal momxmarebl obis ZiriTad saxeobebs.

mosaxl eobis wyal momarageba. es dargi dakavSirebul ia wyl is sasmel ad da komunal ur-sayofacxovrebo daniSnul ebiT gamoyenebasTan. am miznebisatvis saWiro wyl is raodenoba dakavSirebul ia mosaxl eobis raodenobasTan. mag.: moskovsa da niu-iorkSi xvedriTi wyal momarageba Seadgens daaxl oebiT 600 l itrs erT kacze (dRe-RameSi), parizsa da sankt peterburgSi _ 500 l , l ondonSi _ 300 l da a.S.

mrewvel obis wyal momarageba. mrewvel obaSi saWiro wyl is momarageba damokidebul ia TviT mrewvel obis dargze, am mrewvel obaSi arsebul teqno logiebze, wyal momaragebis sistemebze, kl imatur pirobebze da a.S.

XX sk xasiaTdeba mrewvel obaSi wyl is gamoyenebis mzardi tempebiT. mag.: 1900 wel s mTel s msofi ioSi mrewvel obis miznebisTvis gamoiyeneboda 30kub.m wyal i. 1950 wel s _ 190kub.m, 1970 w-s _ 510kub.m, xol o 2000 wl istvis 1900kub.m-s miaRwia. es aixsneba rogorc saerTod mrewvel obis swrafi ganvitarebiT, agreTve iseTi axali wyal tevadi warmoebis swrafi ganvitarebiT, rogoricaa navTobqimiuri mrewvel oba, Tboenergetika da sxva. Tboenergetika moiTxovs wyl is did raodenobas agregatebis gasacivebl ad. wyl is ufro met raodenobas saWiroebs atomuriel eqtrosadgurebi da sxva.

wyl is momxmarebl oba sofl is meurneobis mier. sofl is meurneoba wyl is momxmarebis erTerTi ZiriTadi dargia. sarwyavi miwebis

farTobi ganuwyvetl iv izrdeba. Tu XX sk-is dasawyisSi mTel s msofl ioSi sarwyav miwebs ekava 40 ml n ha, 1970 wel s igi gairda 235 ml n ha-mde, xol o 2000 wl isaTvis am miwebis miaxl oebiTi farTi 420 ml n ha-s Seadgenda.

wyal sacaveebic wyl is erTerTi momxmarebel ia da maTi raodenoba mTel s msofl ioSi ganuwyvetl ad izrdeba. wyl is moxmareba wyal sacavebis mier Seadgenda 1970 wl isaTvis 70kub.km-s, xol o 2000 wl isaTvis 240 k3-s.

jamuri wyl is momxmarebl oba. mTel i msofl ios mdinareTa Camonadeni Seadgens daaxl oebiT 44 540kub.m-Si. 2000 wl istVis kacobrioba iyenebda am Camonadenis 12-13%-s. cal keul kontinentebis Soris yvel aze didi momxmarebl oba aqvs evrazias, roml is wyal momxmarebl oba Seadgens 10-22%-s, xol o yvel aze nakl ebi aqvs samxreT amerikas 10-dan 3 %-mde.

7. sameurneo moRvaweobis gavl ena xmleTis wyl ebze

xmleTis wyl ebis resursebis intensiuri gamoyenebis Sedegad icvl eba ara mxol od wyl is raodenoba, aramed icvl eba agreTve wyl is bal ansis mdgenel ebi, wyl is obieqtebis hidrol ogiuri reJimi da TviTon wyl is xarixic. wyl is resursebis raodenobriv da xarixobriv cvl il ebebze gansakuTrebul gavl enas axdenen sameurneo moRvaweobis iseTi saxeobebi, rogorebicaa wyal momxmarebl oba, samrewvel o da komunal uri miznebisatvis,

agretve urbanizacia, wyal sacavebis Seqmna, morwyva amoSroba da sxvadasxva agromel ioraciul i samuSaoebi.

ganvixil ot es sakiTxebi ramdenadme detal urad.

mrewel oba. wyl is xarisxobrivi cvl il eba umTavresad gamowveul ia mrewel obis iseTi dargebis mier, rogoricaa metal urgiuri, qimiuri, organul i sinTezis da kidev sxva dargebis mier gadamuSavebul i wyal i bunebrivia icvl is Sedgenil obas da binZurdeba. ZiriTad damaWuWyianebe nivTierebebs am wyal Si Seadgenen navTobi, feradi metal ebi, fenol ebi, rTul i qimiuri SenaerTebi da sxva. yovel ive es gavl enas axdens biocenozze, moqmedebs bunebis ganvitarebaze da axdens biol ogiuri procesebis darRvevas. cal ke unda aRiniSnos e.w. siTburi dabinzureba, mag. Tu temperatura ar aRemateba 26C-s biocenozze mavne zemoqmedeba ar aRiniSneba, Tu temperatura 26_30C-mdea, maSin es uaryofiTad moqmedebs Tevzebis sicocxl is unarianobaze, xol o 30C-is zeviTaa, aRiniSneba mavne zemoqmedeba biocenozze.

sameurneo sayofacxovrebo anu komunal uri Camonadeni wyl ebi. am wyl ebis gamo Tanamedrove pirobebsi did mdinareebzec ki, didi qal aqebis maxl obl ad aRiniSneba intensiuri gaWuWyianeba. sayofacxovrebo Camonadeni wyl ebi Seicaven sxvadasxva saxis baqteriebs, sakmaod didi raodenobiT, ris gamoc SeiZl eba gaxdes infeqciur daavadebaTa warmoqmni s mizezi.

urbanizacia. urbanizaciis qveS igul isxmeba mosaxl eobis da sawarmoo Zal ebis

qal aqSi koncentracis procesi. igi mWidrod ukavSirdeba mosaxl eobis zrdas da mecnieribus da teqnikiis swraf ganvitarebas. am procesis intensivoba mkveTrad gaizarda XX sk-is II naxevidan da 2000 wel s mTel i dedamiwis mosaxl eobis didi nawil i cxovrobda qal aqSi. yovel ive es iwvevs urbanizebul teritoriaze wyl is moxmarebis zrdas, rogorc mosaxl eobis, ise mrewvel obis mxriv, rac Tavis mxriv zrdis samrewvel o Tu sayofacxovrebo Camonadenebs da Sesabamisad iwvevs maTi xarisxis cvl il ebebs, roml ebic bunebrivia uaryofiTad moqmedeben garemoze.

samel ioracio RonisZieebis gavl ena zedapirul wyl ebze. morwyvac da amoSroba arsebitad moqmedeben samel ioracio teritoriebis wyl ebis bunebriv resursebze. rwyvis Sedegad icvl eba teritoriis saSual o wl iuri Camonadeni, misi Sida wl iuri ganawil eba, Camonadenis eqstremal uri , sarwyavi masivebidan gamotanil i maril ebis xarj ze xdeba mdinareebis wyl is mineral izaciis zrda, misi qimiuri Sedgenil obis cvl il eba mdinareebSi moxvedril i maril ebis raodenoba aRwevs aTeul obiT, xol o Zl ier daml aSebul i niadagebis SemTxvevaSi ki aseul tonasac 1 hadan.

amoSrobis gavl ena vl indeba gruntis wyl ebis donis dacemaSi, niadagis tenis maragis cvl il ebaSi da saerTod teritoriis wyl is bal ansis cvl il ebaSi.

wyl is xarisxis cvl il eba wyal sacavebSi. wyal sacavebis Seqmna iwvevs wyl is hidroqimiuri

reJimisa da xarisxis cvl il ebas im mdinareTa mimarT, romel zedac aigebian. erTi wyal sacavis hidroTermel reJimze gavl enas axdens am wyal sacavSi wyl is cvl il ebis intensivoba, romel ic gamoiTvl eba Semdegi formul iT: $k=wsr|wwl$, wsr aris wyal sacavis mocul oba, xol o wwl aris konkretul i mdinaris wl iuri Camonadeni. rac metia Camonadeni, miT nakl ebia wyal sacavSi wyl is mineral izaciis cvl il eba da es damokidebul eba saSual ebas izl eva wyal sacavis daproeqtetebis fazaSive gamoviangariSoT masSi wyl is mosal odnel i mineral izacia. wyl is xarisxis cvl il eba wyal sacavSi ganpirobebul ia, rogorc wyl is reJimis cvl il ebiT, ise Sida biol ogiuri procesebiT: dinebis siCqaris cvl il eba, gamWvirval eobis gazrda, organul i da biol ogiuri nivTierebebis gazrda, romel ic gamowveul ia samrewvel o, komunal uri da sasofl o komunal uri CamonadenebiT iwvevs biogenuri nivTierebebiT gamdidrebul wyal Si fotopl anqtonis gaZl ierebas. Tu wyal Si gaCndnen l urj i an mwvane wyal mcenareebi, maSin am wyal Si warmoiqmnebian toqsikuri nivTierebebi da bunebrivia wyl is xarisxi uaresdeba. am process uwodeben meorad anu biol ogiur gaWuWyianeabas.

8. msofi io okeanis dabinzurebis wyaroebi da saxeobebe

msofi io okeanis damaWuWyianebe l ZiriTad nivTierebebs warmoadgenen navTobi da navTobproduqtetebi, pesticidebi, sinTeturad

aqtiuri nivTierebebi, mZime metal ebi (vercxli, tyvia, cinki, kadmiumi, spil enZi da sxva). garda amisa msofli okeanes abinzureben agreTve teqnoenuri warmoSobis radioaqtiuri nivTierebebi. SevCerdeT zogierT maTganze.

navTobi da navTobproduqtebi. navTobis ZiriTadi komponentebia naxSirbadebi. maTi xvedriti Sedgenil oba 98%-mdea. erTmaneTisagan ganaxvaveben navTibis 4 kl ass, esenia parafinebi, cikl oparafinebi, aromatikuli naxSirbadebi da ol efinebi. navTobi Seicavs agreTve gogirds, Jangbads, azotur SenaerTebis, kobal ts, nikel s da a.S.

navTobi da navTobproduqtebi erTerTi yvel aze gavrcel ebul i damabinzurebel i nivTierebebia msofli okeaneSi. isini wyal Si sxvadasxva gziT xvdebian, magram navTobis gansakuTrebit didi raodenoba msofli okeaneSi xvdeba misi transportirebis dros. wyal Si moxvedrisas navTobi warmoqmnis zedapirul apks, am apkis Seferil obis mixedvit SegviZi ia ganvsazRvroT misi sisqe.

pesticidebi warmoadgenen xel ovnurad Seqmnil nivTierebebs, roml ebiC gamoiyenebian mavnebel ebisa da mcenareTa daavadebebis winaarmdeg sabrZol vel ad. Tanamedrove pirobebSi pesticidebis daaxl oebiT 1.5 ml n tona nivTierebaa moxvedrili miwizada da okeanur ekosistemebSi. pesticidebi did zians ayeneben organizmebs da aqveiteben bunebrivi biocenozebis janmrTel obas.

sinTetikuradurad aqtiur nivTierebebs Seicaven sinTetikuriuri sarecxli saSual ebebi.

isini xvdebian zedapirul wyl ebSi da sabol oo jamSi ki okeaneebSi. sinTeturi sarecxi saSual ebani Seicaven natriumis pol ifosfatebs, sil ikatebs da kidev sxva wyl is organizmehisaTvis momwaml av nivTierebebs.

mZime metal ebs miekuTvnebian iseTi saxis nivTierebebi, roml ebic warmoadgenen toqsikur gamaWuWyianebebi nivTierebebs. mZime metal ebi gamoiyeneba sxvadasxva sawarmoebSi da miuxedavad gamwmendi saSual ebebisa maTi garkveul i nawil i xvdeba Camonaden wyl ebSi. am SenaerTebis didi nawil i okeaneSi xvdeba atmosferodan da unda aRiniSnos is garemoeba, rom biocenozebisaTvis gansakuTrebiT saSiSia vercxl i, tyvia da kadmi umi.

teqnoqenuri warmoSobis radiaqtiuri nivTierebebis, ZiriTadad ki uranisa da plutonis daSi is produqtebis okeaneSi didi raodenobiT moxvedra daiwyo 1945 wl is Semdeg. es dro emTxveva birTvul i iaraRis gamocdis da atomuri mrewvel obis ganviTarebis dasawyiss. marto 1948-1962 wl ebSi Catarebul i iyo 450 atomuri bombis afeTqeba, roml is Sedegadac atmosferoSi aeroxol ebis saxiT gavr cel da radiaqtiuri mtveri. atmosferoSi arsebul i radiaqtiuri mtveri haeris masebTan erTad gadaitaneba did manZil ze da il eqeba. maTi didi nawil i il eqeba Cr. ganedis 45^0 -sa da samxr. ganedis 45^0 -s Soris. wyal qveSa xomal debze damontaJebul i atomuri energetikul i danadgarebi, agreTve aWuWyianeben okeanes, amas emateba avariebis Sedegad gamoyofil i radiaqtiuroba da a.S.

9. msofl io okeanis wyl ebis gaWuWyianebis Tanamedrove mdgomareoba

uamravi eqspediciis Catarebis safuZvel ze miRebul ia daskvnebi msofl io okeanis dabinZurebis Tanamedrove mdgomareobis Sesaxeb. upirvel es yovl isa dadgenil ia, rom daWuWyianeba mraval i komponentis mxriv iRebs gl obal ur xasiaTs. dadgenil ia aseve ZiriTadi cirkul aciuri sistemebis da SedarebiT mdgradi zonebis roli gamaWuWyianebel i nivTierebebis gadanawil ebas da dagrovebaSi. ase magal iTad, gol fstrimis da Cr. atl antikuri dinebis wyl ebi intensiurad WuWyianebian Crdil oeT amerikis da evropis sanapiroebTan, samagierod norvegiisa da barenciis zRvebSi isini gani tvirTebian. amrigad arqtikul i raioni, zemoT dasaxel ebul i zRvebis CaTvl iT, warmoadgens mavne nivTierebaTa akumul ators.

Cven ganvixil avT mxol od zogieraTi mavne komponentis ganawil ebas.

navTobis naxSirwyal badebiT gaWuWyianebis raionebi Seesabameba Sel fur wyl ebs, navTobis gadazidvisa da intensiuri mimosvl is raionebs. am mxriv gansakuTrebiT aRsaniSnavia trasebi axl o aRmosavl eTidan da indoneziidan iaponiis mimarTul ebiT. gaWuWyianebis maRal i doniT gamoirCeva iaponiisa da samxr. CineTis zRvebi, wiTel i zRva, sparseTis yure da kidev sxva adgil ebi. wyl is dinebebis saSual ebiT navTobi da navTobproduqtebi gadaitaneba norvegiisa da barenciis zRvebSi. am produqtebis siRrmiT ganawil ebas Semdegi saxe aqvs, navTobis naxSirwyal badebis maqsimal uri koncentracia

aRinSneba wyl is zeda fenebSi, xol o 500 m-is qvemoT isini, rogorc wesi aRar gv xvdebian.

pesticidebis ganawil eba msofl io okeaneSi araTanabaria. am mxriv aRiniSneba gazrdil i, Semicirebul i da nul ovani koncentraciis zonebis monacvl eoba. gazrdil i koncentraciis l okal uri ubnebi aRiniSneba ara mxol od daWuWyianebebis wyaroebTan ganl agebul zonebSi, aramed maTgan sakmaod daSorebul adgil ebSi, rac atmosferul i gadatanisa da dinamiuri movl enebis Sedegia. pesticidebis Semadgenl oba okeanis wyl ebSi, rogorc wesi 0-dan 100 m siRrmemde sakmaod erTgvarovania, xol o 500 m-ze mcirdeba orjer.

sinTetikurad aqtiur nivTierebaTa ganawil ebaSi aRiniSneba gaWuWyianebebis vel ebis l okal izacia Cr. amerikis, das. evropis da afrikis Sel fur zonebSi. Ria okeaneSi maTi koncentracia mcirdeba, maTi fizikur-qimiuri Tvisebebis gamo umetesi raodenoba Tavsiyris wyl is zedapirul fenaSi. amave dros nivTierebaTa mniSvnel ovani xsnadoba da wyl ebis vertikal uri moZraobebi xel s uwyoben maT SeRwevas Rrma fenebSi.

toqsikuri metal ebis ganawil ebaSi aRiniSneba maTi maqsimumi Sel fur raionebSi da Sida zRvebSi, xol o minimumi Ria okeaneSi. gansakuTrebiT didi kontrastia tyviis da cinkis ganawil ebaSi. tyviis didi koncentracia aRiniSneba bal tiis zRvaSi, SedarebiT nakl ebi Crdil oetis zRvaSi. cinkis koncentracia gansakuTrebiT maRal ia wynari okeanis Cr.das. nawil Si, xol o dabal ia samxr. atl antikaSi.

radiaqtiuri gaWuWyianeBa, mraVal ricxovani birTul i afeTqebis Sedegad, wynar okeaneSi ufro maRal ia, vidre atlantis okeaneSi. gansakuTrebiT maRal i radiaqtiuroba iyo aRniSnul i 1954-58 ww-Si atomuri afeTqebebis dros. am dros dafiqsirda Tevzebis didi raodenobiT daRupva. Cr.aRm. atlantikis radiaqtiurobaSi didi wvili Seaqvis islandiis zRvaSi didi britaneTis mier CaSvebul narCenebs. vertikal ur ganawil ebaSi maTi maqsimumi aRiniSneba 100-700 m siRrmeze, minimumi zedapirul fenaSi, xolo 700 m-is qvemoT koncentracia swrafad mcirdeba fskeris mimarTul ebiT.

10. sameurneo moRvaweobis gavlena niadagebze

biosferos Semadgenl obaSi Sedis l iTosferos zeda fena, roml is sisqec ramodenime metrs Seadgens. Swored am fenaSi, anu niadagebSi aris moTavsebuli cocxali organizmebis ZiriTadi masa.

niadagebis cvlilebze gavlenas axdenen sameurneo moRvaweobis iseTi saxeobebi, rogorebicaa urbanizacia, sasoflo sameurneo samuSaoebi, wyal sacavebis Seqmna, morwyva, amoSroba da sxva agromel oraciuli samuSaoebi. mokled ganvixilotes samuSaoebi.

1. **niadagis gaWuWyianeBa atmosferodan.** niadagis gaWuWyianeBa usualod ukavSirdeba atmosferuli haeris gaWuWyianebas, am ukanasknelis mdgomareoba ki zemoT iyo ganxiluli Cvens mier. ar gavimeorebT ra monacemebs maTi bunebisa da Tvisebebis Sesaxeb,

mxol od CamovTvl iT, rom maT miekuTvnebian bunebrivi da anTropogenuli warmoSobis iseTi minarevebi, roml ebic warmoiSvebian vul kanuri moqmedebis, mTis qanebisa da niadagis gamofitvis, tyis xanzrebis, meteoritebis wwis, saTbobis wwis, birtvuli afeTqebebis Sedegad da a.S. es minarevebi haeris dinebaTa saSual ebiT gadaitanebian did manZil ebze da Semdeg il egebian niadagebze.

2. **sasofl o sameurneo samuSaoebi.** am samuSaoebi dan gansakuTrebul yuradRebas ipyobs pesticidebis gamoyeneba. pesticidebi warmoadgenen xel ovnurad Seqmnil nivTierebbs, roml ebic gamoiyenebian mcenareTa daavadebebTan da mavnebl ebTan sabrZol vel ad. ekonomistebis gamoangariSebit, TiToeuli sabWoTa maneTis danaxarji pesticidebze uzrunvel yofs marcvl euli kul turebidan daaxl oebiT 10 man, xol o teqniki kul turebidan _ 30 man mogebas. amave dros ekologiuri gamokvl eebiT dadgenilia, rom pesticidebi, anadgureben ra mavnebl ebs, did zians ayeneben organzmebs da bunebriv biocenozebs. sofl is meurneobaSi ukve didi xania dgas probl ema mavnebl ebTan brZol is qimiuri meTodebidan ekologiurad sufta biologiur meTodebze gadasvl isa.

3. **samel ioracio RonisZiebebi.** ukanasknel wl ebSi sul ufro farTovdeba samel ioracio RonisZiebaTa mocul oebi, rac dakavSirebul ia axali miwebis gamoyenebasTan. Samel ioracio RonisZiebebi, maT Soris morwyva da amoSroba, mniSvnel ovan gavlenas axdenen niadagebis bunebriv resursebze.

amJamad muSavdeba xmel eTis saerTo farTobis 1/3, xol o irwyveba mxol od 4%. morwyva moxmedebs niadagis adiaciul da siTbur bal ansze, cvl is mis temperaturul reJims. morwyvis dros xdeba maril ebis gamotana niadagebidan, rac gavl enas axdens mis qimiur Sedgenil obaze.

Waobebisa da daWaobebul i miwebis saerTo farTobi Seadgens mTel i xmel eTis 5%. maTi amoSroba warmoadgens bunebrivi pirobemis mizandasaxul gardaqmnas adamianis sakeTil dReod. amoSrobis gavl ena upirvel es yovl isa gamoixateba mocemul i teritoriis wyl is bal ansis Secvl aSi. kerZod icvl eba Camonadenis pirobemi, kl ebul obs gruntis wyl ebis done, icvl eba produqtiul i tenis maragis dinamika da a.S. amave dros matul obs niadagis temperatura, rac xel s uwyofs mcenareTa siTboTi uzrunvel yofas.

4. wyal sacavebis mSenebl oba. miuxedavad mTel i rigi keTil sasurvel i efeqtebisa, rasac axdens xel ovnuri wyal sacavi mimdebare teritoriaze, arsebobs azri imis Sesaxeb, rom xel ovnuri wyal sacavis Seqmna uayofiT efeqtsac iZl eva. aseT efeqtTa ricxvs miekuTvneba zaral i (rasac vaxsenebT garemos, sarwyavi miwebis, uZvel esi sofl ebis Tu tyebis ganadgurebiT) dakvirvebaTa safuZvel ze wyal sacavebis eqspl uataciis pirobemi dadgenil ia daWaiwebis procesebis gaZl iereba, hidrol ogiuri procesebis gardaqmna, mwvane zonebis daRupva.

yovel ive es Tavismxriv gavl enas axdens Tbo da tenbrunvis cvl il ebaze, rogorc wyal sacavSi, ise mimdebare teritoriaze.

11. niadagebis radiaqtiul i galWuWyianeba

rogorc cnobil ia xel ovnuri radiaqtiul i nivTierebani xvdebian biosferoSi, maT Soris niadagebSi, birTvul i afeTqebebis, atomuri danadgarebis avariebis da atomuri mrewvel obis sawarmoTa narCenebis gziT. niadagebSi radiaqtiul i daWuWyianebis done ramdenadme SesamCnevi gaxda 1945 wl idan, rac emTxveva birTvul i iaraRis gamocdis periods. niadagebi, iseve rogorc atmosfero da hidrosfero, SedarebiT nakl ebad binZurdeba atomuri industriis narCenebiT.

dakvirvebaTa masal ebis anal izi gviCvenebis, rom radiaqtiuri nivTierebebis maqsimal uri koncentracia niadagebSi aRiniSneba, rogorc Crdil o, ise samxreT naxevarsferoebSi 40-50° ganedebSi. Absoluturi maqsimumi Cr. naxevarsferoSi 3-4-jer metia vidre samxreTSi. Cr. ganedis 20-60° interval Si, sadac Tavmoyril ia msofli o mosaxl eobis 80%-ze meti. niadagebis radiaqtiul i daWuWyianeba 2-jer aRemateba mis saSual o mniSvel obas. minimal uri dabinZureba aRiniSneba ekvatorul zol Si.

niadagi warmoadgens im garemos, romelic radiaqtiuri daSis produqtebiT kvebavs mcnareul da cxovel ur organizmebs. amitom didi mniSvel oba eniWeba mTel rig sakiTxebis, romel Taganac gansakuTrebiT aRsaniSnavia Semdegi ori.

1. radio izotopebis sorbcia, anu unari maTi niadagSi yofnisa.

2. radiaqtiuri produqtebis niadagSi migraciis anu transportirebis unari.

radiaqtiuri produqtebis niadagSi sorbciiis sakiTxs didi mniSvel oba aqvs. is damokidebul ia mraval faqtorze, gansakuTrebiT ki niadagis qimiur da mineral igiur Semadgenl obaze. Didi mniSvel iba aqvs radiaqtiuri izotopebis STanTqmisaTvis niadagis mJavianobis xarisxs, amave dros gavlenas axdens niadagis meqanikuri Semadgenl oba da sxva.

radioizotopebis niadagSi migraciis aRniSnul i Tvissebebis garda efeqti damokidebul ia meteorologiur pirobebeze, nal egebis raodenobaze da a.S. magal iTad dadgenil ia, rom niadagis zedapirze moxvedrili stronciumi Sesazl oa wvimis Sedegad gamorecxil iqnas niadagidan. amave dros misi gadaadgil eba niadagis ufro Rma fenebSi pirdapir proporciulia nal egebis raodenobisa. dadgenil ia agreTve, rom es procesi Zal ze xangrZlivia da stronciumi 15 sm siRmeze Sesazl oa gaiJonos mxol od mcire raodenobiT, Tanac ramodenime wl is Semdeg.

zogierT SemTxvevaSi, mag. qviSaSi, romelic xasiaTdeba kargi filtraciuli TvissebebiT, Tavsxmas swrafad Caaqvs stronciumi niadagis siRmeSi. Sxva SemTxvevaSi ki rodesac niadags susti filtraciuli Tvissebebi gaaCnia, mTel i stronciumis koncentrireba xdeba mxilid zeda fenebSi. Literaturuli monacemebis Tanaxmad mTel i stronciumis 80% moTavsebul ia niadagebis zeda 5 sm-ian fenaSi.

12.zedapriul i wyl ebis dacva gaWuWyi anebisagan

zedapirul i wyl ebis dacvis sxvadasxva RonisZiebaa cnobil i, ganvixil oT zogierTi maTgani.

1. wyl ebis dacvis sainJinro meTodebi. wyl ebis dacvis sainJinro meTodebi Seicaven Camonadeni wyl ebis gasufTavebis meTodebis SemuSavebas da warmoebis teqnol ogiis srul yofas, romelic Seamcirebs an mTlianad aRmofxvris wyl is obieqtebis daWuWyi anebas.

Camonadeni wyl ebis gasufTavebis Tanamedrove meTodebi SeiZieba daiyos or jgufad: xel ovnur pirobebSi gasufTavebis meTodebi da bunebriv pirobebSi gasufTavebis meTodebi.

pirvel SemTxvevaSi wyl is gasufTaveba xorciel deba special urad Seqmnil nagebobebis, danadgarebi gamoyenebiT. am SemTxvevaSi ganasxvaveben gasufTavebis 4 ZiriTad saxeobas: meqanikurs, qimiurs, fizikur-qimiurs da bi oqimiurs.

meqanikuri gasufTaveba gamoiyeneba Camonadeni wyl ebidan organuli da araorganuli nivTierebebis msxvil dispersiuli da gauxsnadi minarevebis amosaRebad filtraciis an sxva gziT. amisaTvis gamoiyeneba sxvadasxva konstrukciebi.

qimiuri da fizikur-qimiuri gasufTaveba gamoiyeneba Camonadeni wyl ebidan araorganuli da organuli nivTierebebis wvri dispersiuli

da gaxsnadi minarevebis amosaRebad bioqimiuri, fizikuri da qimiuri meTodebis saSual ebiT.

bioqimiuri gasufTaveba gamoiyeneba im SemTxvevaSi, rodesac Camonadeni wyl ebidan ukve amoRebul ia msxvil dispersiul i minarevebi. es meTodi emyareba mikroorganizmebis zogierTi saxebis unars sakvebad gamoiyeno Camonaden wyl ebSi arsebul i nivTierebani – organuli mJavebi, cil ebi, naxSirbadebi da a.S.

bioqimiuri gasufTavebis meTodi SeiZl eba gamoyenebul iqnas, rogorc bunebriv (bol ogiur fil trebSi), ise xel ovnur pirobebSi (mindvrebze, arxebSi da a.S.).

2. samel ioracio samuSaoebi xel s uwyoben wyl is resursebis dacvas gaWuWyi anebi sagan. ganaxxvaveben tyis, agroteqnikur da hidroteqnikur samuSaoebs.

satyeo mel ioracia gul isxmobs xeebis dargvas mdinareTa auzebis zemo da Sua wyl ebSi, rac amcirebs zedapirul Camonadens da asustebs wyl is eroziis procesebs.

agroteqnikuri mel ioracia moicavs niadagis wyl is da sahaero reJimis regul irebas sasofl o-sameurneo kul turebis mosayvanad, maT Soris niadagis dacvas sakveb nivTierebaTa gamorecxvi sagan.

kompl eqsuri samel ioracio samuSaoebis Catareba uzrunvel yofs bunebrivi wyl ebis daWuWyi anebis arsebiT Sesustebas.

3. bunebrivi wyl ebis TviTgawmendis procesebi. gawmendavi da nawil obrivad gawmendil i Camonadeni wyl ebi, xvdebian ra wyl is obieqtebSi, iwveven maTi fizikuri Tvissebebis da

qimiuri Semadgenl obis cvl il ebebs, cvl ian wyl is xarisxs, aWuWyianebe mas.

gaWuWyianebul i wyl is obieqtebSi mimdinareoben rTul i procesebi mdinaris, tbi an wyal sacavis bunebivi mdgomareobis aRsadgenad. hidrodinamikuri, bi oqimiuri, qimiuri da fizikuri procesebis erTobl iobas, roml ebic ganapirobeben nivTierebebis koncentraciis Semciebas, uwodeben wyl is masebis TviTgawmendas. imisda mixedviT, Tu romel i nivTierebani da ra fazur mdgomareobaSi xvdebian wyal satevebSi, TviTgawmendis procesSi Warbobs hidrodinamikuri, qimiuri an biol ogiuri procesis roli, mag. Tu Camonaden wyl ebSi Warbobs msxvil dispersiul i nivTierebani, TviTgawmendis procesSi arsebiTi roli miekuTvneba fskerze dal eqvis procesebs, e.i. fizikur da hidrodinamikur procesebs.

unda aRiniSnos, rom bunebrivi wyl ebis TviTgawmendis procesi imdenad rTul ia, rom jerkidev ar aris srul yofil ad Seswavl il i misi yvel a detal i, amasTan dakavSirebiT gaWuWyianebis da TviTgawmendis procesebis Seswavl isas gamoyofen Semdeg ZiriTad mimarTul ebebs.

1. Serevis procesebis Seswavl a hidrol ogiuri da hidrodinamikuri faqtorebis cval ebadibis gaTval iswinebiT.
2. wyl is xarisxis damokidebul ebis dadgena Camonadenis hidrol ogiuri reJimisa da gamoTvl iTi maxasiaTebi ebisan damokidebiT.

3. gamaWuWyianebebi i nivTierebebis qimiuri da fizikur - qimiuri gardaqmnebis Secvl a.
4. gamaWuWyianebebi i nivTierebaTa transformaciis bioqimiuri procesebis gamokvl eva.

13. zRvis garemos dacva gemebis eqspl uataciis dros

zRvis garemos gaWuWyianebebis wyaroebis gemebis eqspl uataciis dros warmoqdgens energetikul i danadgarebis mier gamomuSavebul i airebi, saTbobis da zeTis narCenebi, reaqtorul i danadgarebis gamonabol qvebi, sayofacxovrebo Camonadeni wyl ebi, yovel mxrivi sayofacxovrebo da samrewvel o nagavi. am SemTxvevaSi gaemos dacvis amocana mdgomareobs imaSi, rom ar davuSvaT gaWuWyianebebis kritikul i done.

gamonabol qvi airebisagan zRvis garemos gasufTavebisa da neutral izaciisaTvis gamoiyeneba Semdegi meTodebi:

1. katal izuri neutral izatorebi. maT, rogorc wesi amontaJeben gamomSveb kol eqtorebSi. neutral izatoebis moqmedeba emyareba arasrul i wvis produqtების ual o Jangvas.
2. aal ebadi neutral izatorebi. isini warmoadgenen special ur kameras sadac xdeba gamomuSavebul i airebis srul i wva 700-850°-is pirobebSi.
3. kombiniirebul i sistemebi. am SemTxvevaSi gamoiyeneba neutral izaciis sxvadasxva xerxi.

gemidan Camonadeni wyl ebis
neitral izaciisaTvis gamoiyeneba sami ZiriTadi
meTodi:

1. biol ogiuri, romelic emyareba
narCenebis biogimiur Jangvas.
2. fizikuri- Seicavs fil tracias, dal eqvas
da a.S.
3. fizikur-qimiuri, uzrul vel yofs wril
dispersiul i nawil akebi koagul acias,
adsorbaciad da Jangvas.

navTobis produqtebis mosacil ebl ad
Camonadeni wyl ebisagan gamoiyeneba gawmendis
uxeSi da zusti sistemebi. uxeSi gawmenda
gul isxmobs navTobproduqtebis msxvil
dispersiul i nawil akebisagan ganTavisufl ebas,
xolo zusti _ danarCeni nawil akebisagan.

14.mniSvnel ovani saerTaSoriso SeTanxmebebi zRvis garemos dacvis dargSi

zRvis garemos dacvis probl emebis
warmatebiT gadawyveta SesaZl ebel ia mxol od
yovel mxrivi saerTaSoriso TanamSroml obis
safuZvel ze. is iTval iswinebs yvel a
saxel mwifos, maT Soris did da pataras,
ganviTarebul is da ganviTarebadis, zRvispira da
maTi, visa car aqvs gasasvl el i zRvaze, aqtiur
monawil eobas.

pirvel i saerTaSoriso SeTanxmeba
saxel mwifoTa Soris msOflio okeanis dacvis
Sesaxeb navTobisa da sxva saSiSi mavne
nivTierebebisagan dadebul i iqna l ondodSi 1954
wel sam konvenciam gansazRvra navTobis daRvris
akrZal ul i zonebi-Crdil oeTis da bal tiis

zRvebi, 1969 wel s maT daemata Savi da azovis zRvebi, xol o Semdeg -mTel i msofi io okeanes akvatoria.

1972 wel s aseve l ondonSi 80 saxel mwifos monawil eobiT SemuSavda konvevcia , roml is danarTic Seicavda "Sav sias"-im nivTierebaTanusxas, romel Ta CaSvebac okeaneSi ikrZal eboda. maT miekuTvneba ql ororganuli SenaerTebi, vercxl is wyal i da misi SenaerTebi, kadmiumi da misi SenaerTebi, navTobi da navTobproduqtebi da sxv.

1973 wel s l ondonSi Catarebul konferenciaze miRes axal i axal i saerTaSoriso konvencia, roml is Tanaxmadac narCenebis CaSveba dasaSvebia aranakl eb 12 mil is manZil ze napi ridan aranakl eb 25 m siRrmeze. gansakuTrebul raionebSi, maT Soris Sav zRvaSi aikrZal a narCenebis yovel gvare CaSveba.

anal ogiuri saerTaSoriso SeTanxmebebi daido zRvis garemos radiaqtiuri da baqterial uri gaWuWyianebsagan dacvis dargSi.

pirveli mraval mxrivi saerTaSoriso SeTanxmeba zRvis radiaqtiuri gaWuWyianebasTan dakavSirebiT aris Jenevis 1958 wl is konvencia.

1963 wel s moskovSi daido saerTaSoriso xel Sekrul eba birTvuli iaraRis gamocdis Sesaxeb atmosferoSi, kosmosur sivrcesa da wyal Si. amis Sedegad, dawyebuli 1964 wl idan aRini Sneba dadamiwaze radiawtiurobis mkveTri daqvei Teba.

mniSvnel ovani saerTaSoriso aqti iyo gaerTianebul i erebis organizaciis general uri asambl eis 25-e sesiaze(1970w) miRebul i xel Sekrul eba okeanebisa da zRvebis fskerze

birTvul i da masobrivi ganadgurebis sxva iaraRis ganl agebis akrZal vis Sesaxeb.

1971 wels imave gaertianebul i erebis organizaciis general urma asambl eam miiRo konvencia baqteriol ogiuri da toqsikuri iaraRis damuSavebis, warmoebis da Senaxvis Sesaxeb.

1982 wels Catarda gaertianebul i erebis organizaciis me-3 konferencia. masSi monawil eoba miiRo 156 saxel mwifom. konferenciam miiRo axal i konvecia sazRvao samarTl is Sesaxeb. am konveciis Tanaxmad is saxel mwifoebi, romel Ta iurisdicciis qveS imyofeba wyl ebi val debul ni arian miiRon zomebi, raTa gaWuWyianeba ar gavrcel des maTi suverenul i ufl ebebis qveS myofi raionebis gareT.

msofli okeaneSi dadgenilia 200-miliani ekonomikuri zona sanapiro saxel mwifoebis ekonomikuri interesebis dacvis mizniT. am zonaSi saxel mwifos miniWebul i aqvs suverenul i ufl ebebi bunebrivi resursebis Ziebis, mopovebisa da damuSavebisaTvis. amave dros ekonomikuri zonaSi yvel a sxva saxel mwifos ufl eba eZl eva gaataros Tavisi wyl is da saaviacio transporti.

15.niadagis radioaqtiur gaWuWyianebasTan brZol is meTodebi

niadagis radioaqtiur gaWuWyianebasTan brZol is meTodebs Soris yvel aze aRsaniSnavia 3 _ qimiuri, el eqtrul i da biol ogiuri meTodebi.

brZol is qimiur meTods safuZvl ad udevs radioaqtiuri produqtebis sorbcilul i Tvisebebi. kerZod, am SemTxvevaSi niadagis gasufTaveba

xdeba Sesabamisi xsnarebiT misi garecxvis Sedegad. am dros radoizotopebi niadagis saxnavi fenidan xel ovnurad transportirdebian ufro Rma fenebSi. savel e cdebis pirobebSi gamrexi nivTierebebis rol Si gamoiyeneboda ql oristul i kal ciumis, ql oristul i natriumis, ql oristul i rkinis, gogirdis da maril mJavas koncentrirebul i xsnarebi. aRsaniSnavia, rom recxvis meTodi zogierTi radioizotopisaTvis gamodga araperspeqtul i, amitom aseT SemTxvevaSi SeiZl eba vil aparakoT mxol od nawil obrivi desorbciis Sesaxeb.

savsebiT efeqturi gamodga niadagis el eqtrodezaqtivaciis meTodi, am SemTxvevaSi xdeba niadagis el eqtrul i gasufTaveba radioaqturi gaWuWyianebsagan. meTods safuZvl ad udevs ionebis el eqtro gadatanis procesi, anu el eqtrul i vel s moqmedebiT ionebis difuziis procesi. am meTodis arsebiTi nakl ia procesis nakl ebi siCqare.

aRsaniSnavia niadagis gasufTavebis biologiuri meTodi, radioaqturad gaWuWyianebul niadagze Tesaven iseT mcenareebis, romlebic fesvTa sistemis saSual ebiT intensiurad STanTqaven radioaqtur nivTierebebs da amit asufTaveben niadags. SemdgomSi am mcenareTagan miRebul mosaval s wvaven, xolo niadagi ukve momzadebul ia sasofl o-sameurneo kul turebis dasaTesad.